Office of National Marine Sanctuaries
National Oceanic and Atmospheric Administration

Programmatic Environmental Assessment of Field Operations in the Southeast and Gulf of Mexico National Marine Sanctuaries

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National Oceanic and
Atmospheric Administration

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Cover Photo
Diver with sponges and gorgonians. Gray's Reef is home to a variety of vibrant invertebrates.
Photo: NOAA Gray's Reef National Marine Sanctuary.

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Introduction

The National Oceanic and Atmospheric Administration's (NOAA) Office of National Marine Sanctuaries (ONMS) serves as the trustee for the thirteen national marine sanctuaries and two marine national monuments (Figure 1). Together these protected areas encompass more than 600,000 square miles of ocean and Great Lakes waters from Washington State to the Florida Keys, and from New England to American Samoa. National marine sanctuaries are special areas set aside for long-term protection, conservation and management, and are part of our nation's legacy to future generations. They contain deep ocean habitats of resplendent marine life, kelp forests, coral reefs, whale migration corridors, deep-sea canyons, historically significant shipwrecks, and other underwater archaeological sites. Each sanctuary is a unique place worthy of special protection. Because they serve as natural classrooms, cherished recreational spots and places for valuable commercial activities, national marine sanctuaries represent many things to many people. Organizationally, the national marine sanctuary system is divided into four regions: Northeast and Great Lakes; Southeast, Gulf of Mexico and Caribbean; West Coast; and Pacific Islands. This document analyzes the effects of field operations in the Southeast and Gulf of Mexico region, which includes three national marine sanctuaries: Gray's Reef, Florida Keys, and Flower Garden Banks national marine sanctuaries.

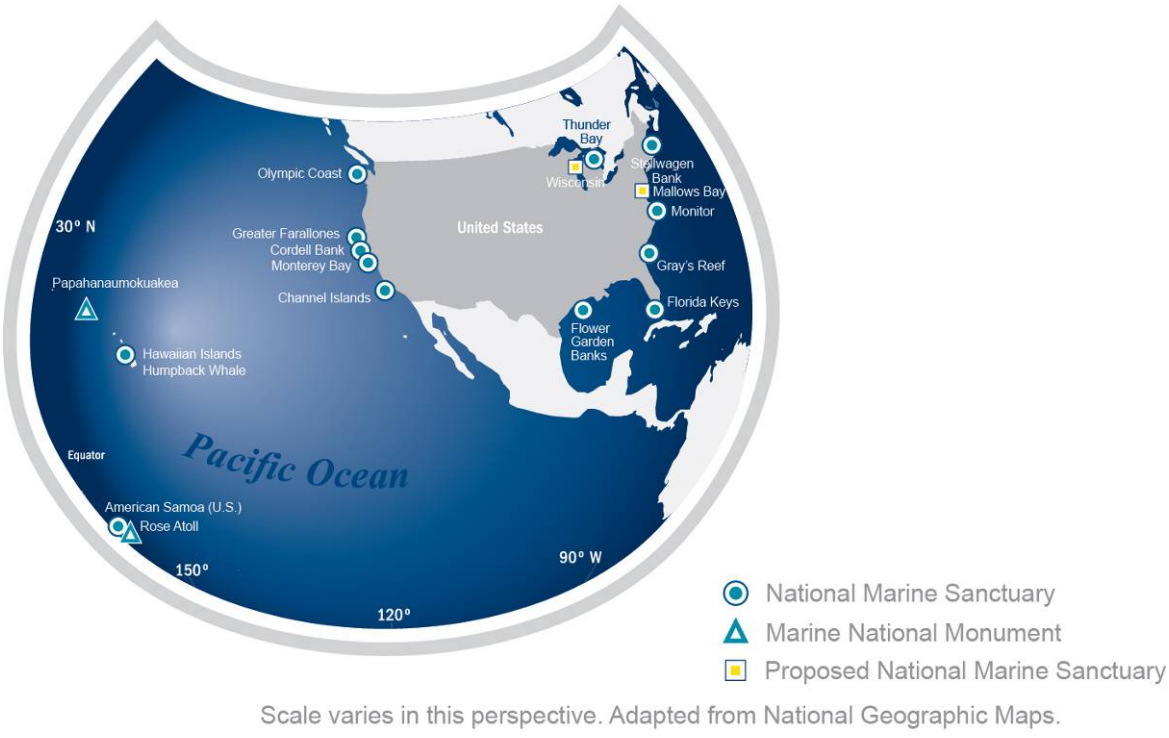


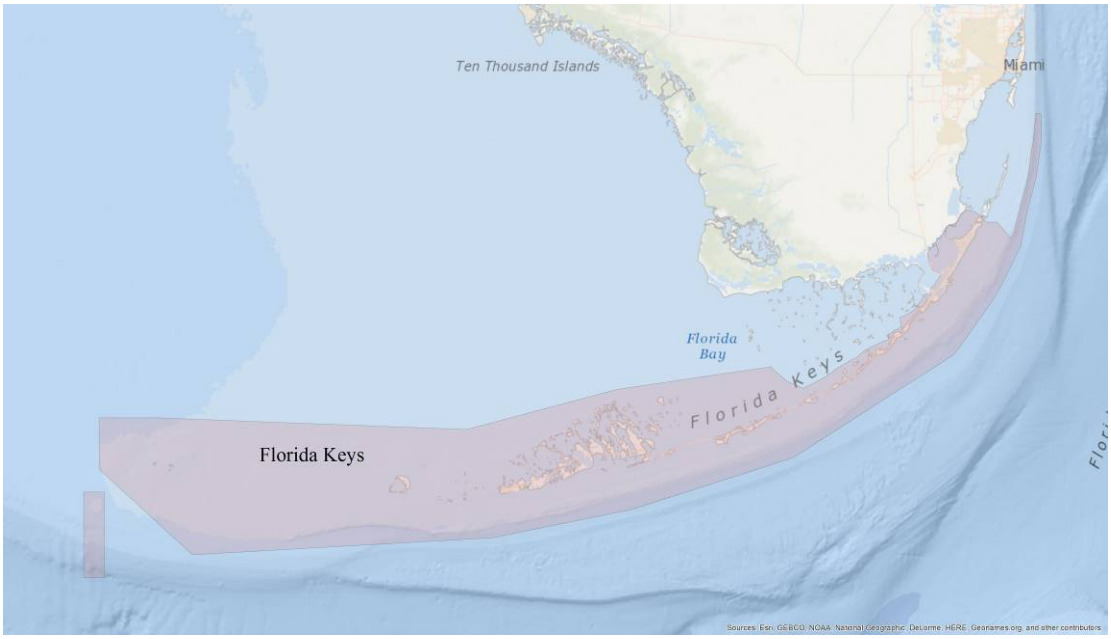
Figure 1: The National Marine Sanctuary System

The National Marine Sanctuaries Act (NMSA) requires that ONMS develop and periodically review the management plans for each national marine sanctuary (Sec. 304 (a)(2)(A) and Sec. 304 (e)). Since revision of a management plan often constitutes a federal action, ONMS typically analyzes changes to the management plan under the National Environmental Policy Act (NEPA). In many cases, this analysis tends to be very broad and does not adequately analyze the consequences of routine field operations, such as vessel operations and ongoing research programs. This programmatic environmental assessment is designed to analyze these types of activities and to detail any other routine operations not previously adequately analyzed under NEPA during the management plan review process.

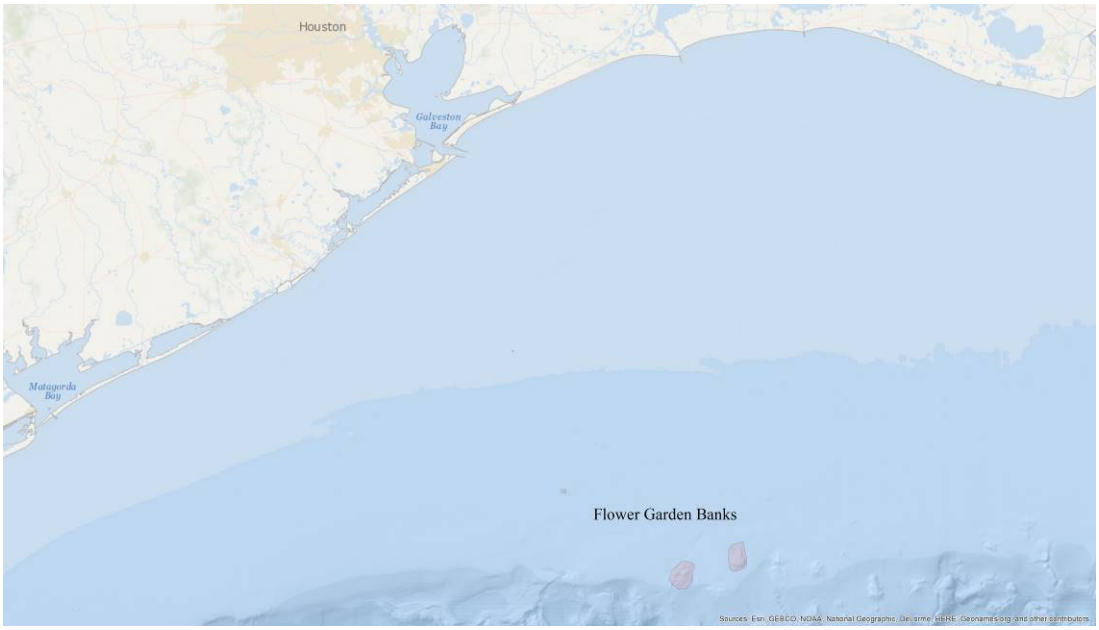
The Southeast and Gulf of Mexico National Marine Sanctuaries

Gray's Reef National Marine Sanctuary (GRNMS): GRNMS was designated as the nation's fourth national marine sanctuary in 1981. The sanctuary is located off the coast of Georgia, and is currently the only protected natural reef area on the continental shelf off the Georgia coast and one of only a few natural marine protected areas in the ocean between Cape Hatteras, North Carolina and Cape Canaveral, Florida. The approximately 22-square-mile sanctuary (about 14,000 acres) is just a small part of the U.S. territorial Atlantic Ocean, yet its value as a natural marine habitat is recognized nationally and internationally. Within GRNMS there are rocky ledges with sponge and coral communities, as well as sandy bottom areas that are more typical of the seafloor off the southeastern U.S. coast. The mission of GRNMS is to identify, protect, conserve, and enhance the natural and cultural resources, values, and qualities of the sanctuary for current and future generations. The vision for GRNMS is that the sanctuary will continue to be an area teeming with a diversity and abundance of marine life supported by healthy habitats in clean ocean waters; and that the public will be aware of, care about, and want to protect their sanctuary for current and future generations to use in diverse ways that are compatible with resource protection.

Florida Keys National Marine Sanctuary (FKNMS): Designated on November 16, 1990, FKNMS is administered by NOAA and jointly managed with the state of Florida. The sanctuary protects 3,327 square miles of waters surrounding the Florida Keys, from south of Miami westward to encompass the Dry Tortugas, excluding Dry Tortugas National Park. Within the boundaries of the sanctuary lie spectacular, unique and nationally significant marine resources, including 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. The goal of FKNMS is to protect the marine resources of the Florida Keys. It also aims to interpret the Florida Keys marine environment for the public and to facilitate human uses of the sanctuary that are consistent with the primary objective of sanctuary resource protection.



Flower Garden Banks National Marine Sanctuary (FGBNMS): Situated 70 to 115 miles off the coasts of Texas and Louisiana, FGBNMS includes underwater reef communities that rise from the depths of the Gulf of Mexico atop mounds called salt domes. The sanctuary protects three separate areas: East Flower Garden Bank, West Flower Garden Bank, and Stetson Bank. East and West Flower Garden Banks are 12 miles apart, and Stetson Bank is located 30 miles northwest of the West FGB. Each bank has its own set of boundaries. The biological diversity and breathtaking beauty of the reefs at East and West Flower Garden Banks led to their designation as a sanctuary in 1992. The coral-sponge communities of Stetson Bank were added to the sanctuary in 1996. The mission of FGBNMS is to identify, protect, conserve, and enhance the natural and cultural resources, values, and qualities of FGBNMS and its regional environment for this and future generations.



This programmatic environmental assessment (PEA) is designed to address the environmental impacts of ONMS field operations at the regional level. In some cases, a detailed description of field activities was not yet available at time of publication of this PEA, and therefore a full analysis of the environmental consequences of these activities was not developed. New activities may come up with time. When more details become available for activities included in this document or when new field operations activities come up, we will assess whether their effects are adequately addressed in this PEA. If they are not, we will conduct additional environmental reviews, either tiering from this PEA (for future actions within the scope of activities described in this PEA, pursuant to 40 CFR §1502.20) or developing independent environmental compliance documentation. The subsequent environmental compliance documentation, when tiered from this programmatic analysis, would need only summarize the issues discussed in the broader statement, incorporate discussions from the broader statement by reference and, concentrate on the issues specific to a subsequent, more detailed action. The subsequent document would state where the earlier document is available. In this programmatic EA, ONMS identified and prepared a qualitative analysis of environmental impacts for the broad scope of actions planned for field operations among the sanctuaries of the region.

Public Involvement

Under NEPA requirements, NOAA is not required to release a draft PEA for public comment. However, NOAA is soliciting public comment on this document for 45 days to ensure transparency and completeness of the final analysis. The input received as a result of both the public comments and the interagency consultations will be considered prior to publication of the final PEA. Public comment and consultation outcomes will be summarized in the final PEA.

1.0

PURPOSE AND NEED

1.1 Purpose for the Action

The purpose of the proposed action is to fulfill the requirements outlined in Section 301(b) of the NMSA in order to protect and manage the resources of each national marine sanctuary. Sanctuary field operations are one aspect of resource management that assists with the accomplishment of the goals, objectives and priorities of each sanctuary. Field operations are activities on, in or above the water that support NMSA's primary objective of resource protection, through direct management, research, and education. These field operations can include vessel, aircraft and scuba diving operations as well as deployment of instrumentation and presence of personnel. The field operations are evaluated on a regional basis taking into consideration the protected resources that may be present at each sanctuary.

1.2 Need for the Action

The need for the proposed action is to ensure that sanctuary resources are maintained and improved. The NMSA states that the ONMS will "maintain for future generations the habitat and ecological services of the natural assemblage of living resources that inhabit [sanctuaries]" (16 U.S.C. §1431(a)(4)(C)). The NMSA further recognizes that "while the need to control the effects of particular activities has led to enactment of resource-specific legislation, these laws cannot in all cases provide a coordinated and comprehensive approach to the conservation and management of the marine environment" (16 U.S.C. § 1431(a)(3)). Accordingly, the ONMS subscribes to a broad and comprehensive management approach to meet the NMSA's primary objective of resource protection. This comprehensive management approach differs from that of various other national and local agencies and laws directed at resource-specific management. Comprehensive sanctuary management serves as a framework for addressing long-term protection of a wide range of living and non-living marine resources, while allowing multiple uses of the sanctuary to the extent that they are compatible with the primary goal of resource protection. Sanctuary field operations are a part of this comprehensive management strategy and are necessary to support resource protection, research and education objectives, as described in the site-specific management plans outlining short- to mid-term priority management actions.

2.0

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

In accordance with NEPA, NOAA seeks to evaluate the proposed action and identify reasonable alternatives, including a No Action alternative, which meet the purpose and need for the proposed action, discussed above. For the purposes of this PEA, the No Action Alternative has been considered in two ways. First, ONMS presents Alternative 1, which describes the No Action as a "no change" from current sanctuary management. Because this is a feasible alternative from a legal and practical standpoint, it has been carried forward for further analysis. The second approach presents the No Action as no field operations to be conducted within each sanctuary (see section 2.1). This alternative has not been considered for further analysis because it does not fit within the purpose and need for the proposed action (*i.e.*, does not meet the mandates of the National Marine Sanctuaries Act). Two alternatives are analyzed in this PEA.

Alternative (1) (No Action) is to conduct current field operations to support sanctuary goals and objectives in the same manner as they are currently conducted and to implement additional required mitigation measures as determined through consultations conducted and applicable permits issued as appropriate under the Endangered Species Act (ESA), Marine Mammal Protection Act (MMPA), National Historic Preservation Act (NHPA), and the Essential Fish Habitat (EFH) provisions of the Magnuson-Stevens Fishery Conservation Management Act (MSA). This is the "Status Quo" alternative for purposes of this analysis, because it would be a continuation of current field operations, even if this alternative contains some required mitigation measures not currently in place.

Alternative (2) is to conduct field operations as currently conducted except that the current manner of vessel operations would be modified. In Alternative 2, ONMS vessels would be operated in accordance to NOAA Small Boat Program standards and other applicable requirement; however, ONMS vessel operations best management practices would be discontinued.

At this time, NOAA has not selected a preferred alternative, which is defined as the alternative which the agency believes would fulfill its statutory mission and responsibilities, giving

consideration to economic, environmental, technical and other factors. Consultation under the statutes mentioned above will begin upon publication of this draft PEA and the selection of the preferred alternative will be dependent upon the consultation process. Therefore, NOAA will select a preferred alternative based on public comment received on this document as well as on consultation processes and will identify the preferred alternative in the final PEA.

2.1 Alternative Considered but Not Analyzed in Further Detail

NOAA considered an alternative in which no field operations would be conducted at GRNMS, FKNMS or FGBNMS. Under this alternative, field operations occurring on, in or above the water conducted as part of projects and programs that support sanctuary and monument management, research and education objectives would not occur. This alternative is not further analyzed in this PEA because it would not meet the purpose and need for ONMS field operations, nor the purposes and policies of the NMSA.

2.2 Alternative 1: No Action/Status Quo

Under Alternative 1, there would be no change from current sanctuary management. This means that each of the sanctuaries in the region would annually conduct a number of field operations as part of projects that support the management, research and education objectives of each site. For the purposes of this PEA, it is assumed that the field operations at each site would continue to be conducted at existing levels over the next five years. The field operations conducted would occur in the same manner as currently conducted, with the addition of any required mitigation measures as determined through consultations conducted and applicable permits issued as appropriate under the ESA, MMPA, NHPA, and the EFH provisions of the MSA. NOAA anticipates that required mitigations arising from consultation with relevant authorities could include measures to minimize risk from vessel strikes, which may include reduced vessel speed, additional on-board observers, or restrictions on operating in adverse environmental conditions. In addition, NOAA is releasing this draft PEA to solicit public comment on the suite of ongoing field operations and the analysis of their potential environmental impact. NOAA could amend certain field operations (and the final PEA) based on required or recommended mitigations or monitoring that result from these permit and consultation processes and the public comment period.

Table 1 describes each category of field operations. Each sanctuary could have multiple projects that include a combination of the field operations listed below.

All ONMS vessels follow the protocols and procedures of the NOAA Small Boats Program. Vessel operators are highly trained and will employ ONMS best management practices and apply the NOAA Small Boat Program Standards and Procedures (https://www.omao.noaa.gov/sites/default/files/documents/SBS%26PM%204th%20Ed%20FINAL_signed%20Corrected%202017%200919.pdf), and follow its requirements as well as sanctuary standing orders and procedures to avoid direct impacts to sanctuary resources. In addition, the NOAA Small Boat program mandates that all vessels longer than 40’ feet be operated by personnel with an appropriate tonnage U.S. Coast Guard (USCG) license or equivalent NOAA

Corps experience for the vessel size. Site-specific standing orders and procedures are described in further detail below. In general, operators of sanctuary vessels employ ONMS best management practices to minimize impacts. And, because they are operating ONMS assets that are very visible to the public they are trained to serve as models of best practices to avoid harm to the environment.

Table 1. ONMS Field Operations

Categories of Field Operations	Definition
Vessel Operations	Vessel operations include all activities conducted on the water from an ONMS small boat or sponsored mission such as, but not limited to, research, education, outreach, resource and habitat assessments, marine mammal disentanglement, and law enforcement. All ONMS vessels must comply with the operational protocols and procedures in the NOAA Small Boats Policy (NAO 209-125) and the best management practices identified in Appendix E. This category applies to all personnel, including crew, staff, visitors, volunteers, and students who may use or work upon any ONMS vessel, regardless of mission sponsor whether directly or indirectly involved. It includes vessel transiting to/from port, where to go, how long to stay there, what is needed to accomplish cruise purpose.
Vessel Maintenance	Regular activities are determined by the program engineer, vessel's crew and operations staff and performed on each vessel to ensure safety, compliance, and reduced risk. Includes vessel maintenance, disposal of waste, general ship operations and any standing orders that improve safety or reduce the potential for resource impacts.
Aircraft Operations	Activities include the use of motorized aircraft including unmanned aerial systems (UAS) for research and surveillance purposes.
Non-Motorized Craft	Activities include the use of any non-motorized craft, such as kayaks and canoes.
SCUBA or Snorkel Operations	Activities include any field work where personnel will be in the water. Includes numbers of divers, time underwater and location of dives.
Onshore Fieldwork	Activities include onshore or intertidal field work where personnel will be walking on shoreline. May include emergency response activities to address marine mammal strandings, vessel groundings, oil or chemical spill response, Shoreline Cleanup Assessment Team protocols, cultural resource assessments or natural resource damage assessments.
Deployment of	Activities include equipment deployed from a vessel such as

AUVs/ROVs/gliders/drifters	autonomous underwater vehicles, remotely operated vehicles, tow-boards, drifters and gliders.
Deployment of Remote Sensing Equipment	Activities include the deployment from a vessel of towed and hull mounted sensor arrays and the use of acoustic survey systems, including use of scientific fish finders and multibeam mapping sonars. These activities may be done on contracted vessels, if not on an ONMS small boat, such as the NMFS vessel, R/V *Pisces*.
Deployment of Equipment on Seafloor	Activities include the deployment and maintenance of stationary buoys, moorings, anchored or weighted instrumentation, buoyed sensor arrays, and small marker buoys that are used for safe and efficient dive operations.
Other Sampling Activities	Activities include extractive sampling, placement and retrieval of sampling devices (e.g., constructed arrays, equipment, and traps), capturing, tagging and collection of animals, and other sampling protocols such as those associated with injury assessments.

Note: Where these operations require vessel support, those vessels may be ONMS owned or contracted (except as noted). Vessel maintenance includes only ONMS vessels. Aircraft operations include ONMS-contracted aircraft. Deployment of equipment includes ONMS-owned and -contracted equipment.

Tables 2, 3 and 4 describe the specific projects at GRNMS, FKNMS and FGBNMS, respectively. These projects range from buoy maintenance to fish tagging and include the categories of field operations listed in Table 1. The potential environmental consequences of these projects at each site are analyzed in Chapter 4 of this document.

All field operations conducted by ONMS are evaluated in this PEA, including those activities prohibited by sanctuary regulations that would require a sanctuary-specific general permit for the purposes of management (referred to as the Superintendent's Permit). This PEA does not analyze field operations conducted as part of other ONMS permits. All permit applications are evaluated separately on a case-by-case basis and undergo a separate evaluation for compliance with NEPA and other environmental statutes at that time.

2.2.1 Field Operations at Gray's Reef NMS

Field operations at GRNMS focus on several projects that support the sanctuary's mission. Unless otherwise noted, GRNMS vessel operations are conducted with 41-foot or smaller sanctuary vessels. GRNMS "buoy deployment" refers to the use of a marker buoy of not more than 10 pounds placed on the bottom with a float on the surface for the purpose of diving safety and efficiency. The marker buoy is removed at the conclusion of dive operations each day.

Table 2. GRNMS Projects and Field Operations under Alternative 1

Project Title	Summary	Categories of Field Operations
Vessel Maintenance and Crew Training	Includes general maintenance for the R/V *Joe Ferguson* (41 ft.), R/V *Sam Gray* (36	Vessel maintenance

	ft.), transit to and from boat yard repair facilities, vessel crew training and safety drills	
Acoustic Tagging Project	Monitor tagged Black Sea Bass, Gag and Scamp (groupers), and Red Snapper via a semi-permanent (weeks to years) anchored array of receivers placed throughout the sanctuary. Use of AUV to evaluate glider-mounted receivers.	Vessel operations SCUBA or snorkel operations Deployment of remote sensing Deployment of AUVs/ROVs Deployment of equipment on the seafloor
Rivers to Reefs Cruise Support	Educational cruise with diving ops and ROV deployment for teachers to observe the seafloor habitat and marine life.	Vessel operations SCUBA or snorkel operations Deployment of AUVs/ROVs Deployment of buoys
Algae Surveys	Conduct visual surveys for algae at three sites in the sanctuary.	Vessel operations SCUBA or snorkel operations Deployment of equipment on the seafloor Other sampling activities
Invertebrate Recruitment	Conduct visual and photographic surveys of invertebrates	Vessel operations SCUBA or snorkel operations Deployment of equipment on the seafloor
Invertebrate Monitoring	Conduct photo and visual surveys for invertebrate recruitment at permanent plots established for this study.	Vessel operations SCUBA or snorkel operations Deployment of equipment on the seafloor
Fish Predator/Prey Studies	Conduct visual and video surveys of fish behavior, specifically focusing on predator/prey interactions.	Vessel operations SCUBA or snorkel operations Deployment of equipment on the seafloor
Lionfish Surveys	Conduct visual surveys for presence of lionfish; remove lionfish encountered using pole spears; and collect lionfish specimens for analysis.	Vessel operations SCUBA or snorkel operations Deployment of equipment on the seafloor Other sampling activities
NOAA Ship Cruise Support	Transit from Savannah to GRNMS to transport personnel and constituents to NOAA ship operating in and around GRNMS.	Vessel operations
Education Cruises	Conduct estuarine trawling and water sampling for educational purposes.	Vessel operations Other sampling activities
U.S. Coast Guard Hoist Training	Conduct training exercises in coastal waterways in cooperation with USCG. Operations involve running at slow speed while USCG helicopter deploys and recovers rescue swimmer to a GRNMS vessel.	Vessel operations
Seafloor and Buoy Sensors	Conduct diving operations to maintain an array of sensors deployed on the NOAA data buoy in GRNMS and on the seafloor near the buoy.	Vessel operations SCUBA or snorkel operations Deployment of equipment on the seafloor
Contaminant	Collection (5-year intervals) of sediment,	Vessel operations

Sampling	fish, and ark shells to analyze for contaminants.	SCUBA or snorkel operations Deployment of equipment on the seafloor Other sampling activities
Marine Debris Monitoring	Conduct visual surveys to document and collect marine debris at stations previously established within the sanctuary.	Vessel operations SCUBA or snorkel operations Deployment of equipment on the seafloor Other sampling activities
Fish Biodiversity & Abundance Surveys	Conduct visual, acoustic (sonar) and video surveys of fish abundance.	Vessel operations SCUBA or snorkel operations Deployment of equipment on the seafloor Deployment of remote sensing equipment
Paleoarcheological Surveys	Conduct visual surveys of the seafloor to identify paleoarcheological resources in the sanctuary.	Vessel operations SCUBA or snorkel operations Deployment of equipment on the seafloor
Sea Turtles Surveys	Conduct photo and visual surveys of sea turtles for identification, behavior and health.	Vessel operations SCUBA or snorkel operations
Acoustic Habitat Characterization and Navigation	Map habitats and nekton biomass inside and adjacent to the sanctuary Hydroacoustic activities may also be conducted by ONMS or by partners on behalf of ONMS, such as NOAA's OMAO and NMFS[1], and the may occur on ONMS vessels or on NOAA ships or NMFS vessels, including but not limited to the *Thomas Jefferson, Nancy Foster, Pisces, Okeanos,* etc.	Vessel operations Deployment of remote sensing equipment

General Vessel Operations

General vessel operations are not a project in and of themselves, but they support a great many of the sanctuary's projects. ONMS small boats are operated according to all NOAA Small Boat Program guidelines (http://www.sbp.noaa.gov/policy/manual.html). In addition, the sanctuary vessels (R/V *Sam Gray* and R/V *Joe Ferguson*) follow additional standing orders imposed by ONMS management (see Appendix E) to minimize impacts on sanctuary resources, particularly sea turtles and marine mammals. In accordance with the NOAA Small Boat Standards and Procedures Manual each vessel at GRNMS is required to have a boat-specific Small Boat Operations Manual, which contains self-imposed standing orders. The Small Boat Operations Manual is a compilation of instructions, procedures, regulations, and guidelines derived from that small boat's Annual Risk Assessment. The vessel operators are required to operate the vessels in

[1] The mission of NOAA's Office of Coast Survey (OCS) is to survey all navigationally significant waters of the U.S., including national marine sanctuaries, in order to produce navigational charts for the public. In 2013, OCS analyzed the impacts of their surveys and other field operations in a PEA which included analysis of their work in the southeastern U.S. and the Gulf of Mexico. NOS subsequently signed a Finding of No Significant Impact for OCS operations on May 29, 2013. OCS environmental compliance procedures require OCS to determine if each specific survey project falls within the scope of the OCS PEA. (OCS 2013).

strict adherence to the NOAA Small Boat Standards and Procedures Manual and the boat-specific Small Boat Operations Manual. Moreover, there are several vessel specific standing orders that have been self-imposed by ONMS.

The general standing orders direct GRNMS small boat operators to:

- **Keep a sharp lookout** – Vessel operators are required to stay vigilant for marine mammals, sea turtles and other collision hazards.
- **Post a minimum of one dedicated lookout** – In addition to the operator, a dedicated lookout is required while operating in areas where large whales, other mammals or sea turtles may be present. A second lookout should be posted in certain circumstances where visibility may be restricted.
- **Watch your speed** – General operating speeds should not exceed 16 knots, or when responding to a whale in distress, speeds should not exceed 20 knots. Speed should be reduced further in limited visibility situations and within Dynamic and Seasonal Management Area restrictions.
- **Stay at the helm** – Vessel operators are required to keep hands on the wheel and throttle at all times while in areas where large whales and turtles can occur, and must be ready to take action immediately to avoid any animal.
- **Keep your distance** – If large whales are sighted, a distance of at least 100 yards should be maintained. In the case of North Atlantic right whales, a distance of at least 500 yards should be maintained per NMFS regulations. The GRNMS vessel operators and lookouts are familiar with the literature provided by the NMFS to identify right whales and other protected species. Identification guides are also located inside the GRNMS Lookout Handbook.
- **If large whales surface** within 100 yards, vessel operators should stop immediately and use prudent seamanship to decide to either move away slowly or wait for the animal to move away on its own.
- **Operate vessels during daylight hours** – Due to the increased risk of collision at night, all vessel operations should take place between ½ hour before sunrise and ½ hour after sunset. If night operations need to occur, the most experienced operator should take the helm, the speed should not exceed 10 knots, a minimum of two lookouts should be posted, and the operator should use all means to enhance visibility (e.g., spotlights, electronics).

GRNMS and its vessel operators are notified of Dynamic and Seasonal Management Areas by NMFS. While small vessels are not subject to the requirements of the SMAs and DMAs, both SMAs and DMAs are evaluated in the Operational Risk Assessment prior to any vessel operations and operations are tailored to minimize risk of whale strikes when whales are present.

Through the Joint Enforcement Agreement with NOAA, the state of Georgia Department of Natural Resources conducts an average of 8 days a year of enforcement missions in the sanctuary. They generally use their own long-range vessel (not a NOAA vessel) and Gray's Reef National Marine Sanctuary is usually not the only destination. When they venture that far offshore, they typically also visit other state-management sites as well as perform duties for other federal

mandates (e.g., MSA). Therefore, enforcement missions conducted by non-NOAA entities on non-NOAA vessels are not included as part of the field operations of GRNMS in this programmatic EA.

Acoustic Telemetry Project

This project investigates the movements of commercially and recreationally important species of grouper (Gag and Scamp), Red Snapper and Black Sea Bass. Scientists have tagged 63 fish with individually identifiable transmitters which allow the fish to be tracked by an array of up to 21 acoustic receivers anchored on short tethers throughout the sanctuary. At each site, a single acoustic receiver is attached to a line held upright in the water column by a trawl float and attached to a small stainless steel rod that serves as an anchor. The receivers are cylindrical, about 13 inches tall and 3 inches in diameter. The array of receivers was deployed in 2008 and they are maintained on a quarterly basis. Acoustic receiver maintenance involves vessel and SCUBA operations, marker buoy deployment for diving safety and efficiency, and deployment of remote sensing. Two divers descend to the seafloor to find the array and replace the receiver attached to the line with a new receiver. Divers typically make 5-10 dives per day for this project. Maintaining the array requires five to seven days (day trips) of vessel operations per quarter. Vessel operations are conducted aboard a GRNMS vessel and are approximately 85 nautical miles per round trip.

In addition, GRNMS is working with scientists at the Skidaway Institute of Oceanography (SkIO) to assess and define bounds of performance of glider-mounted acoustic receivers in the field. The purpose of this investigation is to determine the effectiveness of using gliders to track fish tagged with acoustic transmitters. The glider is outfitted with two externally mounted, internally powered Vemco mobile transceiver units facing in opposite directions. These units detect transmission from acoustic transmitters attached to fish and are designed to extend detection ranges of tagged fish beyond the traditional fixed arrays – which are typically restricted to coastal locations. A course of stationary tags and reference receivers is installed at known positions in GRNMS, with known water depth, height above the bottom, and orientation. An Acoustic Doppler Current Profiler (ADCP) is deployed to measure currents. The glider is then deployed in the array with the goal of flying within and around the stationary transmitters and receivers for approximately 15 days. AUV operations are piggybacked on other acoustic tagging trips.

The 63 fish were tagged with Vemco V13 transmitters that are designed to emit 147 dB re 1 mPa at 1 m, pinging continuously at 3-min intervals. The tags and a receiver system allow the fish to be tracked by an array of up to 21 acoustic receivers anchored on short tethers throughout the sanctuary. As of spring 2016, it is likely that very few of the 63 transmitters (perhaps 6-8) are still functional, and there are no immediate plans for additional tag deployment. Acoustic receivers continue to be monitored however, as fish that are tagged by other investigators outside of the sanctuary can be detected by the receiver array as they move through sanctuary waters.

At each receiver site, a single acoustic receiver is attached to a line held upright in the water column by a trawl float and attached to a small stainless steel rod that serves as an anchor. The

receivers are cylindrical, about 13 inches tall and 3 inches in diameter. The array of receivers was deployed in 2008 and they are maintained on a quarterly basis. Acoustic receiver maintenance involves vessel and SCUBA operations, marker buoy deployment for diving safety and efficiency, and deployment of remote sensing. Two divers descend to the seafloor to find the array and replace the receiver attached to the line with a new receiver. Divers typically make 5-10 dives per day for this project. Maintaining the array requires five to seven days (day trips) of vessel operations per quarter. Vessel operations are conducted aboard a GRNMS vessel and are approximately 85 nautical miles per round trip.

Rivers to Reefs Cruise Support

Sanctuary staff conducts up to two educational cruises to the sanctuary per year to introduce teachers to GRNMS. An ROV dive is included in each cruise so that the teachers can observe the sea floor habitat and marine life from a surface vessel. Teachers travel to the sanctuary aboard the 92-foot R/V *Savannah*, operated by the University of Georgia's SkIO. ROV operations aboard the R/V *Savannah* are supported by divers aboard a sanctuary vessel. Therefore, this project involves vessel and SCUBA operations, marker buoy deployment for diver safety and efficiency, and deployment of an ROV. Each cruise is one day in length and each vessel (sanctuary support vessel and the R/V *Savannah*) travels approximately 85 nautical miles round trip. SCUBA operations include two divers descending to attach an anchor line from the Savannah to an existing seafloor mooring, monitoring the ROV, and recovering the anchor line. The ROV is deployed from the R/V *Savannah* once per trip for up to 40 minutes.

Algae Surveys

Scientists conduct visual surveys for algae at three sites in the sanctuary. The project involves vessel and SCUBA operations, deployment of a marker buoy for diving safety and efficiency, and other sampling activities. Vessel operations consist of four day trips per year with a round trip of approximately 85 nautical miles per day. Two divers conduct up to five dives per day with each lasting between 30 and 40 minutes. One-quarter square meter quadrats are temporarily placed on the seafloor in order to identify all the algae within the quadrats. Algae are collected within some of the quadrats.

Invertebrate Recruitment

Researchers conduct visual and photographic surveys of invertebrates in the sanctuary. For this action the project utilizes vessel and SCUBA operations, deployment of marker buoys for diving safety and efficiency, and other sampling activities. Vessel operations are conducted using a sanctuary vessel on 12 trips per year of approximately 85 nautical miles round trip and may be conducted in conjunction with other research and monitoring projects. SCUBA operations involve two to four divers conducting up to six dives per day. The dives generally last between 30 and 40 minutes.

Invertebrate Monitoring

Researchers conduct photo and visual surveys of invertebrates under an approved sanctuary permit, therefore, that portion of the project is outside the scope of this action. For this action the project involves vessel and SCUBA operations, marker buoy deployment for diving safety and efficiency, and other sampling activities. Vessel operations consist of 12 trips per year and are often combined with other projects. Each trip is approximately 85 nautical miles round trip and is aboard a sanctuary vessel. SCUBA operations comprise two to four divers making up to six dives a day. The dives last for no more than 40 minutes.

Fish Predator/Prey Studies

Researchers conduct visual and video surveys of fish behavior to investigate predator/prey interactions. Divers swim along the bottom of the reef ledges and count the number of predator/prey interactions observed. Vessel and SCUBA operations, and marker buoy deployment for diving safety and efficiency are used in this project. Vessel operations are conducted using a sanctuary vessel during an approximately 85 nautical mile round trip for up to 10 trips per year. SCUBA operations include three to four divers conducting up to six dives per day. Each dive lasts up to 40 minutes.

Lionfish Surveys

As a part of other GRNMS project SCUBA operations, divers conduct visual surveys for the presence of invasive lionfish. Lionfish that are encountered are removed using pole spears and are collected as specimens for analysis. Because this project is conducted opportunistically in conjunction with other GRNMS projects, field operations are piggybacked on other sampling activities such as invertebrate or fish surveys, or remote sensor maintenance.

NOAA Ship Cruise Support

This project entails transiting from Savannah, GA to GRNMS in order to transport personnel and constituents to the NOAA Ship R/V *Nancy Foster*, operating in GRNMS. The only activity associated with this project is vessel operations. Vessel operations consist of up to five trips per year of approximately 85 nautical miles round trip from Savannah to GRNMS on a sanctuary vessel.

Education Cruises

GRNMS staff conduct trawling and water sampling in estuarine waters for educational purposes. Vessel operations and other sampling activities are used in this project. Vessel operations include up to ten, five-hour day trips per year. The trips are ten nautical miles or fewer round trips. During the trips, water sampling is conducted and small otter trawls are deployed and towed for one half mile at a time with several trawls per trip. Otter trawls are trawl nets towed behind a vessel with rectangular boards used to keep the mouth of the trawl net open.

US Coast Guard Hoist Training

This project is a training exercise with the U.S. Coast Guard (USCG), and is conducted in estuarine waters near the GRNMS vessel dock. Vessel operations only are used in this project, which involves a USCG helicopter deploying and recovering rescue swimmers to a sanctuary vessel that is running at slow speed. Vessel operations for this project occur up to six days a year for two hours at a time. The length of each trip is approximately two nautical miles.

Seafloor and Buoy Sensors

This project uses divers to maintain an array of sensors deployed on a NOAA National Data Buoy Center buoy in GRNMS. Sensors are also located on the seafloor near the buoy. This project utilizes vessel and SCUBA operations, and marker buoy deployment for diver safety and efficiency. The vessel operations consist of four round trips per year of approximately 85 nautical miles from Savannah to the sanctuary aboard a sanctuary vessel. These trips are often combined with other projects. During these trips, SCUBA operations require divers to service instruments on the buoy as well as instruments on the seafloor. When servicing instruments on the buoy, two divers spend up to one hour performing maintenance activities. When servicing instruments on the seafloor, two to three divers take two to three dives a day to service the seafloor instruments. These dives last for no more than 40 minutes each.

Contaminant Sampling

This project is conducted approximately every five years to sample sediment, fish, and turkey wing mussel (Arca zebra, or ark shell) to analyze for contaminants. Most recently, the activity was conducted under an approved sanctuary permit (GRNMS-2012-001) therefore, that portion of the project is outside the scope of this action. For this action the project involves other sampling activities (extractive sampling) vessel and SCUBA operations, and marker buoy deployment for diver safety and efficiency. Vessel operations are conducted using a sanctuary vessel and requires five, one-day trips of approximately 85 nautical miles round trip. SCUBA operations involve two divers conducting four to six dives per day for no more than 40 minutes each.

Marine Debris Monitoring

This project is conducted by SCUBA divers using visual surveys to document and collect marine debris at stations previously established within GRNMS. Collected debris is limited to what divers are able to remove by hand without the use of heavy equipment. The types of debris targeted are discarded/derelict fishing gear, bottles, cans and plastics. Vessel and SCUBA operations, marker buoy deployment for diving safety and efficiency, and other sampling activities are used to carry out the project. Vessel operations are conducted using a sanctuary vessel and requires four to five one-day trips a year on a sanctuary vessel. Trips are approximately 85 nautical miles round trip. SCUBA operations involve two divers conducting up to six dives per day. Each dive is 40 minutes or less. During the dives, divers locate permanent site markers and complete 50-meter transects, surveying for debris within two meters on either side of the transect.

Fish Biodiversity and Abundance Surveys

Researchers using SCUBA conduct visual and video surveys of fish abundance in the sanctuary. Conducting these surveys involves vessel and SCUBA operations, marker buoy deployment for diving safety and efficiency, and other sampling activities. Vessel operations are conducted using a sanctuary vessel on 10-12 one-day trips per year of approximately 85 nautical miles round trip each. SCUBA operations involve two to four divers conducting visual surveys by swimming along a 50-meter transect marked by a transect tape deployed by the divers. The transect tape is recovered at the end of each survey.

Paleoarcheological Surveys

Researchers conduct visual surveys of the seafloor using SCUBA to identify paleoarcheological resources in the sanctuary under an approved sanctuary permit (GRNMS-2011-003-A2) therefore, that portion of the project is outside the scope of this action. For this action the project involves vessel and SCUBA operations, and deployment of marker buoys for diving safety and efficiency. Vessel operations are used to conduct two trips per year of approximately 85 nautical miles round trip. This project is conducted in conjunction with other projects described above. Two divers conduct opportunistic visual surveys of no more than 40 minutes per dive. The maximum number of dives per day is six.

Sea Turtle Surveys

As a part of other GRNMS project SCUBA operations, divers conduct visual surveys to capture images of sea turtles using photographs and video. Because this project is conducted opportunistically in conjunction with other GRNMS projects, no additional field operations are required. GRNMS has been advised by NMFS that a permit is not needed for this activity (Memo for the Record, 23 February 2012; Eric Hawk email, 30 October 2013).

Acoustic Habitat Characterization and Navigation

GRNMS conducts annual (late spring to mid-summer) research cruises to aboard the NOAA Ship R/V *Nancy Foster*, which is equipped with multibeam sonar and a single beam fisheries acoustic system. The cruises have 10-20 day duration, and active acoustic systems are used to map habitats and nekton biomass inside and adjacent to the sanctuary. Typically, acoustic surveys are run for fewer than 10 hours per day for a maximum of 10 days during the cruises. GRNMS and NOAA ship staff work to minimize spatial overlap between acoustic mapping and sensitive areas used by endangered or threatened species.

Multibeam sonar habitat mapping and characterization is done with a Reson 7125 SV2, dual frequency (200 kHz or 400 kHz) shallow water system, and all depths surveyed are less than 250 m. Biomass of nekton is surveyed with a single beam Simrad EK60 Fisheries Acoustic suite (38 kHz, 120 kHz and 200 kHz). Survey speeds are around 5 knots. The purpose of these surveys is to characterized habitat and fish biomass associated with different habitats.

In addition to survey echosounders the R/V *Nancy Foster* uses Furuno FE-700 (200 kHz shallow, 50 kHz deep) and Knudsen 3200 (200 kHz/12 kHz) echosounders for navigation. GRNMS vessels navigate using a Furuno Navnet VX2 with an Airmar M260 in-hull transducer that operates at 1 kw with dual frequencies of 50 kHz and 200 kHz aboard the R/V *Joe Ferguson* and a Garmin GPSMAP 7212 with an Airmar SS60 that operates at 600 w dual frequencies of 50 /200 kHz aboard the R/V *Sam Gray*. Ping rates depend on depth, and navigational echosounders are used for less than 1000 hours per year in the sanctuary.

Vessel Maintenance and Crew Training

This project includes general maintenance for the 41-foot R/V *Joe Ferguson* and the 36-foot R/V *Sam Gray*, transit to and from boatyard repair facilities, vessel crew training and safety drills.

2.2.2 Field Operations at Florida Keys NMS

Field operations at FKNMS include several activities that support the mission to protect the sanctuary's natural and cultural resources through responsible stewardship; to conduct and apply research to preserve the area's ecological integrity and maritime heritage; and to promote understanding through public outreach and education. Activities include vessel operations, vessel maintenance and crew training, aircraft operations, natural resource damage assessment, habitat restoration, restoration monitoring, benthic habitat characterization, fish and wildlife surveys, coral spawning observation and sampling, invasive/exotic species management, maritime heritage resource management, emergency response, marine debris management, waterway management, water quality monitoring, and education, outreach, and volunteer programs. Unless otherwise noted, FKNMS vessel operations are conducted on one or more of approximately 20 small vessels (23 – 53 ft.) or two smaller skiffs (22 vessels in total).

Table 3. FKNMS Activities and Field Operations under Alternative 1

Activity Title	Summary	Categories of Field Operations
Vessel Operations	General vessel operations conducted to support field operations and management of the sanctuary. ONMS small boats are operated according to all NOAA Small Boat Program guidelines (http://www.sbp.noaa.gov/policy/manual.html). Hydroacoustic activities may also be conducted by ONMS or by partners on behalf of ONMS, such as NOAA's Office of Coast Survey[2], and the may occur	Vessel operations

[2] The mission of NOAA's Office of Coast Survey (OCS) is to survey all navigationally significant waters of the U.S., including national marine sanctuaries, in order to produce navigational charts for the public. In 2013, OCS analyzed the impacts of their surveys and other field operations in a PEA which included analysis of their work in the southeastern U.S. and the Gulf of Mexico. NOS subsequently signed a Finding of No Significant Impact for OCS operations on May 29, 2013. OCS environmental compliance procedures require OCS to determine if each specific survey project falls within the scope of the OCS PEA. (OCS 2013)[3]
"Procedural recommendations" refer to staff recommendations on the best course of action to respond to an injury, which may entail a judicial action under Section 307 or 312 of the National Marine Sanctuaries Act or under other federal or state statutes.

	on ONMS vessels, or on NOAA ships or NMFS vessels, including but not limited to the *Thomas Jefferson*, *Nancy Foster*, *Pisces*, *Okeanos*, etc.	
Vessel Maintenance and Crew Training	Includes general maintenance for the 22 vessels, transit to and from boat yard repair facilities, vessel crew training and safety drills	Vessel maintenance
Aircraft Operations	General aircraft operations conducted to support field operations and management of the sanctuary.	Aircraft operations
Natural Resource Damage Assessment	Determine the severity and extent of the injury and make procedural recommendations[3] to the ONMS, the NOAA Office of General Counsel Natural Resources and Enforcement Sections.	Vessel Operations Aircraft Operations Non-Motorized Craft SCUBA or Snorkel Operations Onshore Fieldwork Deployment of Equipment on the Seafloor Deployment of AUVs/ROVs/Gliders Deployment of Remote Sensing Equipment Other Sampling Activities
Habitat Restoration	Implement habitat restoration projects in FKNMS by creating the site conditions necessary for the injured areas to recover to pre-incident conditions, and compensate the public and environment for the services lost from the time of injury until full recovery.	Vessel Operations Non-Motorized Craft SCUBA or Snorkel Operations Onshore Fieldwork Deployment of Equipment on the Seafloor Deployment of AUVs/ROVs/Gliders Deployment of Remote Sensing Equipment Other Sampling Activities
Habitat Restoration Monitoring	Monitor habitat restoration projects to evaluate restoration success by assessing the progress of restoration and identifying, as necessary, timely corrective action to shorten the injury recovery period.	Vessel operations SCUBA or snorkel operations Deployment of equipment on the seafloor **Other sampling activities
Benthic Habitat Characterization	Survey and monitor the condition and spatial distribution of seagrass, coral, and hard-bottom habitats to inform and develop management strategies.	Vessel Operations Aircraft Operations Non-Motorized Craft SCUBA or Snorkel Operations Onshore Fieldwork Deployment of Equipment on the

[3] "Procedural recommendations" refer to staff recommendations on the best course of action to respond to an injury, which may entail a judicial action under Section 307 or 312 of the National Marine Sanctuaries Act or under other federal or state statutes.

		Seafloor Deployment of AUVs/ROVs/Gliders Deployment of Remote Sensing Equipment Other Sampling Activities
Fish and Wildlife Surveys	Survey and monitor fish and wildlife to track changes in abundance, diversity, spatial distributions, behavior, and other metrics to inform and develop management strategies.	Vessel Operations Aircraft Operations Non-Motorized Craft SCUBA or Snorkel Operations Onshore Fieldwork Deployment of Equipment on the Seafloor Deployment of AUVs/ROVs/Gliders Deployment of Remote Sensing Equipment Other Sampling Activities
Coral Spawning Observation and Sampling	Continue observation and supporting science activities studying mass coral spawning events. This includes sampling of coral and gametes for a variety of studies including coral reproduction, genetics, symbiotic algal communities, and climate change.	Vessel operations SCUBA or Snorkel Operations Deployment of Equipment on the Seafloor Other sampling Activities
Invasive/Exotic Species Management	Develop and implement a lionfish invasion response and management plan. Response involves delineating removal and non-removal zones, and fish surveys.	Vessel operations SCUBA or Snorkel Operations Deployment of Equipment on the Seafloor Deployment of AUVs/ROVs/Gliders Other sampling Activities
Maritime Heritage Resource Management	Survey and monitor historical and cultural resources to inform and develop management strategies.	Vessel Operations Non-Motorized Craft SCUBA or Snorkel Operations Onshore Fieldwork Deployment of Equipment on the Seafloor Deployment of AUVs/ROVs/Gliders Deployment of Remote Sensing Equipment Other Sampling Activities
Emergency Response	Provide coordination, support, and resource trustee information during emergency incidents that injure or threaten injury to sanctuary resources.	Vessel Operations Aircraft Operations Non-Motorized Craft SCUBA or Snorkel Operations Onshore Fieldwork Deployment of Equipment on the Seafloor

		Deployment of AUVs/ROVs/Gliders Deployment of Remote Sensing Equipment Other Sampling Activities
Marine Debris Management	Identify, determine sources of, assess, prevent, reduce, remove, dispose, or recycle marine debris, including but not limited to construction materials, derelict fishing gear, derelict vessels.	Vessel Operations Aircraft Operations Non-Motorized Craft SCUBA or Snorkel Operations Onshore Fieldwork Deployment of Equipment on the Seafloor Deployment of AUVs/ROVs/Gliders Deployment of Remote Sensing Equipment Other Sampling Activities
Waterway Management	Install and maintain aids to navigation to prevent damage to biological and historical/cultural resources from vessel operation, anchor damage, and delineate sanctuary regulatory zones that protect sanctuary resources.	Vessel Operations SCUBA or Snorkel Operations Deployment of Equipment on the Seafloor
Water Quality Monitoring	Conduct and/or support activities to collect, measure, and analyze data on temperature, salinity, light, currents, chemicals (nutrient) data and other water quality factors.	Vessel Operations SCUBA or Snorkel Operations Onshore Fieldwork Deploy Equipment on Seafloor Other Sampling Activities
Education, Outreach, and Volunteer Programs	Develop and maintain programs for public involvement to support sanctuary management in order to build a stewardship ethic in the community and accomplish management objectives.	Vessel Operations Non-Motorized Craft SCUBA or Snorkel Operations Onshore Fieldwork Other Sampling Activities

Vessel Operations

General vessel operations support a great many of FKNMS's activities. ONMS small boats are operated according to all NOAA Small Boat Program guidelines (https://www.omao.noaa.gov/sites/default/files/documents/SBS%26PM%204th%20Ed%20FINAL_signed%20Corrected%202017%200919.pdf).

In accordance with the NOAA Small Boat Standards and Procedures Manual, FKNMS vessels are required to have a Small Boat Operations Manual, such as Standing Orders. The Small Boat Operations Manual is a compilation of instructions, procedures, regulations, and guidelines derived from the small boat Annual Risk Assessment. The vessel operators are required to operate the vessels in strict adherence to the NOAA Small Boat Standards and Procedures Manual and the Small Boat Operations Manual. In addition, ONMS has best management practices for the entire sanctuary system (see Appendix E). The standing orders for the sanctuary

vessels follow best management practices imposed by ONMS management to minimize impacts on sanctuary resources, particularly marine mammals and protected species. These practices focus on navigating in marked channels; adjusting speed to match visibility and probability of encountering a protected species (e.g., during sea turtle nesting season); and posting lookouts in times and areas of high probability of encountering protected species.

FKNMS vessel operations are typically conducted on one or more of approximately 20 small vessels (23-39 ft.) or two smaller skiffs (22 vessels in total) outfitted with fixed GPS chart plotters and depth sounders (similar to those used by thousands of recreational vessels operating in FKNMS). FKNMS depth sounder systems are dual frequency 50/200 kHz and they are utilized on 20 small boats (16-39 ft.) for 30-200 days per boat each year and are used all months of the year. The small boats are equipped with fathometers that single beam sonar capability.

In some instances, vessel operations may involve larger vessels operated by NOAA Office of Marine and Aviation Operations (OMAO) Marine Operations Center (MOC) (e.g. NOAA ships), other NOAA Line Offices, and/or contracted vessel support.

Vessel Maintenance and Crew Training

This activity involves the routine repair and maintenance for 19 small vessels (23 – 53 ft.) or two smaller skiffs (21 vessels in total) to ensure those vessels and associated equipment are safe, equipped for intended uses, are serviceable, and comply with all NOAA Small Boat Program, United States Coast Guard, and other relevant rules and regulations. Routine maintenance includes cleaning, fluid changes, and some repairs. This also involves transit to and from boatyard repair facilities.

FKNMS staff who operate vessels meet operator qualification, evaluation, and designation requirements established by the NOAA Small Boat Program including obtaining and maintaining appropriate USCG licenses and completion of USCG Auxiliary Boating Skills and Seamanship (or equivalent) training, NOAA Component Course, Personal Qualification Standards, First Aid, CPR, and AED training, and program specific training.

Aircraft Operations

Aircraft operations support a few of FKNMS's activities. FKNMS aircraft operations are typically conducted by NOAA OMAO Aircraft Operations Center (AOC) using NOAA manned and unmanned aircraft or using contract aircraft coordinated through NOAA OMAO AOC. Aircraft operations are conducted in accordance with NOAA OMAO AOC policies and guidance:

- 220-1 Aircraft Operations Manual (https://www.omao.noaa.gov/sites/default/files/documents/AOC%20Ops%20Manual%20Feb%202012.pdf)

- 220-1-5 Unmanned Aircraft Systems Operation (https://www.omao.noaa.gov/sites/default/files/documents/220-1-5%20AOC%20UAS%20Policy.pdf)
- NOAA Unmanned Aircraft Systems Handbook (https://www.omao.noaa.gov/sites/default/files/documents/NOAA%20UAS%20Handbook.pdf)

FKNMS aircraft operations are typically conducted using light aircraft in support of marine mammal population studies, shoreline change assessments, water resource surveys, marine debris surveys, remote sensing projects, damage assessment, and emergency response operations for up to 20 days per year and are used any month of the year. Elevation data are collected using a green laser for bathymetry and a green laser or near-infrared LiDAR for topography.

Natural Resource Damage Assessment

This activity involves the documentation of impacts to sanctuary resources caused by natural or anthropogenic disturbances. FKNMS staff follow protocols described by Hudson and Goodwin (2001), Kirsch et al. (2005), NOAA (2004 and 2010) to determine the severity and extent of injuries to sanctuary resources to make procedural recommendations to the ONMS and the NOAA Office of General Counsel Natural Resources and Enforcement Sections.

This activity uses vessels, aircraft, non-motorized craft, SCUBA/snorkel operations, onshore fieldwork, deployment of equipment on the seafloor, deploy AUVs/ROV/s/Gliders, deployment of remote sensing equipment, and other sampling activities. The vessels used are small boats for approximately 20 trips per year. Aircraft operations are conducted one to three times each year. The vessel trips are less than 20 miles round trip. Flight length/duration is variable based on the location of injury. Kayaks or inflatable boats may also be used during an assessment to gather information. Between two and five staff utilize SCUBA/snorkel and may be deployed for less than four hours per trip to document resource injury. During dives or snorkeling trips, survey-grade GPS, commercially-available off-the-shelf depth-sounders (similar to those used by thousands of recreational vessels operating in FKNMS). FKNMS depth-sounder systems are dual frequency 50/200 kHz single beam sonars and used approximately 20 times per year. During dives or snorkeling trips, survey-grade GPS, PVC stakes, quadrats, stainless steel pins, flagging tape, and measuring tapes may be used, with all equipment removed at the end of each trip. The quadrats are 0.25 to 1.0 square meters and are deployed a minimum of 10 times in each injury and the control/reference area. Divers also take photos and record video. In addition to small vessel trips, staff trailer a small vessel 8-10 times per year between 50-100 miles roundtrip to access grounding sites that are greater than 20 miles from our Upper and Lower Region duty stations.

Habitat Restoration

Seagrass, coral, and hard-bottom restoration projects in FKNMS prevent injuries from expanding in size or increasing in severity, create the site conditions necessary for the injured areas to

recover to pre-incident conditions, and compensate the public and the environment for the services lost from the time of injury until full recovery. FKNMS works with partners to maintain coral nurseries to help replenish wild populations of corals in areas where coral populations have declined due to major environmental events such as coral bleaching and winter cold water events. These nursery corals originate as small colonies rescued from seawall and nearshore construction projects. Other times small corals are salvaged from a vessel grounding. In the nursery, corals are typically attached to pedestals on blocks on the seafloor, hung on line nurseries, or placed in baskets suspended off the seafloor.

Seagrass restoration alternatives are implemented following protocols described in Final Programmatic Environmental Impact Statement for Seagrass Restoration in the Florida Keys National Marine Sanctuary (NOAA 2004) and Final Programmatic Environmental Impact Statement for Habitat Restoration Activities Implemented Throughout the Coastal United States (NOAA 2015) that may include harvesting and installing seagrass planting units, PVC and wood bird-roosting stakes, and fertilizer spikes. Measuring tapes, PVC pipes and PVC quadrats may also be used. Photos and video are taken to document restoration activities.

Coral and hard-bottom restoration alternatives are implemented following protocols described in Final Programmatic Environmental Impact Statement for Coral Restoration in the Florida Keys National Marine Sanctuary and Flower Gardens Banks National Marine Sanctuaries (NOAA 2010) and may include removal of rubble, placement of pre-formed modules, and direct reattachment. During the dives, divers use cement, epoxy, hand tools, PVC stakes, PVC quadrats, stainless steel pins, tags, and/or other markers, as well as measuring tapes. Photos and video are taken to document restoration activities. Coral and hard-bottom restoration projects are conducted under an existing NMFS Programmatic Biological Opinion that is currently under revision.

This activity uses vessels, non-motorized craft, SCUBA/snorkel operations, onshore fieldwork, deployment of equipment on the seafloor, deployment of AUVs/ROV/s/Gliders, deployment of remote sensing equipment, and other sampling activities. For vessel operations, the vessels are used on approximately 10 trips per year. The vessel trips are less than 20 miles round trip. For SCUBA/snorkel operations, between two and five snorkel/SCUBA-certified biologists are deployed to conduct seagrass restoration, provide oversight for contractors and document restoration activities. SCUBA/snorkel trips are typically less than eight hours each.

These activities have also been analyzed in the Final Programmatic Environmental Impact Statement for Habitat Restoration Activities Implemented throughout the Coastal United States (NOAA 2015).

Restoration Monitoring

Monitoring is the primary means for determining whether habitat restoration projects provide services in a manner consistent with restoration goals. Monitoring also allows sanctuary scientists

to assess the progress of restoration and to identify, as necessary, timely corrective action to shorten the seagrass injury recovery period.

Coral and hard-bottom restoration monitoring activities are implemented following protocols described in Final Programmatic Environmental Impact Statement for Coral Restoration in the Florida Keys National Marine Sanctuary and Flower Gardens Banks National Marine Sanctuaries (NOAA 2010).

Seagrass restoration monitoring activities are implemented following protocols described in Final Programmatic Environmental Impact Statement for Seagrass Restoration in the Florida Keys National Marine Sanctuary (NOAA 2004).

The activity uses vessels, SCUBA/snorkel operations, and other sampling activities. This activity uses small vessels for approximately 20 trips per year. The trips are less than 20 miles round trip. Between two and five snorkeling or SCUBA diving biologists may be deployed for less than four hours per trip to document restoration projects. During dives or snorkeling trips, PVC stakes, quadrats, brass chains, and measuring tapes may be used. Divers also take photos and record video.

Benthic Habitat Characterization

FKNMS staff provide support for or participate in a number of habitat surveys and monitoring projects designed to detect status and trends of various ecological parameters in order to discern local and system-wide effects of human and natural disturbances on natural resources and to assess the overall health of the ecosystem. Examples of these projects include, but are not limited to:

- Coral Reef Evaluation and Monitoring Project (Florida Fish and Wildlife Conservation Commission project lead) assessing status and trends in coral reef systems at 47 sites with 192 stations throughout the sanctuary since 1996.
- Seagrass Monitoring Project (Florida International University project lead) assessing trends in seagrass communities through long-term sampling at over 350 sites throughout the sanctuary since 1997.
- Rapid Assessment and Monitoring of Coral Reef Habitats (NOVA Southeastern University/University of North Carolina at Wilmington project leads) conducting surveys of coral community structure and associated organisms for comparisons between fully protected marine zones and reference site at 64 sites from Biscayne Bay to the Dry Tortugas since 1998.
- Florida Reef Resilience Program Disturbance Response Monitoring assessing status and trends of corals during annual periods of peak thermal stress since 2005.

- National Coral Reef Monitoring Program (NOAA Coral Reef Conservation Program project lead) is a strategic framework for conducting sustained observations of biological, climatic, and socioeconomic indicators providing a robust picture of the condition of coral reef ecosystems and the communities connected to them.

- Hydroacoustic and bathymetric surveys and coastal mapping projects are conducted by FKNMS and other partners to assist with the production of benthic habitat maps and other products. FKNMS small boats are limited to single beam sonars, however other partners may be outfitted with dual beam sonar capabilities.

These activities use vessels, aircraft, non-motorized craft, SCUBA/snorkel operations, onshore fieldwork, deployment of equipment on the seafloor, deployment of AUVs/ROV/s/Gliders, deployment of remote sensing equipment, and other sampling activities. This activity uses vessels for approximately 70 trips per year and aircraft for one to three trips per year. The vessel trips are typically less than 20 miles round trip, however some may be hundreds of miles when conducting large scale habitat mapping. Between two and five snorkeling or SCUBA diving biologists may be deployed to over 500 sites for less than four hours per trip to document survey and ground-truth habitats. During dives or snorkeling trips, PVC stakes, quadrats, brass chains, and measuring tapes may be used. Divers also take photos and record video.

Hydroacoustic and bathymetric survey activities may be conducted by FKNMS or by partners on behalf of ONMS, such as NOAA's Office of Coast Survey[4], and the may occur on FKNMS vessels, or on NOAA ships or aircraft, NMFS vessels, including but not limited to the *Thomas Jefferson, Nancy Foster, Pisces, Okeanos*, etc.

Fish and Wildlife Surveys

FKNMS staff provide support for or participate in a number of fish and wildlife surveys designed to track changes in abundance, diversity, spatial distributions, behavior, and other metrics to inform and develop management strategies. Surveys involve collecting data on fish, marine mammals, birds, sea turtles, and other wildlife to evaluate diversity, distribution, abundance, and size. This activity uses vessels, aircraft, non-motorized craft, SCUBA/snorkel operations, onshore fieldwork, deployment of equipment on the seafloor, deployment of AUVs/ROV/s/Gliders, deployment of remote sensing equipment, and other sampling activities. Examples of these projects include, but are not limited to:

- Soundscapes and Coral Reef Surveys (Center for Marine Sciences and Technology NC State University project lead) passive underwater acoustics, habitat data, and ecological

[4] The mission of NOAA's Office of Coast Survey (OCS) is to survey all navigationally significant waters of the U.S., including national marine sanctuaries, in order to produce navigational charts for the public. In 2013, OCS analyzed the impacts of their surveys and other field operations in a PEA which included analysis of their work in the southeastern U.S. and the Gulf of Mexico. NOS subsequently signed a Finding of No Significant Impact for OCS operations on May 29, 2013. OCS environmental compliance procedures require OCS to determine if each specific survey activity falls within the scope of the OCS PEA.

surveys to (1) quantify density, size, and habitat associations of reef fish, threatened coral, and macroalgal species among various management zones (fished, no-take but with public access, no-take and no public access) in FKNMS, (2) directly observe grazing activity of parrotfish and other herbivorous fish using UW video surveys coupled with hydrophone recordings to explore acoustic signatures of species-specific grazing behavior, and (3) characterize spatiotemporal periodicity in reef fish spawning behavior for both target and non-target reef fish species via hydrophone recordings.

- Acoustic telemetry (Florida Fish and Wildlife Conservation Commission project lead) using a network of approximately 130 acoustic receivers, scientists are studying the movement patterns of species such as mutton and gray snapper, black grouper, lionfish, permit and even spiny lobsters.

These activities use vessels for approximately 70 trips per year and aircraft for one to three trips per year. The vessel trips are typically less than 20 miles round trip, however some may be hundreds of miles when conducting surveys in remote areas of the sanctuary. Between two and five SCUBA diving biologists may be deployed for less than four hours per trip. During dives or snorkeling trips, PVC stakes, quadrats, brass chains, and measuring tapes may be used. Divers also take photos and record video.

Coral Spawning Observation and Sampling

Annually in the late summer, coral colonies release their gametes simultaneously. FKNMS staff participate in and/or support observation and sampling activities during the spawn.

This activity uses vessels, SCUBA/snorkel operations, deployment of equipment on the seafloor, and other sampling activities. This activity uses small vessels for approximately 12 trips per year. The trips are less than 20 miles round trip. Between two and five snorkeling or SCUBA diving biologists may be deployed for less than four hours per trip to document, observe, and sample coral spawn. During dives or snorkeling trips, PVC stakes, quadrats, brass chains, and measuring tapes may be used. Divers also take photos and record video.

Invasive/Exotic Species Management

FKNMS encourages the safe removal of invasive lionfish from its waters and issues lionfish removal permits to divers for the collection of lionfish from Sanctuary Preservation Areas, which are otherwise no-take zones. No permits are necessary for removing lionfish from areas of the sanctuary where fishing is normally allowed. FKNMS staff remove lionfish as they are encountered during various project dives and other field operations.

FKNMS and NMFS are also permit the testing of traps to capture lionfish. The effects of testing of traps has been analyzed in *Programmatic Environmental Assessment-Testing Traps to Target Lionfish in the Gulf of Mexico and South Atlantic, Including within the Florida Keys National Marine Sanctuary* (NOAA 2018).

This activity uses vessels, SCUBA/snorkel operations, deployment of equipment on the seafloor, and other sampling activities. This activity uses small vessels for approximately 10 trips per year. The trips are less than 20 miles round trip. Between two and five snorkeling or SCUBA diving biologists may be deployed for less than four hours per trip to remove lionfish. This activity may be conducted on an opportunistic basis during other dives or snorkeling trips.

Maritime Heritage Resource Management

Maritime heritage research activities seek to locate and characterize historical and cultural resources. Study of these now-renewable sites and artifacts is critical to understanding the history of the Florida Keys. Historical and cultural resources include shipwreck (the predominant variety), plane wrecks, historic navigation aids and other structures placed on the seafloor, and submerged Native American archaeological sites.

Sanctuary researchers and archaeologists employ remote sensing equipment such as side scan sonar and AUVs to map the seafloor and locate targets for further investigation. Remote sensing surveys are conducted from the sanctuary's small vessels and from larger vessels operated by partner organizations, such as the University of Miami. Follow up investigations by divers and ROVs capture imagery of the resources. Archaeological sites selected for further investigation may be mapped by larger dive teams of up to 40 persons who utilize analog measuring equipment and drawings to create detailed site maps. These efforts may require the placement of temporary measuring apparatus on the seafloor. Staff archaeologist may collect threatened or diagnostic artifacts to ensure that the information they possess is available to the public. Artifacts are conserved and archived to Secretary of the Interior standards[5]. Archaeological sites of high research interest that are buried in sediment may be excavated to reveal important information. Excavation techniques are appropriately scaled to the research questions and designed to minimally impact the surrounding environment. Monitoring of the sanctuary's historical and cultural resources is also conducted to evaluate changes to the resources from environmental and anthropogenic sources for adaptive management.

These activities use vessels, non-motorized craft, SCUBA/snorkel operations, onshore fieldwork, deployment of equipment on the seafloor, deployment of AUVs/ROV/s/Gliders, deployment of remote sensing equipment, and other sampling activities. Maritime heritage research conducts approximately 50 mission days a year with research vessel transits of 20 nm each mission. Between two and five SCUBA diving biologists may be deployed for less than four hours per trip. During dives or snorkeling trips, PVC stakes, quadrats, brass chains, and measuring tapes may be used. Divers also take photos and record video. The research takes place throughout FKNMS, but is predominantly located in sharply shoaling waters, where the majority of shipwrecks have occurred.

[5] DOI 1983 and 36 C.F.R. Part 79 (https://www.gpo.gov/fdsys/pkg/CFR-1999-title36-vol1/pdf/CFR-1999-title36-vol1-part79.pdf)

Emergency Response

FKNMS staff respond to or support response efforts for approximately 25 incidents per year. These incidents include, but are not limited to vessel groundings, marine casualties, marine mammal strandings, aircraft crashes, and pollution/hazardous materials releases.

FKNMS emergency response activities follow guidance and utilize response measures and alternatives from National Response Framework, National Incident Management System, National and Regional Response Teams, and Southeast Florida and Florida Keys Area Contingency Plans, Geographic Response Plans, Environmental Sensitivity Index Maps, and Tidal Inlet Protection Strategies. During recovery and removal operations in connection with an air or marine casualty, FKNMS also implements best management practices (BMP) developed in conjunction with NMFS, USFWS, United States Army Corps of Engineers, Florida Fish and Wildlife Conservation Commission, Florida Department of Environmental Protection, Florida Department of State, Seminole Tribe of Florida, and the Seminole Nation of Oklahoma. These BMPs are designed to minimize and/or avoid adverse effects to wildlife and habitat during response activities.

This activity uses vessels, aircraft, non-motorized craft, SCUBA/snorkel operations, onshore fieldwork, deployment of equipment on the seafloor, deployment of AUVs/ROV/s/Gliders, deployment of remote sensing equipment, and other sampling activities. Response activities may require the use of small boats and barges up to approximately 250 ft. in length. This activity use vessels for approximately 30 trips per year and aircraft for one to three trips per year. Between two and ten sanctuary staff typically assist in incident response by planning and assisting in operations and logistics.

Marine Debris Management

FKNMS conduct and/or support the removal and disposal of marine debris to eliminate physical, biological, and chemical threats to coastal and marine resources and habitat. This debris may include derelict or illegal fishing gear, derelict or illegal structures, solid waste, and abandoned or derelict vessels. Many forms of debris can negatively impact riverine, riparian, associated upland, coastal, intertidal, or subtidal habitat and compromise the ecosystem by limiting access to habitat, degrading the quality of habitat, or directly harming a living marine resource. Derelict fishing gear can entangle and kill fish, birds, sea turtles, and marine mammals and can snag on or drag across sensitive subtidal habitats such as coral reefs and seagrass.

Debris removal projects typically involve, but are not limited to:

- Identifying, assessing, and removing debris.
- Entry of personnel and/or heavy equipment into upland and marine environments.
- The use of machinery, trucks, and/or heavy equipment to access and remove debris.

- Manual removal by volunteers and/or professionals.

This activity uses vessels, aircraft, non-motorized craft, SCUBA/snorkel operations, onshore fieldwork, deployment of equipment on the seafloor, deployment of AUVs/ROV/s/Gliders, deployment of remote sensing equipment, and other sampling activities. The vessels used are small boats for approximately 20 trips per year. Aircraft operations are conducted one to three times each year. The vessel trips are less than 20 miles round trip. Flight length is variable based on the location of debris. Kayaks or inflatable boats may also be used during an assessment to gather information. Between two and five staff utilize SCUBA/snorkel and may be deployed for less than four hours per trip to document resource injury.

During debris removal operations, FKNMS implements best management practices (BMP) developed in conjunction with NMFS, USFWS, United States Army Corps of Engineers, Florida Fish and Wildlife Conservation Commission, Florida Department of Environmental Protection, Florida Department of State, Seminole Tribe of Florida, and the Seminole Nation of Oklahoma. These BMPs are designed to minimize and/or avoid adverse effects to wildlife and habitat during removal activities.

This activity has also been analyzed in the Final Programmatic Environmental Impact Statement for Habitat Restoration Activities Implemented throughout the Coastal United States (NOAA 2015).

Waterway Management

Waterway management activities assist FKNMS in minimizing impacts to maritime heritage resources and sensitive marine habitats, specifically coral reef formations, to provide reasonable access to sanctuary resources, consistent resource protection, and to manage or restrict activities that have a detrimental impact on resources. FKNMS uses mooring buoys throughout the sanctuary to provide alternatives to anchoring in high-use and sensitive areas. FKNMS also uses buoys to delineate sanctuary regulatory zones that protect sanctuary resources (Sanctuary Preservation Areas (SPA), Special Use Areas (SUA), Wildlife Management Areas (WMA) and Ecological Reserves (ER)). FKNMS is also responsible for maintaining 12 Private Aids to Navigation (PATON) near Carysfort Reef, South Carysfort Reef, Grecian Rocks, Key Largo Dry Rocks, White Bank Dry Rocks, French Reef, Molasses Reef, and Sand Island.

This activity uses vessels, SCUBA/snorkel operations, and deployment of equipment on the seafloor to monitor over 820 buoys with over 28,000 feet of down line. Maintenance involves hydraulic drilling to install new anchor points and PATONs on the seafloor and re-establishing anchor points on artificial reefs (shipwrecks). The activity uses two 39-foot vessels and two smaller vessels to install and maintain moorings throughout the sanctuary. The activity involves approximately 250 vessel trips of 25-50 miles roundtrip per year. Additionally, ONMS staff run one trip per year to the Dry Tortugas Ecological Reserve for a roundtrip of 160 miles. The teams average 35 - 40 dives each month to conduct routine inspections and down-line cleanings. Down-lines are changed out based on a maintenance timeline and anchors are replaced when necessary.

Water Quality Monitoring Program

FKNMS staff conduct and/or support activities to collect, measure, and analyze data on temperature, salinity, light, currents, chemicals (nutrient) data, chlorophyll-a and pigment concentrations, environmental DNA (eDNA), bio-optical measurements, phytoplankton and zooplankton samples for taxonomy and primary productivity, in situ bio-optical measurements includes surface remote sensing reflectance (Rrs), chlorophyll-a and colored dissolved organic matter (CDOM) fluorescence, and specific absorption spectra of phytoplankton and detritus. Examples of these projects include, but are not limited to:

- Water Quality Monitoring Project (Florida International University project lead) collecting water samples from 154 water quality monitoring stations throughout the sanctuary since 1995.
- FKNMS staff have maintained and collected data from 38 subsurface recording thermographs deployed throughout the sanctuary since 1988.
- Marine Biodiversity Observation Network partners to conduct comprehensive bi-monthly sampling at 30 locations in the sanctuary collecting data.
- Ocean Acidification (NOAA Coral Reef Conservation Program project lead) conducting long-term observations of carbonate chemistry.

This activity uses vessels, SCUBA/snorkel operations, onshore fieldwork, deployment of equipment on the seafloor, and other sampling activities. The vessels used are small boats for approximately 20 trips per year. Between two and five snorkeling or SCUBA diving staff may be deployed for less than four hours per trip to obtain samples.

Education, Outreach, and Volunteer Programs

Successful sanctuary management relies on a well-informed public who understand their role in the overall management of the sanctuary. Education and outreach programs develop opportunities and tools to reach key audiences, such as students or first-time visitors, with critical messages that enlist their support in protecting Sanctuary resources.

Volunteers are a vital mechanism for involving the community and a valuable resource for accomplishing a variety of tasks, including research and monitoring, education and outreach programs, underwater projects, representation at certain events and functions, and administrative tasks. Volunteers support many activities that would otherwise not be accomplished as efficiently or cost effectively.

Examples of field operations associated with this activity include, but are not limited to:

- The Team Ocean Conservation Education Action Network (OCEAN) volunteer program promotes safe and enjoyable use of the marine environment within the sanctuary. Trained teams operating sanctuary vessels stationed at heavily-visited reef sites during peak

recreational boating seasons inform boaters about the sanctuary's zones and regulations, encourage proper use of resources and mooring buoys, promote dive flag safety, and promote safe and responsible boating behavior.

- Goal Clean Seas Florida Keys local tour operators and other businesses to identify and remove lobster traps, fishing gear, construction materials, and other items that pose significant pollution and navigation threats.

This activity uses vessels, SCUBA/snorkel operations, non-motorized craft, and onshore fieldwork. Team OCEAN utilizes three small vessels for approximately 80 trips per year. The trips are less than 20 miles round trip. Team OCEAN also conducts 8-10 shoreline/mangrove cleanups per year using up to 16 kayaks.

2.2.3 Field Operations at Flower Garden Banks NMS

Field operations at FGBNMS focus on several projects that support the mission to identify, protect, conserve, and enhance the natural and cultural resources, values, and qualities of FGBNMS and its regional environment for this and future generations. Projects include research and monitoring; invasive species removal; acoustic and satellite tracking; mooring buoy placement and maintenance; impact assessments; and habitat characterization and mapping.

Since all three areas that compose the sanctuary are submerged areas located far from shore, all field operations involve vessel operations. The primary vessel used for the projects is the R/V *Manta*, the sanctuary's 83-foot research catamaran. This vessel holds a maximum of ten researchers and four crew members. Of the ten research slots, the number filled with diving participants is variable by cruise. The cruises are typically based out of Galveston, Texas, and generally support either SCUBA or ROV activities. Activities are either conducted from a mooring buoy location, or live-boating (not anchored or moored). Activities described for various projects listed in Table 4 below are often conducted during the same cruise.

Table 4. FGBNMS Projects and Field Operations under Alternative 1

Project Title	Summary	Categories of Field Operations
East and West Flower Garden Bank Long-Term Monitoring	Collect annual field data that includes repetitive photo stations, random photographic transects, video transects, coral colony and recruit transects, fish counts, lobster and sea urchin counts, sclerochronology, water sampling, *in situ* water quality instrumentation, and deployment of water quality instrument racks. Includes installation and maintenance of repetitive photo stations, study site delineation and corner markers.	Vessel operations SCUBA or snorkel operations Other sampling activities
Water Quality Collection and Instrument	Collect quarterly water samples for long-term monitoring and maintenance of water quality instrumentation.	Vessel operations SCUBA or snorkel operations Other sampling activities

Maintenance		
National Coral Reef Monitoring Plan	Collect data every two years for input into the National Coral Reef Monitoring Database with stratified random surveys of the East and West Flower Garden Banks.	Vessel operations SCUBA or snorkel operations Other sampling activities
Stetson Bank Long-term Monitoring	Collect annual field data that includes repetitive photo stations, stratified random photographic transects, video transects between mooring u-bolts, fish counts, lobster and sea urchin counts, water sampling, and *in situ* water quality instrumentation. In 2015 the area of study will extend to the deepwater (>200 ft.) outer ring of Stetson Bank.	Vessel operations SCUBA or snorkel operations Deployment of AUVs/ROVs/gliders Other sampling activities
HIA389A Monitoring	Acoustic, SCUBA and ROV visual surveys. Multibeam systems maybe used.*	Vessel operations SCUBA operations Monitoring activities AUVs/ROVs/gliders Deployment of remote sensing Equipment
Ocean Acidification Sentinel Site	Install MAPCO2 buoy, along with associated sensor arrays. Periodically collect and analyze coral cores to support ocean acidification investigations.	Vessel operations SCUBA or snorkel operations Other sampling activities Deployment of remote sensing equipment Deployment of equipment on the seafloor
Deepwater Fish Habitat Characterization	Conduct mapping and ROV surveys to explore, characterize, and define the deepwater (> 200 ft.) fish habitats within the sanctuary, in proposed boundary expansion sites, and unexplored reefs and banks that have potential for harboring deepwater habitat. Conduct targeted sampling to address research questions, verify species, document undescribed species, and contribute to regional catalog development. Multibeam systems maybe used.*	Vessel operations Other sampling activities Deployment of AUVs/ROVs/gliders Deployment of remote sensing equipment
Deep Reef Assessments - Technical Diving	Conduct technical dive operations to characterize the deep coral reefs and associated deep zones. Conduct targeted sampling to address research questions, verify species, document previously undescribed species, and contribute to regional species catalog development.	Vessel operations SCUBA or snorkel operations Other sampling activities
High Resolution Multibeam Mapping	Conduct high resolution multibeam mapping of previously unmapped features in northwestern Gulf of Mexico. The R/V *Manta* has a fishery acoustic system (split beam sonar) operating at 120-200kHz	Vessel operations Deployment of remote sensing equipment

	and a Reson 7125 multibeam sonar that operates at 200 kHz or 400 kHz at depths less than 250 meters. Hydroacoustic activities may also be conducted by ONMS or by partners on behalf of ONMS, such as NOAA's Office of Coast Survey[6], and the may occur on ONMS vessels or on NOAA ships, including but not limited to the *Thomas Jefferson, Nancy Foster, Pisces, Okeanos*, etc.	
Lionfish Invasion Response and Management Plan/Other invasive species removal	Develop a lionfish invasion response and management plan. Response involves delineating removal and non-removal zones, and fish surveys. Analyze removed animals in terms of size, sex, reproductive status, stomach content, genetics, otolith aging, otolith chemistry, and when size is appropriate, ciguatera and mercury. In addition, monitoring and removal is done for other invasive species (e.g., *Tubastraea*) encountered within the sanctuary.	Vessel operations SCUBA or snorkel operations Other sampling activities
Monitoring of human health issues: mercury and ciguatera	Provide algae samples to NCCOS and FDA to monitor and document dinoflagellate *Gambierdiscus* sp. – the source of ciguatera poisoning. Provide targeted and opportunistic fish samples to NCCOS and FDA for ciguatera analysis and to GotMercury.Org for mercury analysis.	Vessel operations SCUBA or snorkel operations Other sampling activities
Acoustic and Satellite Tagging	Deploy acoustic array and tag target species with acoustic tags and/or satellite tags. This involves installing of receiver anchors, and tagging of target species, including elasmobranchs, recreationally/commercially/ecologically important fish species, sharks and rays, and invertebrates. Tags deployed both underwater and from topside.	Vessel operations SCUBA or snorkel operations Deployment of remote sensing equipment Other sampling activities
Whale Shark Monitoring and tagging in the Northwestern Gulf of Mexico	Conduct surveys and deploy acoustic and satellite tags to assess aggregations of whale sharks in the vicinity of Ewing Bank.	Vessel operations SCUBA or snorkel operations Deployment of remote sensing equipment Deployment of AUVs/ROVs/gliders
Monitoring the manta rays at	Opportunistically collect imagery of spot patterns on undersides of mantas, tissue collection for	Vessel operations SCUBA or snorkel operations

[6] The mission of NOAA's Office of Coast Survey (OCS) is to survey all navigationally significant waters of the U.S., including national marine sanctuaries, in order to produce navigational charts for the public. In 2013, OCS analyzed the impacts of their surveys and other field operations in a PEA which included analysis of their work in the southeastern U.S. and the Gulf of Mexico. NOS subsequently signed a Finding of No Significant Impact for OCS operations on May 29, 2013. OCS environmental compliance procedures require OCS to determine if each specific survey project falls within the scope of the OCS PEA. (OCS 2013)

FGBNMS	genetics and isotopic analysis, acoustic and satellite tagging	Deployment of remote sensing equipment
Coral Spawning Investigations	Continue observation and supporting science activities studying the mass coral spawning event. This includes sampling of coral and gametes for a variety of studies including coral reproduction, genetics, symbiotic algal communities, and climate change.	Vessel operations SCUBA or snorkel operations Other sampling activities
Sea Turtle Releases	Release sea turtles that have been rehabilitated by NOAA's sea turtle facility in Galveston.	Vessel operations SCUBA or snorkel operations
Event Response	Conduct in water surveys to assess impacts from events such as hurricanes, coral bleaching and disease events, anchoring, and oil spills.	Vessel operations SCUBA or snorkel operations Other sampling activities
Mooring Buoy Maintenance and Installation	Install u-bolts and maintain mooring buoy assemblies.	Vessel operations SCUBA or snorkel operations Deployment of equipment on the seafloor Other sampling activities
Image/Video Collection	Collect quality still photographs and HD videography.	Vessel operations SCUBA or snorkel operations

*When multibeam systems are used, the specifications are: Fishery acoustic system (split beam sonar, 120-200kHz) Reson 7125 (dual freq., dual freq 200kHz or 400 kHz depth range <250m) ROV subatlantic mohawk (multibeam system).

General Vessel operations

General vessel operations are not a project in and of themselves, but they support a great many of FGBNMS's projects. ONMS small boats are operated according to all NOAA Small Boat Program guidelines (https://www.omao.noaa.gov/sites/default/files/documents/SBS%26PM%204th%20Ed%20FINAL_signed%20Corrected%202017%200919.pdf). The FGBNMS vessel (R/V *Manta*) follows additional standing orders imposed by ONMS management to minimize impacts on resources, particularly sea turtles and marine mammals, within the sanctuary and while transiting between sites or from/to shore (See Appendix E). Large whales encounters are possible during typical operations with the FGBNMS vessel, however extremely rare. The general standing orders direct FGBNMS small boat operators to:

- **Keep a sharp lookout** – vessel operators are required to stay vigilant for marine mammals, sea turtles, and other collision hazards.
- **Lookouts** – Post a minimum of one dedicated lookout when the vessel is transiting above speeds of 15kts.

- **Night transits** – Operator will keep a sharp lookout during night transits. Night transits are limited to less than 15kts, unless in the case of an emergency. Watch your speed in limited visibility situations.

- **Stay at the helm** – vessel operators are required to keep hands on the wheel and throttle at all times while in areas where large whales and turtles can occur, and must be ready to take action immediately to avoid any animal.

- **Keep your distance** – if large whales are sighted, a distance of at least 100 yards should be maintained.

- **Stop vessel when large whales are near** – If large whales surface within 100 yards, vessel operators should stop immediately and use prudent seamanship to decide to either move away slowly or wait for the animal to move away on its own.

- ***Sargassum* interaction** – Limit *sargassum* interaction as much as is reasonably feasible, to prevent impact on sea turtle hatchling habitat.

Through the Joint Enforcement Agreement with NOAA, the states of Texas and Louisiana have agreed to conduct a limited number of enforcement missions in the sanctuary. They generally use their own long-range vessel (not a NOAA vessel) and Flower Garden Banks National Marine Sanctuary is usually not the only destination. When they venture that far offshore, they will also perform duties for other federal mandates (e.g., MSA). Therefore, enforcement missions conducted by non-NOAA entities on non-NOAA vessels are not included as part of the field operations of FGBNMS in this programmatic EA.

East and West Flower Garden Banks Long-term Monitoring

The purpose of this activity is to collect field data on an annual basis for a long-term monitoring (LTM) dataset. The vessel operations consist of two four-day cruises each year aboard the sanctuary vessel R/V *Manta* with approximately 250 miles traveled each cruise round trip departing from Galveston, TX. During each cruise, the vessel serves as a platform for crew accommodations, SCUBA operations, Seabird water sampling/CTD carousel-over the side operations using the A-frame and a hand-deployed temperature/salinity probe. A temporary mooring buoy is shackled to a U-bolt in the middle of each study site prior to operations and removed once operations have ceased.

A total of approximately 400 SCUBA dives per year are conducted by ten divers. SCUBA operations include the use of repetitive photo stations, random photographic transects, video transects, fish counts, lobster and sea urchin counts (at night), coral colony and recruit transects, coral core collection every two years for sclerochronology, water sampling for water quality analysis, and in situ water quality instrumentation. This project is conducted within study sites (100 m2) at the East and West Flower Garden banks, and also at 12 additional monitoring stations outside the study sites in deep water habitat. Coral cores are collected using a pneumatic drill, and the resulting hole is plugged with remnant coral plugs and epoxy. Water quality instruments are

changed out using lift bags and wrenches. Installation and refurbishment of new permanent photo stations, delineation sight line markers, and corner stations are installed using a pneumatic drilling rig and epoxy. This project is a partnership primarily between FGBNMS and the Bureau of Ocean Energy Management (BOEM).

Water Quality Collection and Instrument Maintenance

The activity supports both the East and West FGB LTM and the Stetson Bank LTM projects. Vessel operations comprise up to four two-day cruises on the sanctuary vessel with approximately 250 miles traveled each cruise round trip departing from Galveston, TX. During each cruise, the vessel serves as a platform for crew accommodations, SCUBA operations, A-frame operations for water collections, and CTD cast. A total of 72 SCUBA dives per year are conducted by six to ten divers to change out water quality instruments using lift bags and wrenches.

National Coral Reef Monitoring Plan

Researchers collect data every two years for input into the National Coral Reef Monitoring Database. Vessel operations are comprised of one five-day cruise on the sanctuary vessel with approximately 350-400 miles traveled round trip departing from Galveston, TX. During each cruise, the vessel serves as a platform for crew accommodations and SCUBA operations. A total of 200 SCUBA dives per year are conducted by up to ten divers. SCUBA operations consist of stratified random belt fish transects and coral colony and recruit counts and point count benthic surveys. Coral cores are collected every 10 years to support Ocean Acidification Sentinel Site activities.

Stetson Bank Long-term Monitoring

Researchers annually collect field data for a LTM dataset. Vessel operations comprise one four-day cruise per year on the sanctuary vessel with approximately 160 miles traveled round trip departing from Galveston, TX. During each cruise, the vessel serves as a platform for crew accommodations, SCUBA operations, A-frame operations and CTD casting. SCUBA operations consist of photographing repetitive photo stations and stratified random transects, video transects and belt-transect fish counts, lobster and sea urchin counts (at night), and in situ water quality monitoring. The project also includes ROV operations to monitor deepwater (>200 ft.) photographic monitoring stations around the ring of Stetson Bank proper. The stations consist of cement blocks weighing 25kg were placed on the seafloor, adjacent to biology selected for monitoring. A small 20cm hard trawl float and wire cable is attached to an eyebolt embedded into the concrete block.

HIA389A Monitoring

HIA389A is a gas platform located within the boundaries of the East Flower Garden Bank. It is slated for partial removal in the future. An Interagency Agreement is in development between Bureau of Safety and Environmental Enforcement (BSEE) and FGBNMS for FGBNMS to

conduct pre- and post-removal monitoring of the mobile and benthic communities associated with the platform. Vessel operations will comprise two five-day cruises per year on the sanctuary vessel with approximately 250 miles traveled round trip departing from Galveston, TX. During each cruise, the vessel will serve as a platform for crew accommodations, SCUBA operations, A-frame operations and CTD casting. SCUBA and ROV operations consist of fish and benthic surveys. Acoustic surveys will be conducted to assess fish biomass, using a portable Fishery Acoustic System installed on the Manta. The system is similar to that used on other NOAA vessels. These systems will include split-beam sonar that provides backscatter information on targets in the water column as well as an indication of bottom features along transects. Because of the relatively shallow depth at FGBNMS, higher frequencies (120 and 200 kHz) will be used to acoustically-reflecting targets such as fish. Sonar aboard the *Manta* includes the fishery acoustic system (split beam sonar, dual frequency, 120/200kHz) and a Reson 7125 (multibeam, dual frequency, 200/400 kHz). The fishery-acoustic system is used on two 5-day cruises/yr and the Reson system is used during ROV operations on six 5-day cruises. Transducers are aimed at the bottom and surveys are done for less than 10 hours per day during the cruises.

Ocean Acidification Sentinel Site

FGBNMS, BOEM Regulation and Enforcement, NOAA's National Coral Reef Monitoring Program, Texas A&M University (TAMU), and Shell are developing infrastructure and protocols to develop FGBNMS as an Ocean Acidification Sentinel Site. An in situ instrument package is under development to measure parameters to monitor conditions, and provide real-time data upload capabilities. It is estimated that installation of the system may require one five-day cruise on the sanctuary vessel resulting in approximately 250 miles traveled round-trip from Galveston, TX. A permanent mooring buoy and anchor system would be deployed upon which the instrumentation will be installed. Quarterly maintenance trips (8 days total) would also be needed, each approximately 350 miles round trip on the sanctuary vessel. It is not yet known how many divers will be needed to install and maintain the system.

Deepwater (>200ft.) Fish Habitat Characterization

Researchers conduct multibeam sonar mapping studies, which they then ground-truth using ROV surveys to explore, characterize, and define the deepwater fish habitats within the sanctuary, in proposed boundary expansion sites, and also unexplored reefs and banks that have potential for harboring productive deepwater habitat.

Vessel operations comprise up to six five-day cruises a year aboard the sanctuary vessel with approximately 350-500 miles traveled round trip departing from Galveston, TX. During each cruise, the vessel serves as a platform for accommodations, multibeam mapping and ROV operations. Multibeam operations utilize a Reson 7125 dual frequency (200/400 kHz) shallow water system owned and operated by Texas A&M University, or contractor, and similar to the system used aboard the NOAA Ship *Nancy Foster* at GRNMS (see additional information above on the Reson system). All depths surveyed are less than 250 m. ROV operations utilize a Sub Atlantic Mohawk ROV owned by the National Marine Sanctuary Foundation, and maintained and

operated by University of North Carolina – Wilmington. The multibeam system was purchased primarily for investigation by FGBNMS in the Gulf of Mexico. The ROV is used to ground truth multibeam bathymetry, collect HD video and high resolution still imagery, and conduct targeted sampling using a 5-function manipulator and custom collection carousel. The sampling is done to research questions, verify species, document undescribed species, and contribute to regional catalog development, as well as the development of site specific biological habitat maps.

Deep Reef Assessments Technical Diving

Researchers conduct technical SCUBA operations to characterize the deep coral reefs and associated deep zones. Vessel operations comprise one five-day cruise aboard the sanctuary vessel with approximately 350-500 miles traveled round trip departing from Galveston, TX. During each cruise, the vessel serves as a platform for crew accommodations and SCUBA operations. Up to ten SCUBA divers conduct up to 100 dives total per cruise. The dives are used for sample collection, photography, and training. Targeted sampling is conducted to support research questions, verify species, document undescribed species, and contribute to regional catalog development. These may include a variety of invertebrates – octocorals, antipatharians, scleractinian corals, algae, etc. Sampling method typically would be ziplock bags, knife or scissors, or small chisel and hammer. Technical diving requires a series of training dives at depth in order to complete certification. Also, work up dives for greater depths is necessary to complete some dives targeting deeper range of technical diving.

High Resolution Multibeam Mapping

Vessel operations comprise up to four five-day cruise per year on the sanctuary vessel with approximately 350-500 miles traveled round trip departing from Galveston, TX. During each cruise, the vessel serves as a platform for crew accommodations. Researchers conduct high resolution multibeam mapping using the Reson multibeam system described above, or similar system, and concentrating on previously unmapped features in the Northwest Gulf of Mexico at a depth range of <250m.

In addition to ONMS small boats, contracted vessels such as the *Pisces* are used. *Pisces* is a modern Fisheries Survey vessel capable of completing multi-disciplined tasks at the same time. From catching live specimens, mapping their habitat to delivering state of art remote sensing equipment. The *Pisces* is equipped with 2 different sonars, Simrad EK60 single beam and the Simrad ME70 multibeam. The EK 60 uses 18, 38, 120, 200kHz enabling it to detect the bottom down to approximately 10,000 meters. The ME70 multibeam is a configurable acoustic fan fisheries sonar containing 3 to 45 stabilized beams with a 2° minimum beam opening to 140°. The Atharwartship center angle of the fan can be adjusted -45° to +45°. Frequency ranges are from 70 kHz to 120 kHz commonly transmitted through continuous wave with a pulse duration 64 to 5120 µs.

Lionfish Invasion Response and Management Plan/Other Invasive Species Removal

Vessel operations include one five-day cruise per year on the sanctuary vessel with approximately 250-400 miles traveled round trip departing from Galveston, TX. During each cruise, the vessel

serves as a platform for crew accommodations, SCUBA operations and handling of lionfish for assessment. SCUBA operations include up to 10 divers conducting 180 dives. FGBNMS is responding to the increasing numbers of invasive Indo-Pacific lionfish by removing as many as is logistically possible. Lionfish are removed using pole spears. All removed fish are assessed for size, sex, stomach contents, reproductive status, genetics, age, and otolith chemistry.

A lionfish response and management plan is in development to address future response at FGBNMS. Concentrated removal efforts will take place around the buoyed areas at each bank, including the 100mx100m study sites. Divers also remove invasive species, such as Pacific cup coral, *Tubastraea* sp. as they are encountered during various project dives.

Monitoring of Human Health Issues: Mercury and Ciguatera

FGBNMS staff collect algae samples for ciguatera and mercury analysis. Algae samples are provided to NOAA's National Centers for Coastal Ocean Science (NCCOS), the Food and Drug Administration (FDA), and to the University of South Alabama to monitor and document the cigua-toxin that causes ciguatera poisoning. Divers collect algae by hand and place in Ziploc bags for transport to the surface. Fish are obtained opportunistically from recreational fishers, or from NOAA partners conducting targeted fishing operations and provided to NCCOS and FDA for ciguatera analysis and to GotMercury.org for mercury analysis.

Establishing an acoustic array in and around FGBNMS

As funding becomes available, FGBNMS will collaborate with ONMS, Texas A&M University – Galveston, BSEE, MarAlliance, and California State University – Monterey Bay, to establish an acoustic array in and around FGBNMS. Acoustic receivers will be anchored at target locations, and Vemco acoustic tags similar to those described for GRNMS (147 dB re 1 mPa at 1 m, pinging continuously at 3-min intervals) will be deployed on a variety of target species (to be determined) but will include commercially, recreationally, and ecologically important species. Receivers will be installed on the coral cap and in deepwater habitat of the sanctuary, as well as on artificial reef structures and natural reefs throughout the NW Gulf of Mexico. The receivers are cylindrical, about 13 inches tall and 3 inches in diameter. Vessel operations include a variable number of days per year on the sanctuary vessel with approximately 500 miles traveled round trip departing from Galveston, TX. During each cruise, the vessel serves as a platform for crew accommodation and SCUBA operations of up to 10 divers.

Up to thirty (30) Anchors (I-bolts) will be installed on the reef cap (down to 130ft) using a pneumatic drill and epoxy. A steel cable will attach to a submerged buoy. The cable will be used as the attachment point for the acoustic receivers. Sand bags will be deployed to submerge the deepwater receivers. The receivers will be released acoustically at a predetermined time, and float to the surface for recovery. The deployment of the acoustic tags into and onto the target animals will vary, depending on the species. This will be determined once the target species are identified. Attachment methods may include attachment using a pole spear, or hook and line capture and surgery for internal placement.

Whale Shark Monitoring and Tagging in the Northwestern Gulf of Mexico

Researchers conduct surveys to assess aggregations of whale sharks in the vicinity of Ewing Bank. Snorkel operations are used to tag and photograph whale sharks. Snorkelers use Hawaiian slings to deploy acoustic and satellite tags onto whale sharks. These operations are funding-dependent and will likely not take place every year. When funding permits, vessel operations comprise one four-day cruise per year on the sanctuary vessel with approximately 500 miles traveled round trip departing from Galveston, TX. During each cruise, the vessel serves as a platform for crew accommodation and snorkel operations. Snorkel operations are conducted with up to ten people, but no more than six in the water at one time. In 2015, a UAV's was deployed as part of the whale shark project, to assist in identifying location and extent of aggregations, and conduct counts of individuals making up the aggregation.

Monitoring the Manta Rays of FGBNMS

Researchers conduct this project opportunistically. The project is conducted on board the sanctuary vessel opportunistically with approximately 500 miles traveled round trip departing from Galveston, TX. During each cruise, the vessel serves as a platform for crew accommodation, SCUBA operations, A-frame operations and CTD casting. SCUBA and snorkel operations consist of photographing manta rays encountered, and using a pole spear to obtain a tissue sample for genetic analysis. Acoustic or satellite tags with a small stainless anchor are attached by a trained individual to the body of the animal using a pole spear. The tissue sampling and acoustic/satellite tagging is conducted under a permit issued to an outside PI.

Coral Spawning Investigations

As funds are available FGBNMS provides ship time to support observation and science activities surrounding the annual mass coral spawning event that occurs 7-10 days after the full moon in August, and sometimes in September. FGBNMS provides up to six slots for outside researchers and retains approximately four slots for staff divers. Vessel operations comprise up to two or five-day cruises per year on the sanctuary vessel with approximately 250 miles traveled round trip departing from Galveston, TX. During each cruise, the vessel serves as a platform for galley duties and SCUBA/snorkel operations. Ten divers conduct up to a total of 160 total dives per cruise. During the dives, divers take photographs, samples of corals and gametes, collect video and still images, and make observations. Gamete collections are conducted using tenting or netting techniques, and coral collections are conducted using hammer and chisel. Last year approximately 200 small coral samples were obtained either by biopsy or by hammer and chisel. No samples of endangered species were collected, but threatened species are sampled. Two colonies of *Acropora palmata* are known to exist in the sanctuary. *Orbicella franksi* makes up 25-30% of the coral cover at the East and West FGB. *Orbicella faveolata* and *O. annularis* have historically been sampled for annual growth rate as part of our long-term monitoring program. No ESA permit has been obtained. Currently, no ESA permit is required to sample the threatened coral species. ONMS staff will coordinate with NMFS should this change in the future. Samples have been and will continue to be collected for various scientific projects including identification,

genetics, reproduction, and histology. This work is expected to be conducted every year. These samples are collected under research permits for individual PIs, and not the Superintendent permit.

Sea Turtle Releases

FGBNMS coordinates with NMFS Galveston Sea Turtle facility and other partners to release rehabilitated sea turtles back into the ocean. Vessel and snorkel operations are used in this project. The animals are transported by the R/V *Manta* during previously scheduled cruises for other projects. The sea turtle releases take place during the transit to the research cruise destination. Juvenile turtles are typically released in close proximity to *sargassum* patches. The vessel is stationary at the time of release. Depending on the size of the animal, the turtle is handed off to a snorkeler who guides the turtle to the *sargassum* for release. Large turtles are carefully placed into the water off the stern of the vessel, and allowed to swim free, in accordance with a permit issued by NOAA Fisheries' Office of Protected Resources (TE-676379-5).

Event Response

Researchers conduct in-water surveys to assess impacts, such as those from a hurricane or a coral bleaching event. This project utilizes vessel operations with transit from Galveston and SCUBA operations. In the event of a hurricane, a research team is sent to measure the hurricane's impact on the sanctuary. In the event of coral bleaching, at least one trip aboard the R/V *Manta* to the sanctuary is necessary. While underway, the vessel serves as a platform for crew accommodations and SCUBA operations. Up to 10 divers may make up to 180 dives to conduct photographic and quantitative surveys. These surveys are conducted at randomly placed locations or at photo stations within study sites. These protocols will follow long-term monitoring protocols and locations.

Mooring Buoy Maintenance and Installation

The FGBNMS installs and maintains mooring buoys at each bank. The activities associated with this project are vessel operations, SCUBA operations and deployment of equipment on the seafloor. Vessel operations consist of at least one annual cruise aboard R/V *Manta*. The cruise originates from Galveston and lasts between three and five days with 250 miles round trip traveled. During the cruise, the vessel serves as a platform for SCUBA operations. Up to ten divers participate in up to 150 total dives a year. New buoy installation involves coring into dead reef rock in two places and cementing a U-bolt in place. A hydraulic drilling system is used by the divers to drill the cores. After the cement has set, the downline is shackled to the U-bolt by the divers using large wrenches. The mooring line runs up to the surface buoy, and associated painter – the line that vessels use to attach to the mooring.

Image/Video Collection

Researchers collect high quality still photographs and high definition video. While this project uses vessel operations and SCUBA operations, it is typically an opportunistic activity conducted

during research cruises for other projects. Therefore, the exact vessel operations will vary from cruise to cruise. However, typical vessel operations will entail a transit from Galveston to the sanctuary (250-500 miles round trip) and/or other locations in the northwestern Gulf of Mexico, operation of the galley, tank filling and SCUBA support. SCUBA operations include taking video and still photographs during dives scheduled for other projects. The imagery is utilized for sanctuary education, outreach, and interpretive activities.

Table 5. Estimated field operation days per year for Southeast/Gulf of Mexico Region

Categories of Field Operations	GRNMS Annual Activities	FKNMS Annual Activities	FGBNMS Annual Activities	Estimate units/year for Southeast/Gulf of Mexico Region for the next 5 years.
Vessel Operations (days/year)	Up to 117	Up to 1300	Up to 128	1545
Vessel Maintenance (vessels/year)	2	22	1	25
Aircraft Operations (hours/year)	0	150	0	150
Non-Motorized Craft (trips/year)	0	300	0	300
SCUBA or Snorkel Operations (team dives/year)	582	658	1356	165
Onshore Fieldwork (people x days)	730	200	1883	2813
Deployment of AUVs/ROVs (deployments/year)	17	25	30	47
Deployment of Remote Sensing Equipment(deployments/year)	Up to 39	25	Up to 16	55
Deployment of equipment on the seafloor (buoys/year)	604	900	10	1514

Other Sampling Activities	placement of recruitment tiles: 30 days/year; trawling: 20 days/year; bottom package placement: 4 days/year; sediment grabs: 2 days/year; placement of transect lines & markers: 5 days/year; placement of transect tape: 10 days/year	use of PVC stakes, quadrats, and measuring tapes: 76 days/year; use of brass chains: 31 days/year; use of stainless steel pins, tags, and/or other markers: 24 days/year;	water quality sampling: 29 days/year; coral removal: 17 days/ year; whale shark tagging: 4 days/year; manta ray tagging: 4 days/year; fish tagging: 4 days/ year, every other year; deployment of anchors, spuds, cables, boom, and/or other pollution response equipment: 5 days/year	Sum of previous columns

2.3 Alternative 2: Conduct Field Operations without Voluntary and Precautionary Procedures for Vessel Operations

Alternative 2 is to conduct field operations as currently conducted with the exception of ONMS self-imposed best management practices (BMPs) for vessel operations. In Alternative 2, ONMS vessels would be operated in accordance to NOAA Small Boat Program standards and other statutes but without the ONMS vessel operations best management practices. Therefore, Alternative 2 would contain all of the activities described in Alternative 2, except for the vessel operations BMPs described below.

2.3.1 Gray's Reef National Marine Sanctuary

The standing orders described in Section 2.2.1 would not be followed under this alternative. There would be no vessel speed restrictions, no requirement for observers on board to keep a lookout for marine mammals and other species, no safe distance requirement from whales and no prohibition on night operations.

2.3.2 Florida Keys National Marine Sanctuary

The voluntary standing orders and best management practices described in Section 2.2.2 would not be followed under this alternative. There would be no vessel speed restrictions, no requirement for observers on board to keep a lookout for marine mammals and other species and no obligation to navigate in marked channels.

2.3.3 Flower Garden Banks National Marine Sanctuary

As described in Section 2.2.3, there are no additional, voluntary standing orders for vessel operations at Flower Garden Banks National Marine Sanctuary. Thus, operations would not change under this alternative.

3.0

AFFECTED ENVIRONMENT

This section includes a brief summary of the physical, biological, socioeconomic and maritime heritage and cultural environments for each sanctuary and surrounding region that may be affected by the proposed action. For a complete description of the affected environment at each of the sanctuaries please see

- Gray's Reef National Marine Sanctuary Final Environmental Impact Statement Sanctuary Research Area Designation Section 4 p. 34-39 (ONMS 2011) http://graysreef.noaa.gov/management/research/research_area.html
- Gray's Reef National Marine Sanctuary Final Management Plan/Final Environmental Impact Statement p. 6-15 (NMSP 2006) http://graysreef.noaa.gov/management/mgmtplan/welcome.html
- Gray's Reef National Marine Sanctuary Condition Report p. 6-10 (ONMS 2008) http://graysreef.noaa.gov/science/publications/pdfs/grnms_condition_report08.pdf
- Gray's Reef National Marine Sanctuary Condition Report Addendum p. 5-18 (ONMS 2012) http://graysreef.noaa.gov/science/publications/pdfs/grnms_condition_add_2012.pdf
- Florida Keys National Marine Sanctuary Final Management Plan/Environmental Impact Statement Volume II p. 8-112 (Sanctuaries and Reserves Division 1996) http://floridakeys.noaa.gov/mgmtplans/1997.html
- Florida Keys National Marine Sanctuary Revised Management Plan pg. 13-18 (NMSP 2007) http://floridakeys.noaa.gov/mgmtplans/2007.html
- Florida Keys National Marine Sanctuary Condition Report p. 10-19 (ONMS 2011) http://floridakeys.noaa.gov/scipublications/condition.html
- Flower Garden Banks Final Management Plan p. 16-25 (ONMS 2012) http://flowergarden.noaa.gov/management/2012mgmtplan.html

- Flower Garden Banks National Marine Sanctuary Condition Report p. 7-13 (ONMS 2008) http://flowergarden.noaa.gov/science/condreport08.html

Those descriptions are incorporated by reference, and are summarized and supplemented below.

3.1 Gray's Reef National Marine Sanctuary

3.1.1 Physical Environment

Geology and Oceanography

GRNMS comprises scattered outcroppings that stand above the sandy substrate of the nearly flat continental shelf. These outcroppings are composed of Pliocene, carbonate-cemented sands and mud that stand above the surrounding shelf sands, exhibiting relief up to six feet. The rock outcrops are continuously being reshaped by storms, tidal currents and bioerosion and are subject to frequent burial and exposure by mobile sands. Surrounding these rock outcroppings are soft bottom habitats, made up of marine and terrestrial sediments (sand, shell, and mud), consisting predominantly of fine-grained to medium-grained quartz sand and granule-sized gravel (Hunt, 1974).

The bathymetry of GRNMS is typified by several ridges and troughs, which extend for several miles in a northeast to southwest direction. The most prominent bathymetric features occur in the western and central portions of the sanctuary with patchy expressions in the southern and eastern portions.

Water Quality

GRNMS receives nutrients from freshwater runoff of coastal rivers as well as deep, nutrient-rich water upwelled along the western edge of the Gulf Stream and carried into the sanctuary by eddies that occasionally break off from the main Gulf Stream current and wash over GRNMS.

Chemical contaminants within the sanctuary are generally at low background concentrations, below probable bioeffect levels. However, trace concentrations of pesticides (DDT, chlorpyrifos), polychlorinated biphenyls and polycyclic aromatic hydrocarbons have been detected in sediments and biota, demonstrating that substances originating from human activities are capable of reaching the offshore environment either by air or cross-shelf transport from land (Hyland et al., 2001, 2002).

GRNMS is subject to seasonal variations in temperature, salinity, and water clarity. Due to agitation from periodic high seas, re-suspension of organic material in the sediments adds to the productivity of sanctuary waters.

Air Quality

Air quality in GRNMS is believed to be good, although very little research has been done to confirm this. A single research project on air quality was conducted in which a semi-permeable

membrane device (SPMD) was deployed in GRNMS by researchers at Texas A&M University in 2001. The results of this study (unpublished) indicated that atmospheric contaminants found in GRNMS were within normal levels.

Acoustic environment in GRNMS

The acoustic environment in GRNMS is affected by biological and anthropogenic noise. The amount of anthropogenic noise from boats is minimal, with generally few boats observed in the sanctuary. Scientific divers report some but very little observable noise from snapping shrimp and unknown biological sources, probably fish. In February 2011, GRNMS initiated a focused study to determine impacts on the acoustic environment to specific transmitters due to physical and environmental interference. Stationary acoustic transmitters and receivers were deployed to assess sound transmission over set distances for 15 months and compared to environmental parameters gathered using a data buoy within the sanctuary. This work showed that the acoustic environment of GRNMS is variable and changes on both long-term and short-term scales. Sound transmission is improved during the winter and spring and greatly decreased during the summer months. This is likely a result of current stratification but could also be due to other factors such as turbidity. Additionally, as sound transmission is diminished from late spring into summer, it also is affected in the short-term by flood/ebb tidal current direction and speed.

3.1.2 Biological Environment

Biological Habitat and Invertebrates in GRNMS

The rock outcroppings within the sanctuary provide hard surfaces that are colonized to varying extents by algae and sessile and burrowing invertebrates, which in turn provide shelter, food and nursery areas for a large diversity of fish. This structurally-complex assemblage is known as live-bottom habitat. Live-bottom habitats typically support high numbers of large invertebrates such as sponges, corals and sea squirts. These creatures thrive in rocky areas, where they are better able to attach themselves to the hard substrate as compared to sandy or muddy "soft" bottom habitats. The percent cover of attached benthic species is significantly greater on higher ledges in comparison to the low-relief ledges. In addition, total percent cover - and cover of macroalgae, sponges and other organisms - is significantly lower on low ledges in comparison to medium and tall.

Larger sessile invertebrates, such as gorgonians, hard corals and sponges provide refuges for many smaller, more cryptic invertebrates. Other dominant invertebrates include sea stars, brittlestars, crabs, shrimps, bivalves and snails.

The soft bottom habitats in and around GRNMS comprise vast stretches of unconsolidated sandy substrates surrounding the rocky-reef structures and these areas teeming with a great biodiversity of life. The benthic fauna living within these sediments are important functional components of the offshore ecosystem, playing vital roles in detrital decomposition, nutrient cycling, and energy

flow to higher trophic levels. GRNMS supports highly diverse and abundant benthic assemblages comprised mostly of annelids, mollusks, and bivalves.

Fish in GRNMS

The biologically diverse live-bottom habitat of GRNMS attracts reef-associated fish including bottom-dwelling and midwater fish species such as sea bass, snapper, grouper and mackerel, as well as their prey. Just over 200 species of fish, encompassing a wide variety of sizes, forms and ecological roles, have been recorded at the sanctuary. Some fish species are dependent upon the reef for food and shelter, and rarely venture away from it during their life. Many of these fish are nocturnal, seeking refuge within the structure of the reef during the day and emerging at night to feed. Some species of reef-dwelling fish disperse to sandy habitats or to other reef areas north and south or offshore for feeding and spawning. Other reef residents, such as Gag and Black Sea Bass, rely on the inshore areas and estuaries in early life stages.

Many species of reef fish are overfished or subject to overfishing. According to the National Marine Fisheries Service (NMFS), overfished stocks (reef fish only) in the waters of the Southeastern U.S. Atlantic include Red Porgy, Red Snapper, Snowy Grouper, and Blueline Tilefish. Red Snapper, Speckled Hind, Warsaw Grouper, and Blueline Tilefish are undergoing overfishing. Of these species, Red Snapper is common at GRNMS.

Until 2013, Black Sea Bass - also a common species found in GRNMS - was overfished. Black Sea Bass stocks were declared rebuilt in 2013. Recent regional data is showing improvement in the status of Red Snapper, which is reflected in GRNMS. Gag and Scamp, although neither overfished nor undergoing overfishing regionally, have decreased in abundance in visual census transects in the sanctuary. Length-frequency measurements of Black Sea Bass, Gag and Scamp (from trap and visual census data) indicate that a large portion of the population is removed upon reaching minimum size, either by fishing or by migration out of the sanctuary. The reduced abundance of these selected key species may inhibit full community development and function in GRNMS (ONMS 2012). In addition, research suggests that a very low level of increased fishing pressure on the sanctuary's ledges could reduce local abundance of snapper-grouper complex species within a short amount of time (Kendall 2008).

In addition to species of the Snapper-Grouper management unit, GRNMS serves as habitat for a number of other fish species. King Mackerel, Spanish Mackerel, Great Barracuda, and Cobia make up the majority of coastal pelagic species that are targeted for recreational angling. The high abundance of schooling baitfish, such as Spanish Sardine and Round Scad, likely attract these pelagic predators to sanctuary waters. There is considerable but unmeasured fishing effort on King and Spanish Mackerel during tournaments and at other times. Federal management of coastal pelagic species has resulted in sustainable fisheries for King Mackerel and the current stock determination is not overfished and not undergoing overfishing (SEDAR 38, 2014).

Approximately 30 species of fish spawn in the vicinity of GRNMS and only a third of these are reef-associated (Walsh et al. 2006, Sedberry et al. 2006). The large areas of sandy habitat in the

sanctuary form another habitat that is not as rich in fish species, and is not generally targeted by recreational anglers. These sandy areas support a number of species including flounders, tonguefish, cusk eels, stargazers, and lizardfish (Gilligan 1989, Walsh et al. 2006).

Sea Turtles in GRNMS

Sea turtles known to occur in the South Atlantic Bight (SAB), which encompasses GRNMS, include the Kemp's Ridley (*Lepidochelys kempii*), Hawksbill (*Eretmochelys imbricata*), Leatherback (*Dermochelys coriacea*), Green (*Chelonia mydas*) and Loggerhead (*Caretta caretta*) (See Appendix A). Kemp's Ridley, Hawksbill, Leatherback and Green sea turtles are federally listed as endangered under the Endangered Species Act (ESA). Loggerhead Sea Turtles are divided into nine distinct population segments. The Northwest Atlantic Ocean population is the most abundant sea turtle population in the SAB and is listed as threatened under the ESA. GRNMS is an important area for juvenile and adult loggerheads to rest and forage throughout the year, especially during the summer nesting season when females may nest two to four times on area beaches laying approximately 120 eggs per nest.

Pelagic Birds in GRNMS

Pelagic birds, many of which are seasonal migratory species, occur on the middle and outer shelf regions of the SAB, particularly along the western edge of the Gulf Stream. More than 30 species of marine birds occur off the southeastern coast of the United States. Seabirds observed in the sanctuary area include gulls, petrels, shearwaters, Northern Gannet, phalaropes, jaegers and terns. To date, species such as the Band-rumped Storm-Petrel and Audubon's Shearwater have not been observed in GRNMS, although records exist for offshore Georgia. No records for the threatened Roseate Tern (*Sterna dougallii dougallii*) are known from offshore Georgia, including GRNMS. NOAA, however, recognizes the waters of GRNMS may be important as a "stop-over" site for various seabird species that move over long distances.

Protected Species: Marine Mammals, Other Listed/Threatened Species in GRNMS

Marine mammals in the waters of the Georgia shelf (Table 6) include cetaceans, rare pinnipeds (Harbor Seals) and rare sirenians (West Indian Manatee). Atlantic Spotted Dolphin and Bottlenose Dolphins (most likely from the Western North Atlantic coastal stock) are the most common marine mammals at GRNMS. Both species have been designated as depleted under the Marine Mammal Protection Act. There are four species of federally- listed endangered whales in the region: Northern Right, Sperm, Sei and Fin. Of these, only the highly-endangered North Atlantic right whale has been observed in GRNMS. In addition, GRNMS is located within the critical habitat of the North Atlantic right whale and serves as the only known calving ground for the species. There are a number of other ESA-listed species in GRNMS including five sea turtles, Atlantic Sturgeon (*Acipenser oxyrinchus (=oxyrhynchus) desotoi*), and Shortnose Sturgeon (*Acipenser brevirostrum*). The area is also habitat for the Nassau Grouper (proposed to be listed). See Appendix A for a list of protected species.

Table 6. A list of marine mammals found around GRNMS, their ESA Status, and functional hearing ranges for three Cetacean functional groups.

Common Name	Scientific Name	Local Population ESA Listing	Functional Hearing Group*	Functional Hearing Range
North Atlantic Right Whale	*Eubalaena glacialis*	Endangered	LFC	7 Hz to 25 kHz
Humpback Whale[7]	*Megaptera novaeangliae*	MMPA	LFC	7 Hz to 30 kHz
Fin Whale	*Balaenoptera physalus*	Endangered	LFC	7 Hz to 25 kHz
Sperm Whales	*Physeter macrocephalus*	Endangered	MFC	150 Hz to 160 kHz
Pygmy Sperm Whale	*Kogia breviceps*	None	HFC	200 Hz to 180 kHz
False Killer Whale	*Pseudorca crassidens*	None	MFC	150 Hz to 160 kHz
Risso's Dolphin	*Grampus griseus*	None	MFC	150 Hz to 160 kHz
Atlantic Spotted Dolphin	*Stenella frontalis*	None	MFC	150 Hz to 160 kHz
Pantropical Spotted Dolphin	*Stenella attenuata*	None	MFC	150 Hz to 160 kHz
Striped Dolphin	*Stenella coeruleoalba*	None	MFC	150 Hz to 160 kHz
Bottlenose Dolphin	*Tursiops truncates*	None	MFC	150 Hz to 160 kHz
Harbor Seal	*Phoca vitulina*	None	MFP	75 Hz to 75 kHz (in water)
West Indian Manatee	*Trichechus manatus*	Endangered	U	400 Hz - 46 kHz

*LFC = Low frequency cetaceans (baleen whales)
MFC=Mid Frequency Cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)
HFC-High Frequency Cetaceans (pygmy/dwarf sperm whales)
MFP = Mid frequency pinnipeds
U = unknown

[7] On April 21, 2015, NOAA's National Marine Fisheries Service completed a comprehensive status review under the Endangered Species Act for the Humpback Whale (80 FR 22304) and announced a proposal to revise the listing status of the species. The DPS that occurs within the sanctuaries of the southeast is that of the West Indies, which is not listed under the Endangered Species Act. Source accessed on 07/05/2018: https://www.fisheries.noaa.gov/species/humpback-whale

3.1.3 Socioeconomic Environment

Recreational Fishing in GRNMS

The majority of visitors to GRNMS visit the sanctuary to participate in recreational fishing activities, and most use rod and reel fishing gear (Ehler and Leeworthy 2002). Despite the fact that this is the most common activity in the sanctuary, the level of recreational activities in the sanctuary is relatively low. Recreational fishing occurs year-round, but at different levels of intensity. Most recreational fishing occurs on weekends, and targets both benthic and mid-water species. The highest levels of use are during fishing tournaments for king mackerel that occur May through September.

Commercial Fishing in GRNMS

Some commercial fishing gear, such as traps and bottom trawls, has been prohibited in the sanctuary since its designation in 1981. Although legal, commercial fishing with hand-held hook and line has not been observed in the sanctuary.

Maritime Transportation in GRNMS

GRNMS is not located in or close to any major shipping routes, and as such transportation through the sanctuary is primarily limited to recreational fishing or other vessels (*e.g.*, private yachts, commercial operators) transiting to GRNMS or other areas.

Other Recreational Activities in GRNMS

A small amount of SCUBA diving by generally experienced divers occurs year-round in GRNMS, although most diving activities occur on weekends during warmer months of the year. Underwater photography and nature observing are also popular activities for SCUBA divers in the sanctuary. Other forms of ecotourism are not known to occur in GRNMS.

Tourism in GRNMS

Very little tourism occurs in Gray's Reef National Marine Sanctuary. No regularly scheduled charter vessels offer tours to the sanctuary, although some charter boats will arrange trips on demand for diving or recreational fishing activities at Gray's Reef.

Research and Education Activities in GRNMS

Research and monitoring efforts are underway year-round in the Gray's Reef sanctuary and are primarily undertaken by NOAA. Science activities are at their peak during the months of May-October. Other agencies and institutions utilize Gray's Reef as a research destination; these include the Skidaway Institute of Oceanography, the Georgia Department of Natural Resources and the South Carolina Department of National Resources. Occasionally, researchers affiliated with a university or other organization will charter a vessel to conduct research in the sanctuary, but most often, researchers utilize NOAA vessels to undertake research in the sanctuary.

Each year, Gray's Reef staff conducts several on-water educational programs for teachers and students. No other educational institutions currently conduct field training in the sanctuary. The Gray's Reef NMS educational programs are intended to inform educators and students about the connections between inland and coastal systems and the waters of the sanctuary.

3.1.4 Maritime Heritage and Cultural Environment in GRNMS

To date, no aircraft or shipwrecks have been documented within Gray's Reef NMS. However, fossil oysters, scallops and snails embedded in the hard bottom of the sanctuary indicate that the reef was once a shallow coastal environment. Fragments of mammal bones and a projectile point located in the sanctuary may indicate that the current reef area could have been inhabited by people who were present at the end of the last ice age, when it was above sea level (NMSP 2006).

3.2 Florida Keys National Marine Sanctuary

3.2.1 Physical Environment

Geology and Oceanography

The Florida Keys are a chain of limestone islands that extend from the southern tip of the Florida mainland southwest to the Dry Tortugas. The islands are the fossilized (lithified) remnants of ancient coral reefs and sand bars that flourished during a period of higher sea levels approximately 125,000 to 100,000 years ago. Today, the Florida Keys outer reefs are a semi-continuous series of offshore bank reefs located at the northern zoogeographic boundary of tropical waters. They began forming between 6,000 and 10,000 years ago.

The FKNMS also includes the Florida Plateau, which extends 223 miles from Miami to the Dry Tortugas. This shelf forms part of the Florida-Bahamas carbonate province and is the only area in the continental U.S. where active carbonate deposition is occurring on a large scale (Enos 1977, Shinn et al. 1989). The Florida Plateau is bounded by the Florida Straits to the east and south and by the Gulf of Mexico to the west.

Water Quality in FKNMS

Maintaining good water quality in FKNMS is a major concern for NOAA. Nutrient enrichment can lead to increased turbidity and increased growth of macroalgae and seaweed. These factors can impact critical coral and seagrass habitats in the sanctuary. Sources of pollutants affecting water quality include land and vessel-based wastewater, storm runoff, landfills and mosquito spraying. Geographic differences in water quality include higher nutrient concentrations in the middle and lower Florida Keys and lower nutrient concentrations in the upper Florida Keys and Dry Tortugas. Also, declining inshore-to-offshore trends across Hawk Channel have been noted for some parameters (nitrate, ammonium, silicate, total organic carbon and nitrogen, and turbidity). Monitoring programs in FKNMS have noted increasing total phosphorus for the Dry Tortugas, Marquesas Keys, lower Florida Keys and portions of the middle and upper Florida

Keys. Increases in nitrate in the Southwest Florida Shelf, Dry Tortugas, Marquesas Keys and the lower and upper Florida Keys have also been observed. In contrast, total organic nitrogen decreased somewhat, mostly in the Southwest Florida Shelf, the Sluiceway, and the lower and upper Keys. These trends may be driven by regional circulation patterns arising from the Loop Current and Florida Current, and have changed as the period of record has increased.

With the exception of nutrient variability from upwelling events, offshore waters of the Florida Keys are relatively stable in terms of temperature, salinity and dissolved oxygen, as compared to nearshore areas. Distinct gradients can occur in circulation patterns and water residence time from the upper to lower Florida Keys: while the offshore environment of the upper Florida Keys is relatively well-circulated, and dominated by Florida Current circulation (Klein and Orlando, 1994), the offshore waters of the middle Florida Keys exchange with Florida Bay via tidal channels. The offshore waters of the lower Florida Keys are influenced by wind-driven circulation in Hawk Channel and offshore gyres of the Florida Current.

Air Quality in FKNMS

Like water quality, it is important to maintain good air quality in FKNMS. Poor air quality can have a detrimental effect on humans, animals, and vegetation. The federal Clean Air Act was passed in order to protect human health and welfare from air pollution. As part of the Clean Air Act, National Ambient Air Quality Standards (NAAQS) were established. NAAQS are defined as levels of pollutants above which detrimental effects on human health or welfare may result. NAAQS have been established for six pollutants. These are: particulate matter (PM_{10} and $PM_{2.5}$); sulfur dioxide; nitrogen dioxide; ozone; carbon monoxide; and lead by the EPA. Monroe County, the county in which the state waters of FKNMS lie, currently meets or exceeds the requirements for the national ambient air quality standards for all six pollutants.

Acoustic Environment in FKNMS

The acoustic environment in FKNMS includes anthropogenic and naturally-occurring noise. Anthropogenic sources include: commercial vessels; recreational vessels; construction; military activities; and recreational activities. Natural sources include: marine mammals; fish; lobsters; crabs; shrimp; wind; and waves. While anthropogenic and natural noise sources are contributors to the Florida Keys' soundscape, anthropogenic noise from commercial and recreational vessels is of particular concern. Recreational vessel registrations in Monroe County have increased more than 1000% since 1964. Conversely, commercial vessel registrations have decreased 37% in the same period. As of 2016, there were 26,233 recreational vessels and 2,699 commercial vessels registered and presumably operating in Monroe County. In addition to vessels registered in Monroe County, there has been a spike in the number of large vessels transiting the waters in and near FKNMS. This is because more cruise ships have been calling on destinations near the sanctuary, and the presence of large shipping vessels has increased. The operation of these large vessels undoubtedly increases the amount of sound emitted into the acoustic environment of FKNMS. Potential impacts of sound on marine organisms can range from no or very little effect to various levels of behavioral reactions, physiological stress, threshold shifts, auditory masking,

and direct trauma. Responses to sound generally fall into three categories: behavioral, acoustic, and physiological. Noise pollution can be intense and acute or less intense and chronic. Commercial shipping is considered to be the major contributor to low frequency noise within the sanctuary.

3.2.2 Biological Environment

Habitat in FKNMS

The boundaries of FKNMS encompass numerous habitats and structural zones. Benthic habitats include unconsolidated sediments (e.g., sand and mud), mangrove, submerged aquatic vegetation (e.g., seagrass and algae), coral reefs and colonized hard-bottom habitats (e.g., spur and groove reefs, individual and aggregated patch reefs, and gorgonian-colonized pavement), and uncolonized hard bottom (e.g., reef rubble). These habitats support one of North America's most diverse assemblages of flora and fauna. The Florida coral reef tract is one of the largest systems of coral reefs in the world and a unique system of coral reefs in the continental U.S. The ecosystem also includes one of the world's largest seagrass beds, which are among the richest, most productive, and most important submerged coastal habitats. Seagrasses provide food and habitat for commercially and recreationally important species of fish and invertebrates and are an integral component of tropical coastal environments. Mangroves are the third important component of the Florida Keys ecosystem, and provide habitat for juvenile fish and invertebrates, stabilize sediments and produce prop-root surfaces for attached organisms such as oysters, sponges and algae.

Invertebrates in FKNMS

The Florida Keys coral reef ecosystem is highly biologically diverse. The Florida peninsula and the Florida Keys archipelago serve as a biogeographic transition zone between the warm-temperate waters of the Gulf of Mexico and the adjacent tropical and subtropical waters of the Atlantic Ocean. This division has resulted in a distribution of marine fauna and flora characterized as having both a warm-temperate and tropical Caribbean component (NOAA 1996). Invertebrates in the sanctuary are highly diverse. Resident invertebrate phyla include: Cnidaria (corals, sea anemones, jellyfish), Platyhelminthes (flatworms), Porifera (sponges), Annelida (segmented works), Arthropoda (crustaceans), Ectoprocta (bryozoans), Mollusca (bivalves and snails), and Echinodermata (sea stars, sea urchins and sea cucumbers).

Fish in FKNMS

Because of the FKNMS' connection to adjacent aquatic environments, a variety of different fish assemblages rely on sanctuary resources for all, or part of their life history. Historic long-term studies suggest that there may be over 400 fish species in the Florida Keys (Longley and Hildebrand 1941, Starck 1968).

Birds in FKNMS

The Florida Keys host more than 285 species of birds, and include gulls, terns, plovers, cormorants, pelicans, herons, egrets, ssprey (*Pandion haliaetus*) and the magnificent frigatebird (*Fregata magnificens*). ESA listed species include the piping plover (*Charadrius melodus*), the Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*), Bachman's warbler (*Vermivora bachmanii*), everglade snail kite (*Rostrhamus sociabilis plumbeus*), Florida grasshopper sparrow (*Ammodramus savannarum*), Florida scrub-jay (*Aphelocoma coerulescens*), Kirtland's warbler (*Setophaga kirtlandii*), red knot (*Calidris canutus rufa*), roseate tern (*Sterna dougallii dougallii*), wood stork (*Mycteria americana*), and the red-cockaded woodpecker (*Picoides borealis*). FKNMS is also an important stop-over point for other migratory birds and waterfowl.

Protected Species in FKNMS

A variety of over 50 plants, invertebrates, fish, reptiles, birds and mammals that use or contribute to sanctuary resources in FKNMS are protected at the federal or state level (see Appendix A for a list of all federally listed species). State and federally threatened and endangered marine and aquatic fauna include, but are not limited to: elkhorn coral (*Acropora palmata*), staghorn coral (*A. cervicornis*), pillar coral (*Dendrogyra cylindrus*), mountain star corals (*Orbicella annularis, O. faveolata, O. franksi*), cactus coral (*Mycetophyllia ferox*), all five species of sea turtles found in the western Atlantic – Loggerhead, Green, Hawksbill (*Eretmochelys imbricata*), Kemp's Ridley (*Lepidochelys kempii*), and Leatherback – the American Alligator (*Alligator mississippiensis*), American Crocodile (*Crocodylus acutus*), Smalltooth Sawfish (*Pristis pectinata*), Roseate Tern (*Sterna dougallii*), Least Tern (*Sterna antillarum*), and the West Indian Manatee (*Trichechus manatus*). Twelve species of birds are on the federally endangered list, including the wood stork (*Mycteria americana*). Eight are considered threatened and nine are species of special concern, including the roseate spoonbill (*Ajaia ajaja*). The sanctuary is also in the migratory range of three species of whales: Humpback (*Megaptera novaeangliae*), Fin (*Balaenoptera physalus*) and North Atlantic Right (*Eubalaena glacialis*). Twenty-eight mammal species utilize habitats in the Lower Everglades. Several species ranging into the region have been identified as rare or endangered. In addition, twenty species of mammals have been identified in the mangrove zone. Of these, the West Indian manatee (*Trichechus manatus*) are endangered. Lastly, for fish species, the Smalltooth Sawfish (*Pristis pectinata*) is endangered and the Nassau Grouper and Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) are listed as threatened. Please see Appendix A for more information.

The FKNMS is within the seasonal geographic range of a variety of marine mammals. Thirteen species of whales, seven species of dolphins and the West Indian Manatee either reside in or travel through the sanctuary at some point in their lifetimes.

Table 7. A list of marine mammals found around FKNMS, their ESA Status, and functional hearing ranges for three Cetacean functional groups.

Common Name	Scientific Name	Local Population ESA Listing	Functional Hearing Group*	Functional Hearing Range
North Atlantic Right Whale	*Eubalaena glacialis*	Endangered	LFC	7 Hz to 35 kHz
Humpback Whale	*Megaptera novaeangliae*	None	LFC	7 Hz to 35 kHz[8]
Sperm Whales	*Physeter macrocephalus*	Endangered	MFC	150 Hz to 160 kHz
Pygmy Sperm Whale	*Kogia breviceps*	None	HFC	275 Hz to 160 kHz
Killer Whale	*Orcinus orca*	None	MFC	150 Hz to 160 kHz
Pygmy Killer Whale	*Feresa attenuata*	None	MFC	150 Hz to 160 kHz
False Killer Whale	*Pseudorca crassidens*	None	MFC	150 Hz to 160 kHz
Risso's Dolphin	*Grampus griseus*	None	MFC	150 Hz to 160 kHz
Short-Finned Pilot Whale	*Globicephala macrorhynchus*	None	MFC	150 Hz to 160 kHz
Short-Beaked Common Dolphin	*Delphinus delphis*	None	MFC	150 Hz to 160 kHz
Atlantic Spotted Dolphin	*Stenella frontalis*	None	MFC	150 Hz to 160 kHz
Pantropical Spotted Dolphin	*Stenella attenuata*	None	MFC	150 Hz to 160 kHz
Striped Dolphin	*Stenella coeruleoalba*	None	MFC	150 Hz to 160 kHz
Rough-Toothed Dolphin	*Steno bredanensis*	None	MFC	150 Hz to 160 kHz
Bottlenose Dolphin	*Tursiops truncates*	None	MFC	150 Hz to 160 kHz
West Indian Manatee	*Trichechus manatus*	Endangered	U	150 Hz - 50 kHz[9]

*LFC = Low frequency cetaceans (baleen whales)
MFC=Mid Frequency Cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)
HFC-High Frequency Cetaceans (pygmy/dwarf sperm whales)
MFP = Mid frequency pinnipeds
U = unknown

[8] With sensitivity 2 to 7 kHz, hearing threshold 100 hz to 20 kHz. Pg 100-101. Source: NMFS 2016.

[9] Hatch, L. Personal Comm. 2018. Fwd_ Re_ sirenian hearing threshold. NMFS technical assistance. ONMS, Silver Spring, MD June 4, 2018

3.2.3 Socioeconomic Environment

The Florida Keys economy is dependent upon a healthy marine environment. Below are a few of the important components of the socioeconomic environment of FKNMS.

Commercial and Recreational Fishing in FKNMS

Commercial and recreational fishing are economically important to the Florida Keys. In terms of volume of seafood landed, the Florida Keys is the most important area in the state of Florida for landings, dockside value, and numbers of commercial fishing vessels, most of which target the highly valued invertebrate fisheries (Adams 1992). Studies suggest that fishing pressure as measured by the number of trips, traps and angler days has declined for commercial and recreational fisheries between 1995 and 2008 (Leeworthy and Wiley 1996, Leeworthy 1996, Leeworthy and Wiley 1997, Leeworthy et al. 2010 and Leeworthy and Morris 2010). It is uncertain, however, if these trends will continue. Furthermore, the decrease in pressure may be offset by a growth in average fishing power (the proportion of stock removed per unit of fishing effort) due to technological advances in fishing gear, hydroacoustics, navigation and vessel propulsion (Bohnsack and Ault 1996, Mace 1997).

Tourism in FKNMS

Tourism is the number one industry of the Florida Keys economy. Resident and visitor use includes activities such as guided eco-tours, diving and snorkeling trips, and recreational fishing. Recreation-tourism accounts for anywhere between 33% and 75% of the local economy (depending on the definition of income, i.e. by place of residence or by place of work). More than 13 million visitor days are logged in the Florida Keys annually (Leeworthy and Wiley, 1996). Tourists and residents swim, boat and fish in the sanctuary: 66% of all visitors participated in at least one water-based recreational activity including snorkeling, SCUBA diving, recreational fishing, wildlife viewing or nature study or beach activities.

Marine Transportation in FKNMS

The Florida Straits have historically been the access route for all commercial vessels entering the Gulf of Mexico from the north and east and, consequently, these waters are some of the most heavily trafficked in the world. It is estimated that 40% of the world's commerce passes within 1.5 days sailing time of Key West (U.S. Department of the Navy 1990). Recreational vessel registrations in Monroe County increased more than 1000% from 1964 to 1998, but have since decreased by 37%. Combined with transits around the sanctuary each year by large shipping vessels (greater than 300 gross tons), cruise ships and military ships, vessel traffic affecting FKNMS is continuing to increase.

Research and Education in FKNMS

Management of FKNMS requires ongoing research and monitoring efforts to collect information on the health of marine resources and the effectiveness of management efforts. Research and monitoring is undertaken by sanctuary staff as well as numerous partners, some of whom are also

within NOAA, others represent state agencies and institutions, colleges and universities and non-profit organizations. Researchers investigate water quality in the sanctuary, evaluate the effectiveness of marine zones, monitor coral disease and condition, and study fish and benthic habitats. Sanctuary scientists also conduct injury assessments when vessels impact sanctuary resources, and when possible, undertake habitat restoration to mitigate resource damage.

FKNMS utilizes many educational programs to help visitors understand the unique qualities of the sanctuary. The most visible is The Florida Keys Eco-Discovery Center. It is sponsored and operated by FKNMS, NOAA, the South Florida Water Management District, Everglades and Dry Tortugas National Parks, the National Wildlife Refuges of the Florida Keys, and Eastern National. The Florida Keys Eco-Discover Center is a 6,000 square foot facility with exhibits interpreting the ecology of the Keys' habitats, including the upland pineland, hardwood hammock, beach dune, mangrove shoreline, seagrass flats, hardbottom, coral reefs, and deep-shelf communities.

FKNMS also administers two tourism-oriented programs to promote a better understanding and responsible use of the sanctuary. These programs are the Blue Star Program and Dolphin SMART. The Blue Star Program includes two programs one that recognizes SCUBA and snorkeling tour operators and one that recognizes for hire charter fishing guides who have made a commitment to reduce the impact of divers, snorkelers, and recreational fisherman respectively on coral reefs of the Florida Keys. As part of their commitment, the tour operators educate customers on how to be better environmental stewards and how to interact responsibly with coral reefs in FKNMS. Blue Star Program operators participate in training, conservation activities, and display the Blue Star logo to signify they are part of the program.

Other educational programs include the Heritage Awareness Diving Seminar and Team Ocean. The former is a multiday seminar that teaches participants how to be proactively protective of cultural resources. The latter is a program that sends trained volunteers out on the water to inform recreational boaters about sanctuary zones and regulations, proper use of resources and mooring buoys, dive flag safety, and safe and responsible boating behavior.

Mooring Buoy Maintenance in FKNMS

Each year, thousands of boaters visit FKNMS to fish and dive. Mooring buoys installed and maintained by the sanctuary make it possible for them to do this without damaging the reef. These buoys are utilized by private boaters as well as charter operators carrying passengers to the reefs. There are over 800 mooring buoys available for use in the sanctuary, at no cost to the boater. Buoys are also used to mark areas that have specific regulations, assist with navigation and provide information to visitors.

3.2.4 Maritime Heritage and Cultural Environment

The waters of FKNMS have some of the most significant maritime heritage and historical resources of any coastal community in the nation. Because of its unique geographical position on

the European and American trade routes, shipwrecks in the Keys contain a record of the 500-year history of the Americas. The relative inaccessibility of underwater cultural sites has ensured that many delicate artifacts remain undisturbed.

3.3 Flower Garden Banks National Marine Sanctuary

3.3.1 Physical Environment

Geology and Oceanography

The banks of FGBNMS range in depth from 55 feet to nearly 500 feet and are underwater hills formed by rising domes of ancient salt. The banks provide a wide range of habitat conditions that support several distinct biological communities (described below). The salt domes began to form 190 million years ago when the Gulf of Mexico was a very shallow sea. The hot dry climate at that time caused evaporation and deposition of a thick layer of salt on the sea floor. As the Gulf of Mexico deepened and rivers began to flow from the land to the sea, mud, sand and silt were steadily deposited over the salt layers. Eventually, pressures from these denser overlying sediments became great enough that the salt layers began to push upward. In some places the salt layers broke through completely, while in others they simply forced the seafloor to bulge upward in distinct domes. The coral reef communities of East and West Flower Garden Banks probably began developing on top of the salt domes 10,000 to 15,000 years ago. These communities have thrived to the extent that dense coral reefs hide all traces of the deformed bedrock underneath. The Flower Garden and Stetson Banks are only three among dozens of reefs and banks scattered along the edge of the continental shelf of the northwestern Gulf of Mexico. All of these banks are part of a regional ecosystem heavily influenced by current patterns within the Gulf.

From the south, the Gulf of Mexico is fed by the Yucatan Current, a current of warm water from the Caribbean that enters the Gulf between Mexico's Yucatan Peninsula and Cuba. The deeper water flows up the middle of the sea, forming the Gulf Loop Current, which curves east and south along Florida's coast and exits through the Straits of Florida. Meanwhile, the shelf waters of the southern Gulf tend to travel northward, following the Mexico and Texas coastlines before turning east. These wind driven currents may also cross over the Flower Garden, Stetson and other banks and add to the Caribbean influence in the region. Fresh water from rivers emptying into the northern Gulf of Mexico (Mississippi, Atchafalaya, Calcasieu, Sabine, Brazos, and others) generally flow west and south along the Louisiana and Texas coasts. As these waters move, they mix with nearshore waters of the continental shelf and are also forced offshore as they encounter northward flows along the Texas coast. At times, exceptionally high flow rates can extend the influence of fresh water quite far offshore in the northwestern Gulf.

Water Quality

From the south, the Gulf of Mexico is fed by a current of warm water from the Caribbean, which enters the Gulf between Mexico’s Yucatan Peninsula and Cuba. This forms the Gulf Loop Current, which curves east and south along Florida’s coast and exits through the Straits of

Florida. The Gulf Loop Current is highly variable in terms of its path through the Gulf and at times can pass directly over the eastern banks along the continental shelf. At other times, parts of the current break away and form circular eddies that move across FGBNMS. This influx of water brings with it upwelled nutrients and larvae from the south.

Another factor that influences FGBNMS is the Mississippi River Basin, which drains two-thirds of the continental United States and part of Canada. This and other watershed systems around the Gulf can bring with them nutrients, sediments and contaminants, all of which influence the health of the Gulf of Mexico and the habitats it contains.

These water flows connect the dozens of banks along the continental shelf of the northwestern Gulf of Mexico. Recent research suggests that there may be much more physical connection between habitats around the Gulf.

Air Quality in FGMNMS

Because the banks that make up FGBNMS (East Flower Garden Bank, West Flower Garden Bank, and Stetson Bank) are situated 70 to 115 miles off the coasts of Texas and Louisiana, little is known about the air quality in the exact location. However, recent offshore Gulf of Mexico air quality studies provide some reference. The studies measured the amounts of nitrogen oxide, volatile organic compounds, carbon monoxide, sulfur dioxide, and particulate matter released into the environment by both offshore and onshore sources in the Gulf of Mexico region. These studies have indicated offshore air quality in the Gulf of Mexico is affected by commercial marine vessels, shipping, recreational boating, military, and fishing operations. Biogenic and geogenic sources such as bacterial processes, mud volcanoes, and crude oil seeps also affect offshore air quality. In specific reference to offshore sources of pollution, the study noted that emissions from oil platforms and oil-and-gas related non-platform activities were the predominant source of offshore emissions. While other sources of offshore emissions are not the predominant source of air pollution, it should be noted that the amount of emissions is on the rise for all categories of sources.

Acoustic Environment in FGBNMS

Data gathered over the past three decades has shown an increase in the number of sources emitting sounds in FGBNMS. These sources include boat engines, generators, exploration activities, acoustic air gun surveys, and pile driving.

3.3.2 Biological Environment

Habitat in FGBNMS

The FGBNMS is significant among ecosystems in the Gulf of Mexico. The sanctuary contains the northernmost coral reefs in the continental United States. Brain and star corals dominate the coral caps of FGBNMS, with a few coral heads exceeding 20 ft.in diameter. There are at least 21 species of coral on the coral cap, covering over 50% of the bottom to depths of 100 ft., and

exceeding 70% coral cover in places to at least 130 ft. (Schmahl et al. 2008). Two live *Acropora palmata* colonies have been documented, one each at East and West Flower Garden Bank.

The Gulf Loop Current is variable, sometimes barely entering the Gulf before turning, while at other times, it travels almost to Louisiana's coast before swinging toward Florida. Simultaneously, portions of the loop often break away from the main current and form circular eddies that move westward, affecting the Flower Garden, Stetson and other banks to the west. The influx of water to the Gulf brings with it animal larvae, plant spores and other imports from the south, and accounts for the many Caribbean species found in the northern Gulf of Mexico. During its progress, the loop current also picks up similar 'passengers' from the northern Gulf to deliver along its route to the northern Caribbean and western Atlantic.

Invertebrates

The deepwater (> 200 ft.) habitat of FGBNMS makes up over 98% of the area within the sanctuary. These areas include algal-sponge zones, “honeycomb” reef (highly eroded outcroppings), mud flats, mounds, mud volcanoes and at least one brine seep system. Assemblages of sea life inhabiting these deeper areas include extensive beds of coralline algae pavements and algal nodules, sea fans, sea whips, black corals, deep reef fish, batfish, sea robins, basket starfish and feather stars.

Stetson Bank experiences more extreme fluctuations in temperature and turbidity, and therefore does not support the growth of reef forming corals like those found on East and West Flower Garden Banks. The pinnacles of Stetson Bank are dominated by fire coral and sponges. There are at least nine coral species at Stetson Bank, as well as algae, sponges and rubble, which dominate the flats. In the outcroppings that ring the main feature of Stetson Bank are a community of sponges, gorgonians and black corals. Deep reef fish and invertebrates are also prominent inhabitants of the “Stetson Ring.” Long-term Monitoring has shown that Stetson Bank has experienced a decline of primary benthic components (sponges and coral), beginning in 2005.

Fish

The area around FGBNMS supports many species of fish, almost 300 of which have been documented in the sanctuary. FGBNMS provides important habitat for many recreational and commercially important fish species, which play an important role in the ecosystem. Also important to sanctuary ecosystems are an incredible array of invertebrates which are found within all the habitats of the sanctuary. Over 250 species of invertebrates have been identified in the sanctuary, including corals, sponges, urchins, oysters, lobsters, snails, octopus, shrimp and jellies.

Birds

Because FGBNMS lies in the middle of the Gulf of Mexico with no surrounding land for over a hundred miles, seabirds are an uncommon sight in sanctuary waters, however opportunistic sightings have reported at least 57 species.

Protected Species: Marine Mammals, Sea Turtles, Other Listed/Threatened Species

Twenty-nine species of marine mammals are known to occur within and near the sanctuary (See Appendix A). All are protected under the Marine Mammal Protection Act. Two species of sea turtles are known to occur in the sanctuary: loggerhead and hawksbill. Loggerhead and hawksbills have been documented as permanent residents, with loggerheads exhibiting higher site fidelity. One hawksbill was documented as setting up residency for several years at Stetson Bank, which provides a more suitable diet for this species. The leatherback, green, and Kemp's do not occur within the sanctuary, but are within the federal waters around the sanctuary. All marine turtles are either threatened or endangered and thus protected by the Endangered Species Act in U.S. territorial waters. State and federally threatened and endangered marine and aquatic fauna include, but are not limited to: Manta rays (*Manta birostris*), elkhorn coral (*Acropora palmata*), staghorn coral (*Acropora cervicornis*), lobed star (*Orbicella annularis*), boulder star (*Orbicella franksi*), and pillar coral (*Dendrogyra cylindrus*).

Table 8. A list of marine mammals found around FGBNMS, their ESA Status, and functional hearing ranges for three Cetacean functional groups.

Common Name	Scientific Name	Local Population ESA Listing	Functional Hearing Group*	Functional Hearing Range
North Atlantic Right Whale	*Eubalaena glacialis*	Endangered	LFC	7 Hz to 35 kHz
Humpback Whale	*Megaptera novaeangliae*	Endangered	LFC	7 Hz to 35 kHz[10]
Minke Whale	*Balaenoptera acutorostrata*	None	LFC	7 Hz to 35 kHz
Bryde's Whale	*Balaenoptera edeni*	None	LFC	7 Hz to 35 kHz
Sperm Whales	*Physeter macrocephalus*	Endangered	MFC	150 Hz to 160 kHz
Pygmy Sperm Whale	*Kogia breviceps*	None	HFC	275 Hz to 160 kHz
Killer Whale	*Orcinus orca*	None	MFC	150 Hz to 160 kHz
Pygmy Killer Whale	*Feresa attenuata*	None	MFC	150 Hz to 160 kHz
False Killer Whale	*Pseudorca crassidens*	None	MFC	150 Hz to 160 kHz
Cuvier's Beaked Whale	*Ziphius cavirostris*	None	MFC	150 Hz to 160 kHz
Mesoplodon whales	*Mesoplodon densirostris, Mesoplodon europaeus, Mesoplodon mirus*	None	MFC	150 Hz to 160 kHz
Melon-Headed Whale	*Peponocephala electra*	None	MFC	150 Hz to 160 kHz
Risso's Dolphin	*Grampus griseus*	None	MFC	150 Hz to 160 kHz

[10] With sensitivity 2 to 7 kHz, hearing threshold 100 hz to 20 kHz. Pg 100-101. Source: NMFS 2016.

Short-Finned Pilot Whale	*Globicephala macrorhynchus*	None	MFC	150 Hz to 160 kHz
Atlantic Spotted Dolphin	*Stenella frontalis*	None	MFC	150 Hz to 160 kHz
Pantropical Spotted Dolphin	*Stenella attenuata*	None	MFC	150 Hz to 160 kHz
Striped Dolphin	*Stenella coeruleoalba*	None	MFC	150 Hz to 160 kHz
Fraser's Dolphin	*Lagenodelphis hosei*	None	MFC	150 Hz to 160 kHz
Rough-Toothed Dolphin	*Steno bredanensis*	None	MFC	150 Hz to 160 kHz
Clymene Dolphin	*Stenella clymene*	None	MFC	150 Hz to 160 kHz
Spinner Dolphin	*Stenella longirostris*	None	MFC	150 Hz to 160 kHz
Bottlenose Dolphin	*Tursiops truncates*	None	MFC	150 Hz to 160 kHz

*LFC = Low frequency cetaceans (baleen whales)
MFC=Mid Frequency Cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)
HFC-High Frequency Cetaceans (pygmy/dwarf sperm whales)

3.3.3 Socioeconomic Environment

Recreational Use in FGBNMS

The primary visitors to FGBNMS are recreational SCUBA divers and recreational fishermen. Visitation by SCUBA divers and fishers is estimated to be relatively low compared to other sanctuaries, primarily due to the distance of the banks from shore, and possibly a lack of public awareness of the sanctuary. An estimated 2,500 to 3,000 divers visit the sanctuary each year, primarily on charter vessels, but some visit the sanctuary on personal boats. The spatial resolution of fishing data is currently not precise enough to quantitatively assess fishing pressure within the sanctuary. However, observations by sanctuary staff and others suggest that the level of fishing activity has been increasing in recent years.

Commercial Fishing in FGBNMS

Commercial fishing is a common and economically important activity in the northwestern Gulf of Mexico. Conventional hook and line fishing is allowed within FGBNMS. All other fishing methods, including bottom trawling, trapping, bottom long-lining and spearfishing are prohibited.

Oil and Gas in FGBNMS

The northwestern Gulf of Mexico is home to one of the most active areas of oil and gas exploration and development in the world. Approximately 150 oil and gas platforms are located within 25 miles of the existing boundaries of FGBNMS. One production platform, located in BOEM lease block High Island 389A, is within the boundary of East Flower Garden Bank. This platform has been identified for removal, and at the time of this writing, removal plans are in development.

Mooring Buoy Maintenance in FGBNMS

Mooring buoys are an important part of the FGBNMS' efforts to protect sanctuary resources while still enabling visitor access to the coral reefs. Mooring buoys have been installed, and are maintained by the sanctuary, at all three banks: seven buoys at East Flower Garden Banks, five buoys at West Flower Garden Banks, and five buoys at Stetson Bank. These buoys are made available to vessels up to 100 ft. in length at no charge to the boater, allowing vessels to tie off to surface buoys instead of dropping anchor on the coral reefs below.

Research in FGBNMS

FGBNMS has a long history of research and exploration that continues today. Scientists from a variety of universities, research foundations and government agencies are regularly monitoring and evaluating the fauna and flora of the sanctuary. Because of the remote location, the coral reefs of the sanctuary have remained relatively buffered from problems that plague many other reefs in the world and have become a benchmark for evaluating the health of other reef systems.

Education and Outreach in FGBNMS

As the only coral reef ecosystem in this region, FGBNMS is a valuable experiential learning site for educational programming. FGBNMS staff organizes workshops that train between 500 and 1,000 teachers each year. A few of these workshops involve teachers visiting the sanctuary.

3.3.4 Maritime Heritage and Cultural Environment

To date, acoustic and visual surveys of Flower Garden Banks National Marine Sanctuary reveal no evidence of significant submerged archaeological artifacts outside of several fluked anchors of unknown origin and age.

4.0

ENVIRONMENTAL CONSEQUENCES

This section evaluates the environmental consequences of the No Action or status quo alternative and the other alternative is described in Chapter 2 (Description of Proposed Action and Alternative). The environmental effects of these alternatives are summarized in Table 9 and then evaluated within the context of the physical, biological, socioeconomic and historic and cultural sanctuary setting. Information about the physical, biological, socioeconomic and historic and cultural sanctuary setting can be found in Chapter 3 (Affected Environment).

Characterizing Effects

NEPA requires consideration of the effects of major federal actions on the quality of the human environment (42 U.S.C. § 4332(c)). Effects are characterized as negligible, less than significant, or significant, and are also characterized by type (adverse or beneficial), context, intensity and duration (short- or long-term). Effects can be further characterized by whether they affect resources directly or indirectly. The following definitions and characterizations were used for this analysis:

- **Negligible effects** – effects for which virtually no effect to a resource can be detected (whether beneficial or adverse), essentially neutral effects.
- **Less than significant effects** – effects that do not rise to the level of significant as defined below, or these can be thought of as minor effects.
- **Significant effects** – effects resulting in an alteration in the health of a physical, biological, historic/cultural or socioeconomic resource. Long-term or permanent effects with a high intensity of alteration to a resource, whether beneficial or adverse, would be considered significant. The significance threshold is evaluated on a case-by-case basis, taking into consideration the context and intensity of each action.
- **Direct effects** – effects that are caused by the action and occur at the same time and place as the action.

- **Indirect effects** – effects that are caused by the action and are later in time or farther removed in distance from the action, but are still foreseeable. Indirect effects may include effects on individual growth and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

4.1 Alternative 1: No Action/ Status Quo

Under the No Action Alternative, ONMS would continue to conduct field operations to support sanctuary goals and objectives, and implement required mitigations. Certain activities would be modified as a result of interagency consultation with NMFS and FWS pursuant to the MMPA and ESA, in order to minimize impact on protected species. While the specific mitigation measures required by the consulting or permitting agencies (if any) are not known at this time, NOAA assumes that overall adverse environmental impacts of field operations would be reduced through implementation of such measures. NOAA will complete consultation with NMFS and FWS prior to publishing the final EA. The final EA will clearly describe any mitigation measures issued as a result of this consultation process and will contain an additional analysis of the environmental consequences of this alternative at that juncture.

4.1.1 Physical Environment

Geology

Activities with less than significant beneficial, less than significant adverse and negligible impacts

Onshore Fieldwork

Onshore fieldwork consisting of the removal or relocation of large items such as grounded vessels or large amounts of marine debris is expected to have less than significant beneficial impacts to the physical environment by preventing large and potentially damaging items from no longer threatening the marine and nearshore environment.

Onshore fieldwork that consists of the removal or relocation of large items such as grounded vessels or large amounts of marine debris may have less than significant adverse impacts to the physical environment when removing or moving large items from a shoreline area. For example, the removal of grounded vessels may require motorized equipment that may alter the surrounding environment and the relocation of large items may adversely impact the substrate upon which the vessel or marine debris was originally found during the removal or relocation process. However, adverse impacts to the physical environment of the area are expected to be less than significant because they are conducted within a localized area, for a short duration, amounting to a low impact and short term effect on the physical geological surrounding environment.

Onshore fieldwork that is limited to beach-walk and intertidal surveys through the movement of personnel engaged in collection and identification studies will have negligible impacts on the physical environment. Short term and insignificant disturbance to the physical environment may occur during fieldwork sampling activities through incidental and unavoidable contact by feet and hand-operated equipment with physical resources. However, the effects of this contact are expected to be negligible as any contact with the physical environment is localized and short term (activities likely to occur a few days per year in any one area).

Activities with both less than significant beneficial and less than significant adverse impacts

Deployment of Equipment on the Seafloor

The scientific data generated through the seafloor deployment of equipment helps create a better characterization of the biological, geological and oceanographic processes within a sanctuary, thus increasing our understanding of sanctuary resources and their associated relationship to the physical environment, (e.g., the physical habitat use by fish) and aiding the development of education and outreach materials. This aids protection and management of these resources, and the sanctuary as a whole.

For example, vessel moorings prevent anchor damage to the seafloor, and the use of weighted marker buoys for dive operations supports science and education projects that help managers take action to protect sanctuary physical resources. Also, incident response operations that may occasionally require use of marker buoys benefit physical resources through the removal of hazardous material and pollution threats.

Thus, deployment of equipment on the seafloor and other seabed deployed instruments in sanctuaries is expected to provide less than significant, indirect, short-term and long-term beneficial effects to the physical environment.

Thus, fixed buoy deployments are expected to have less than significant adverse effects on a sanctuary's physical resources because of the nature of ground-secured buoys. Although efforts are made to secure buoys on open bottoms, storms and other physical events can move anchors into coral and other sensitive areas.

The deployment of some scientific, safety and monitoring equipment attached to the seafloor via weights or embedded anchors poses a chance of adversely affecting the physical environment through its direct contact with the bottom. Usually, the temporary nature of these devices (although some are placed on the seabed for a long period of time), their limited local effects, as well as the narrow scope of each study with regards to the size of the area keep these adverse effects minor. For example, the deployment of buoys on the seafloor may have a short-term, direct but slightly adverse effect on a small area ($<3m^2$) and any associated resources of the seafloor. Therefore, the adverse effects are expected to be less than significant.

Deployment of Remote Sensing Equipment

The scientific data generated through remote sensing efforts help create a better characterization of the geologic and oceanographic processes within a sanctuary, thus increasing our understanding of sanctuary resources and their associated relationship to the physical environment (e.g., the physical habitat used by fish), and aiding the development of education and outreach materials. This aids protection and management of these resources, even if indirectly. For example, the development of bathymetric maps is beneficial in developing better strategies for managing physical resources found on the seabed, which could result in indirect and less than significant beneficial conditions for such resources.

The deployment of some remote sensing arrays pose a slight chance of directly affecting the physical environment through direct contact with the bottom, either planned or unplanned although normal operations usually preclude this possibility. Usually, the temporary nature of these devices (although some are placed on the seabed for a long period of time), their limited local effects, as well as the limited scope of each study with regards to the size of the region are expected to keep these adverse effects less than significant.

Other Sampling Activities

The scientific and monitoring data generated through other sampling activities help create a better characterization of the geologic and oceanographic processes within a sanctuary, thus increasing our understanding of sanctuary resources and their associated relationship to the physical environment. Sampling activities in the southeast and Gulf of Mexico national marine sanctuaries include, but are not limited to, placement of recruitment tiles, sediment and water quality sampling, placement of transect lines and tape, and other markers. These activities are localized and of small scale, and they are located in areas and performed in manners that minimize impact to the environment. This also raises public awareness of the nature and importance of the physical environment and the need to protect it; helps deduce potential impacts from human and natural sources; and aids protection and management of these resources and the sanctuary as a whole. For example, whale disentanglement activities in sanctuaries serve to remove foreign objects such as lines and boys from the physical environment. The benefits are expected to be indirect, long-term and less than significant.

The deployment of some other sampling activities poses a slight chance of directly affecting the physical environment through direct contact with the bottom, either planned or unplanned. For example, research projects that require sampling devices such as small PVC pipe quadrats placed on the seafloor to document species diversity, or sediment sampling procedures may affect the physical habitat of a sanctuary and its resources, but due to the small area impacted and the brief time frame for the operation these direct adverse effects are expected to less than significant, because they are localized and short-term.

Activities with only less than significant adverse impacts

Vessel Operations

The operation of vessels, although episodic and of low intensity (<1300 vessel days per year for the region), has the potential to have adverse but less than significant direct impacts to geological resources from anchoring and from unintentional striking or groundings. Fixed moorings, drifting or live boating (maintaining a stationary location using the vessel engine) are used whenever possible to avoid impacts from anchoring. Vessel operators are highly trained and will employ ONMS best management practices and apply the NOAA Small Boat Program and sanctuary standing orders and procedures to avoid direct impacts to physical resources. In addition, the NOAA Small Boat program mandates that all sanctuary vessels longer than 40 feet be operated by personnel with an appropriate tonnage US Coast Guard (USCG) license or equivalent NOAA Corps experience for the vessel size. In general, operators of sanctuary vessels employ ONMS best management practices to minimize impacts. And, because they are operating assets that are very visible to the public they serve as models of best practices to avoid harm to geological resources.

Activities with negligible impacts or less than significant adverse impacts

Aircraft Operations

Under typical circumstances, operation of unmanned aerial systems (UAS) and other remote aerial systems is expected to have negligible impacts to the physical environment due to their small size and remote aerial operation. UAS and other remote aerial systems are used for research activities in FKNMS only. In the unlikely event a remotely operated aerial system requires an unintentional or emergency landing, trained operators would use care during landing operations and utilize the surrounding environment and coast to a soft landing, targeting an unpopulated area, and all efforts would be taken to ensure minimal impact to the surrounding physical environment. In compliance with FAA regulations and NOAA standing orders, all remote aerial system operators are required to successfully complete training certifications specific to the UAS system being used and a health screening and must be licensed to operate such systems within sanctuary boundaries. Therefore, aircraft (UAS) operations conducted by ONMS staff are expected to have negligible effects on sanctuary's physical environment.

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters is considered a discharge and most national marine sanctuaries have regulations restricting certain discharges. In those cases, a permit from the sanctuary superintendent will be required. Deployment of AUV/ROV/gliders/drifters are expected to result in negligible effects on geological and oceanographic resources due to the unlikely disturbance of the water column or submerged lands in each sanctuary. Fewer than 20 AUV ops days are conducted in the region and ROVs are deployed on about 32 days per year. While intentional or accidental improper operator techniques are possible, trained operators are utilizing assets that are very visible to the public and operators serve as models of best practices. Thus, these activities are expected to result in negligible effects.

Drifter buoys, though only 30-40 cm in diameter, remain at sea in the physical environment as a long-term effect. However, the low number of drifting buoys per year and the short-term nature of anchored buoys are expected to result in less than significant impacts.

Dive marker weights are deployed with a buoy at the surface to temporarily mark dive locations to ensure diver safety. Marker buoys are removed at the termination of dive operations at each site visited and at the end of each diving day. These direct adverse effects on the physical environment are expected to be less than significant, because they are localized and short-term. Additionally, the weight is light (10 pounds or less) and are designed to quick release to prevent damage to ledge habitat if the current carries the line attached to the weight.

Non-Motorized Craft

Non-motorized craft are expected to have negligible effects on the geology of an area because they are small, lightweight, slow and maneuverable, and therefore, are generally not capable of inflicting damage on geological features or altering oceanography features.

SCUBA/Snorkel Operations

SCUBA/snorkel operations, while frequently used in the southeast region for research in the sanctuaries, are expected to result in negligible effects on geological/oceanographic resources due to very limited disturbance of sediments and other submerged lands of each sanctuary. Although over 1400 dives are performed annually in the sanctuaries of the southeast, all are done by highly-trained divers, and most divers are conducting visual census or other non-removal sampling of the habitats and organisms. While intentional or accidental improper techniques and overuse of specific locations can result in damage to these physical resources, sanctuary dive sites vary according to the different projects throughout each sanctuary tending to prevent overuse of any specific location. In addition, both divers and snorkelers are highly trained and will employ ONMS best management practices. Furthermore, they are briefed on proper protocols and supervised during in-water activities to avoid improper actions that can cause harm to the physical environment. Thus, these operations are expected to result in negligible effects.

Vessel Maintenance

The routine maintenance of sanctuary owned vessels is episodic, low intensity (24 total vessels) and accomplished by trained NOAA personnel and contractors to avoid impacts to the physical environment. Routine maintenance includes cleaning, fluid changes, and some repairs. It is highly unlikely that routine vessel maintenance will have any detectable effect on geological resources. Because sanctuary vessels are relatively small, heavy maintenance (e.g., welding, grinding, painting) is typically accomplished on land in self-contained contractor facilities which are highly regulated for industrial safety and environmental compliance by local, state and other federal entities. Therefore, the effects of vessel maintenance on geological resources are expected to be negligible.

Water Quality

Activities with only less than significant adverse impacts

Onshore Fieldwork

Onshore fieldwork activities are conducted by experienced ONMS staff. Such work involves responding to vessel groundings which often may involve fuel spills. Care is taken to avoid additional spills during grounding response operations to ensure any adverse effect to water quality in connection with such operations is minimized. Accordingly, the adverse impacts to water quality associated with vessel operations are expected to be less than significant.

Vessel Operations

The general operation of vessels has the potential to have adverse but less than significant direct impacts on water quality from unintended fuel, lubricant, sewage and garbage spills from sanctuary vessels. Because there are existing state, federal and sanctuary regulations prohibiting most discharges, impacts to water quality is highly unlikely. As stated above, sanctuary vessel operators are highly trained and will employ ONMS best management practices and apply the NOAA Small Boat Program mandates and sanctuary standing orders to avoid impacts to water quality.

Activities with negligible impacts

Aircraft Operations

Many remote aerial systems are capable of landing on both land and water and are designed to float when landing on the water. The operation of UAS and other remote aerial systems may require a water landing, in which the operator lands and retrieves the aerial system in the ocean. In such instances, negligible effects to water quality are anticipated due to the fact that the systems are battery operated and sealed to ensure water does not enter the system, even when submerged, thereby minimizing the threat of a discharge during retrieval. In the unlikely event a remote aerial system unintentionally lands in the ocean and sustains damage, the damage to the surrounding environment is expected to be minimal because, per NOAA standing orders, the systems must be within eyesight of the remote operator resulting in an immediate retrieval following an emergency landing. The infrequency in which overflights occur further reduces potential threat to water quality.

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters is considered a discharge and most national marine sanctuaries have regulations restricting certain discharges. In those cases, a permit from the sanctuary superintendent will be required. Their use is expected to result in negligible effects on water quality due to the lack of discharge generally involved in operations of these tools. Thus, these operations are expected to result in negligible effects.

Deployment of Equipment on the Seafloor

The normal deployment and use of equipment on the seafloor generally causes no discharge of harmful waste material into the water column and thus is expected to have a negligible impact on a sanctuary's water quality.

Deployment of Remote Sensing Equipment

Normal remote sensing operations generally cause no discharge of harmful waste material into the water column and thus are expected to have a negligible impact on a sanctuary's water quality.

Non-Motorized Craft

Non-motorized craft are expected to have negligible effects on water quality because they do not generally discharge any substance in the water.

Other Sampling Activities

The use of other sampling technologies and operations, such as deploying instruments to measure oceanographic and water quality conditions, or tagging marine mammals to better understand their behavior, or placement of temporary transect lines or quadrats for visual census of biota generally has no or a negligible effect on the physical environment. Normal operations cause no discharge of harmful substances into the water column, atmosphere or onto the seafloor.

SCUBA/Snorkel Operations

SCUBA/snorkel operations are expected to result in negligible effects on water quality due to the lack of discharge generally involved in SCUBA diving or snorkeling activities. Thus, these operations are expected to result in negligible effects.

Vessel Maintenance

The routine maintenance of sanctuary owned vessels is episodic, low intensity and accomplished by trained NOAA personnel and contractors to avoid impacts to the physical environment. Where possible, bio-based lubricants and fluids (and, in some cases bio-based fuels are used) further reducing the threat to water quality resources in the unlikely event of a spill. Because these vessels are small and limited in total number at any location, heavy maintenance (e.g., welding, grinding, painting) is typically accomplished on land in self-contained contractor facilities which are highly regulated for industrial safety and environmental compliance including spill prevention by local, state and other federal entities. Therefore, the effects of vessel maintenance on water quality resources are expected to be negligible.

Air Quality

Activities with only less than significant adverse impacts

Aircraft Operations

Even though aircraft operations are infrequent within sanctuary boundaries, there are still some adverse effects on air quality associated with them.

Unmanned remote aerial systems are generally battery operated and usually water- and weather-proofed to enable landings and retrievals in all weather conditions. These remotely operated systems are generally built to endure rugged environments and treatment and are operated infrequently within sanctuary boundaries (less than ten flights per year). Therefore, less than significant adverse and short term impacts are anticipated.

Vessel Operations

The general operation of vessels has the potential to have adverse, but less than significant impacts on air quality from engine and generator emissions. The overall intensity of the vessel operations is limited (less than 1300 vessel days per year) and episodic. Compared against other vessel and shipping traffic, the addition of sanctuary vessel operations has less than significant impact on air quality. Larger sanctuary vessels constructed since the mid-2000's have EPA Tier 3-compliant diesel engines; in other cases on smaller vessels, four stroke and low emission outboard motors are used whenever possible. A detailed list of all vessels used in this region is found in Appendix B.

Activities with negligible impacts

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters are expected to result in negligible effects on air quality due to the lack of emissions involved in operations of these tools.

Deployment of Equipment on the Seafloor

The normal deployment and use of equipment on the seafloor causes no discharge of harmful emissions into the atmosphere, and thus has no or negligible impact on a sanctuary's air quality.

Deployment of Remote Sensing Equipment

Normal remote sensing operations generally cause no discharge of harmful emissions into the atmosphere, and thus are expected to have a negligible impact on air quality.

Vessel Maintenance

The routine maintenance of sanctuary owned vessels is episodic and low intensity and accomplished by trained NOAA personnel and contractors to avoid impacts to the physical environment. Because these vessels are small and limited in total number at any location, heavy maintenance (e.g., welding, grinding, painting) is typically accomplished on land in contractor's facilities which are highly regulated for industrial safety and environmental compliance by local, state and other federal entities. Therefore, the effects of vessel maintenance on air quality resources are expected to be negligible.

Non-Motorized Craft

Non-motorized craft are expected to have negligible effects on water quality because they do not emit any emission into the air.

Onshore Fieldwork

All onshore fieldwork is expected to have negligible impact to air quality as activities generally do not involve air emissions.

Other Sampling Activities

The use of other sampling technologies and operations, such as deploying instruments to measure oceanographic and water quality conditions, or tagging marine mammals to better understand their behavior, or placement of temporary transect lines or quadrats for visual census of biota generally has no or a negligible effect on the physical environment. Normal operations cause no discharge of harmful substances into the water column, atmosphere or onto the seafloor.

SCUBA/Snorkel Operations

SCUBA/snorkel operations are expected to result in negligible effects on air quality due to the lack of emissions involved in SCUBA diving or snorkeling activities.

Acoustics

Activities with only less than significant adverse impacts

Aircraft Operations

Unmanned and manned aerial systems conducting remote sensing survey activities often involve repeat passes of low overflights and occur infrequently in a year (less than ten flights each year). While noise emissions from these flights do occur, remote aerial monitoring projects are very limited in number (less than ten a year), scope and time frame and are expected to result in activities that would cause less than significant adverse acoustic effects on affected resources, because these effects are short-term and localized.

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters are expected to result in less than significant adverse effects on the acoustic environment due to minor engine noise associated with vehicle function and occasional use of operational altimeters. This equipment introduces limited, short-term and localized noise into the acoustic environment. Thus, these operations are expected to result in less than significant effects, because the effects are short-term and localized.

Deployment of Equipment on the Seafloor

Some equipment attached to the seafloor may result in increased noise levels from its normal operations, such as the chain dragging on the seafloor due to wave action or currents. This

disturbance is expected to be less than significant, if not negligible, to the acoustic environment, because it is low intensity and localized.

Deployment of Remote Sensing Equipment

Passive acoustic equipment is instrumentation that receives sound waves, but is silent itself. Approximately 25 days each year, GRNMS vessels deploy passive acoustic equipment (including recording hydrophones) that are either attached to moorings anchored to the seafloor, towed/tethered from vessels using marine grade ropes or cables. Common equipment is approximately 2 ft. long and 0.5 ft. wide. Up to 30 staff and partners may be involved in these acoustic equipment deployment missions. Passive acoustic equipment may be deployed by vessel, SCUBA, or free diving.

A hydrophone is a specialized microphone that is designed to listen and record underwater sound. It may either transmit live or recorded information related to the presence/absence of cetaceans, vessel traffic, and general soundscape of the area. A recording unit consists of microphone components, a battery and storage components encased in a waterproof housing. Hydrophones can be tethered, towed, or moored.

Active sounds are often broadly categorized as impulsive or non-impulsive. Impulsive sounds have short durations, rapid rise-times, and higher peak sound pressures. Explosions, air guns, weapon firing, and impact pile driving are examples of highly impulsive sound sources. Multi beam and side scan sonars are often characterized as impulsive due to their extremely short rise times, despite their more constrained frequency content. Vessels (propellers, machinery, and trustees used in dynamic positioning) are the most common sources of non-impulsive anthropogenic sound. Naval sonars are also typically characterized as non-impulsive, despite some features in common with research sonars such as discussed here.

The normal use of towed arrays, such as magnetometers, single beam sonar systems, and EK-60 scientific fish finders, are expected to cause negligible disturbance to the acoustic environment through the emission of noise generated by remote sensing devices.

For the purposes of understanding and addressing their impacts, sounds are characterized by their frequency, intensity, duration and duty cycle, among other features. Frequency can be understood as “pitch”, where the higher the frequency the higher the pitch, and is measured in Hertz (Hz). Intensity is a measure of “loudness”, or sound amplitude, and can be measured in decibels (dB). For side scan and multi beam sonar, duration can be measured in seconds from the on to offset of a single signal. Duty cycle is measured in number emitted signals (pings) per minute.

Impacts of any specific sound source, such as single and multi-beam sonars, depends on the ocean “soundscape” (acoustic environment). Soundscapes comprise multiple sound sources, such as anthropogenic sounds (produced by human activities), biological sounds (produced by animals) and geophysical sounds (produced by wind, waves and other physical forces) components. Relative sound contributions vary significantly over time and space. Overall, the

dominant contributions to the soundscape are living marine resource communications and both short and long-range vessel noise. Relatively rare use of highly directional, mid-high frequency, impulsive sources, such as single beam and multi-beam sonar, represents a non-detectable change in the long-term (monthly, annual) acoustic conditions of an exposed location, and a near-non-detectable change over mid-duration (weekly) acoustic conditions. These adverse impacts to the soundscape are expected to be negligible due to the limited use of systems and the relatively small affected study areas.

Species-specific implications associated with the use of these active acoustic research sources are discussed further below in the "Biological Environment".

Other Sampling Activities

Some other sampling operations, such as sediment sampling or water sampling, may result in increased noise levels from using the equipment under normal procedures. This equipment does not emit high intensity noise. As this acoustic disturbance is relatively minor and short-term, the adverse impacts to the acoustic environment are expected to be less than significant, if not negligible.

Vessel Operations

The general operation of vessels has the potential to have adverse, but less than significant impacts on acoustics generated by the movement of vessels through water, the operation of propulsion machinery and other equipment including depth sounders. The overall intensity of the vessel operations is limited and episodic. Compared against existing recreational and commercial boating and shipping traffic background noise, the addition of sanctuary vessel operations has limited direct adverse less than significant impacts. Scientific and mapping sonar operations are analyzed in another section of this document.

Activities with negligible impacts

Non-Motorized Craft

Non-motorized craft are expected to have negligible effects on the acoustic environment because they lack an engine or other motorized propulsion system, and thus, are unlikely to create noise above a negligible level. Any noise created is likely to be quieter than nearby natural sounds such as waves or wind on the surface of the water.

Onshore Fieldwork

All onshore fieldwork is expected to have a negligible impact to the acoustic environment as activities do not involve the emission of detectable noise both in the air and underwater.

SCUBA/Snorkel Operations

SCUBA/snorkel operations are expected to result in negligible effects on the acoustic environment due to negligible noise emitted in SCUBA diving or snorkeling activities. Thus, these operations result in negligible effects.

Vessel Maintenance

The routine maintenance of sanctuary owned vessels is episodic and low intensity and accomplished by trained NOAA personnel and contractors to avoid impacts to the physical environment, including acoustical environment. Because these vessels are small, heavy maintenance (e.g., welding, grinding, painting) is typically accomplished on land in contractor's facilities which are highly regulated for industrial safety and environmental compliance including by local, state and other federal entities. Therefore, the effects of vessel maintenance on acoustic resources are expected to be negligible.

Summary of the Effects on Physical Resources

The effects on physical resources from the preferred alternative are expected to be negligible or less than significant (beneficial and adverse, depending on the type of operations), resulting in improved characterization of geology and oceanography which would enhance conservation and management of resources, while preventing anchor damage. The adverse effects are expected to be short-term and of low intensity, and would result from minor seabed disturbance from buoy deployment, emissions from vessel operations, and noise disturbance from vessel operations and deployment of active acoustic instruments.

4.1.2 Biological Environment

Habitat

Activities with less than significant beneficial, less than significant adverse and negligible impacts

Onshore Fieldwork

Programs that involve monitoring biological resources from shore directly benefit the resource directly and indirectly. Removal, disentanglement and monitoring efforts provide a direct, short-term benefit to biological resources as immediate attention and action is employed when necessary to ensure the safety and health of marine and nearshore habitat and species (birds, invertebrates, fish, marine mammals, sea turtles, and cetaceans). Indirect effects are expected from the education and outreach materials generated by these studies to educate the public about the resources. Public awareness and education is vital to helping public stakeholders understand the resources throughout the region. Improved public awareness and understanding of resources may inspire the public to cause fewer negative effects on resources, and to act to improve resource protection, both of which would benefit the resources in the long-term. These benefits remain less than significant effects due to the limited nature of the studies of the entire region. Because these studies need to be repeated over time, impacts are short-term for each particular

effect. In the event of a vessel grounding or the presence of marine debris, necessitating the removal of large or bulky items, the prompt removal of such items would result in indirect, short- and long-term benefits to the entire ecosystem by eliminating the threat of further damage to the marine and nearshore environment. Similarly, large congregations of marine debris create entanglement and entrapment hazards and prompt removal eliminates threats to both habitat and species. By the immediate attention to known threats and the elimination of threats caused by foreign objects, such as marine debris, response efforts will allow for species and habitat disentanglements.

Inherent in any effort to remove large or bulky foreign items from the nearshore or marine environment is the potential for impact to the surrounding biological environment. Grounded vessels may be dragged along shoreline areas to eliminate threat to the environment. Similarly, large aggregation of marine debris creates entanglement and entrapment hazards, however, removal efforts may require the use of cranes or other equipment that could cause incidental damage to the surrounding area. In addition, while the physical presence of staff conducting monitoring and removal or mitigation efforts may displace or disturb nearshore and marine species, staff are highly trained and will employ ONMS best management practices to ensure disturbance to the surrounding environment is minimized as much as possible. Further, removal of marine debris often results in overall positive impacts by eliminating immediate physical, biological, and/or chemical threats to the survival of living coastal and marine resources and their habitats. As such, field work activities that require the removal and relocation of large foreign objects, such as marine debris or grounded vessels are expected to have a less than significant adverse impact on the surrounding biological environment.

Beach-walk and intertidal surveys through the movement of personnel engaged in collection and identification studies are expected to have negligible impacts to the surrounding ecosystem (including habitat, fish, invertebrates, birds, and protected species). Short term and insignificant disturbance to the surrounding area may, but is unlikely to, occur during fieldwork activities through necessary, incidental, and unavoidable contact within the surrounding area. However, the effects of this contact are expected to be negligible as any contact with the environment is localized and short term (activities likely to occur a few days per year in any one area) and care would be taken to avoid unnecessary or potentially harmful contact.

Activities with both less than significant beneficial and less than significant adverse impacts

Aircraft Operations

Monitoring efforts conducted via manned and unmanned aerial operations can lead to better characterization of habitat and species in remote areas and reduce the need for a physical presence in remote areas, which may cause a disturbance to the areas physical and biological surroundings. As such, while infrequent in occurrence, the use of aircraft for research activities are expected to result in the further characterization and protection of sanctuary resources,

resulting in less than significant beneficial, indirect and long-term effects to the general biological environment.

While aircraft operations are infrequent (less than ten UAS flights each year, all of which occur in FKNMS), some adverse direct effects are anticipated on biological resources associated with potential seabird strikes and behavioral disturbance from UAS noise. UAS operating at low altitudes conducting remote sensing surveys may have indirect effects on biological resources via seabird disturbances (i.e., low overflights could result in seabird flushing). In order to minimize the likelihood of interactions with birds, aircraft operations do not generally occur below 200 feet in elevation and generally operate at elevations of 500 feet or more. Aircraft operations are also very limited in number, scope and duration. Therefore, they are expected to result in less than significant adverse effects on biological resources, because these effects are short-term and localized.

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters is considered a discharge and most national marine sanctuaries have regulations restricting certain discharges. In those cases, a permit from the sanctuary superintendent will be required. Deployment of AUV/ROV/gliders/drifters, used for scientific or educational purposes, increases the understanding and appreciation of the biological environment, thus enhancing management strategies to protect habitat, invertebrates, fish, birds and protected species. The scientific and education results also serve to improve public stewardship. Thus, these activities are expected to result in less than significant beneficial, indirect and long-term effects.

Deployment of AUV/ROV/gliders/drifters is expected to result in less than significant adverse effects on biological habitat due to the small potential for disturbance of the water column or submerged lands in each sanctuary. While intentional or accidental improper operator techniques are possible, trained operators are utilizing assets that are very visible to the public and operators serve as models of best practices. In addition, the high mobility of these tools prevents overuse of any specific location. Thus, these operations are expected to result in less than significant, short term, adverse effects.

Deployment of Equipment on the Seafloor

Seafloor deployed equipment, such as instrumentation placed on data buoys that focuses on biological data collection (such as contaminant sampling or lionfish traps) and monitoring (as opposed to measuring oceanographic conditions as described above), can improve the conservation and management of species and habitats, and allow sanctuary managers to better understand certain oceanographic conditions such as sea temperature, pH and carbon dioxide fluctuations that affect species and biological communities. This gives managers better information to use when developing future habitat characterizations and research and management plans that address environmental changes. The beneficial impacts of this information gathering, usually derived from routine research and monitoring projects, are

expected to remain less than significant due to the limited nature of the studies of the entire region.

Further, mooring buoys used by visiting boaters prevent anchor damage to the seafloor. They are expected to yield direct less than significant beneficial effects to the biological environment, because these effects are short-term and long-term and localized.

Because virtually all seafloor substrates in sanctuaries host some organisms, disturbing the seafloor with buoy deployments can adversely affect habitats. Seafloor disturbance occurs in projects that involve buoy weights or moorings, often small buoys used for diving safety. However, every effort is made to place buoy anchors on bare bottom to limit any possible adverse disturbances. These buoys are removed at the termination of dive operations at each site visited. Temporary buoys and markers are also used to establish safety zones during response operations. These direct adverse effects on the physical environment are expected to be less than significant, because they are localized and short-term. Additionally, the buoys are lightweight and designed for quick release to prevent damage to bottom habitats and organisms.

Further, deploying moored instruments on the seafloor is expected to have short-term, temporary effects including mortality only on the benthos directly impacted by the instrument or mooring and the small footprint of the instruments means that direct impacts would be minimal.

The long-term effects from the permanent placement of buoys and moorings may adversely affect surface or subsurface organisms that may either be crushed or blocked from accessing overlying waters. However, the affected area on the bottom is very small and the placement is intentionally selected to minimize impacts. Therefore, the adverse effects for long-term buoys and moorings are less than significant, long-term, direct and localized.

Deployment of Remote Sensing Equipment

Most remote sensors measure parameters (e.g., temperature, wave height, oxygen) in the water. Multibeam and single beam fisheries sonars used to map habitat from autonomous or tethered vehicles, or shipboard mounts, penetrate the water column and seafloor with high frequency sound waves that are the lowest estimated sensation levels of active acoustic sources (MacGillivray et al. 2013). Remote sensing can have several indirect beneficial impacts on biological resources including increased understanding of individual species, biodiversity and habitats; better education and outreach materials for public education, which can lead to indirect benefits to living marine resources; and the use of hydrographic mapping as a means to improve habitat characterization and protection of seabed living resources. Increased public education, awareness and understanding of resource protection may inspire users to cause fewer negative effects on resources, and to act in ways that benefit resources in the long-term. These indirect beneficial effects are expected to be less than significant, because they are long-term.

Deployment of remote sensing equipment, such as instrumentation on data buoys, is beneficial as it allows sanctuary managers to better understand oceanographic conditions such as sea

temperature, pH and carbon dioxide fluctuations that affect species and biological communities. This gives managers better information to use when developing future research and management plans that address environmental changes, (e.g., ocean acidification) resulting in what are expected to be long-term, less than significant beneficial impacts. As another example, the development of sanctuary maps is beneficial as they lead to more precise habitat characterization, including the water column and other specific ecosystems, by the sanctuary and its partners. The limited nature of deployments of remote sensing equipment per year indicates that the benefits are likely to be less than significant.

Possible adverse effects on habitat from remote sensing operations may occur if the equipment impacts or causes changes to habitat. Normal operations are designed to preclude this possibility, and any effects would be short-term and less than significant.

Other Sampling Activities

The use of other sampling techniques and instrumentation is beneficial to habitats as it allows sanctuary managers to better understand certain oceanographic conditions such as sea temperature, pH and carbon dioxide fluctuations that affect species and biological communities; can result in improved characterization of habitats and protection of seabed living resources; and improves the monitoring of habitat conditions and changes. This gives managers better information to use when developing future research and management plans. One example is coral disease mitigation and reversal studies that allow divers to directly remove diseased portions of coral colonies to test their recovery abilities. The amount of coral removed is quite small, but it provides valuable information to researchers and coral managers which then results in indirect, less than significant beneficial effects on coral habitats.

Other sampling activities can have several indirect beneficial impacts on biological resources including data collection for future study; increased understanding of individual species, biodiversity and habitats, which leads to improved conservation and management of resources; as well as the indirect benefits of increased awareness and the development of education and outreach materials for public education that may inspire the public to cause fewer negative effects on resources, and to act in ways that benefit the sanctuary in the long-term. These indirect beneficial effects are expected to be less than significant, because they are long-term.

The use of other sampling technology and operations, particularly those involving collecting, capturing and tagging individual animals, may have some adverse impacts to marine species and habitats. For example, because virtually all seafloor substrates host some organisms, disturbing the seafloor with equipment and/or collecting samples can adversely affect these biological resources. Similar disturbances also occur in projects that involve injury assessment and restoration activities. While there may be some adverse impacts the effects are less than significant because most monitoring and sampling devices deployed on the seafloor are relatively small in size and few in number, and are generally temporary or stay in place for a long-time, (i.e., undisturbed). Therefore, only a very small part of the sanctuary's habitats are affected. While those organisms that are collected do not, of course, survive, the overall population of

these organisms and the habitat itself are not likely to be significantly affected. Recommended minimization, avoidance, and mitigation measures provided by NMFS will be employed to the maximum extent practical. Therefore, the overall direct impacts are expected to be less than significant, because they are short-term and localized.

SCUBA/Snorkel Operations

The results of SCUBA/snorkel operations - that are predominantly for scientific or educational purposes - increase the understanding and appreciation of biological resources enhancing management strategies to protect biological habitat, invertebrates, fish, birds and protected species. The scientific and educational results also serve to improve public stewardship. Thus this activity is expected to result in less than significant beneficial, indirect, and long-term effects.

SCUBA/snorkel operations are expected to result in less than significant adverse effects on biological habitat and sessile invertebrates due to the minor and limited disturbance of the water column and bottom habitats (live bottom, coral, etc.) of each sanctuary. While intentional or accidental improper techniques and overuse of specific locations can result in damage to these resources, sanctuary dive sites vary according to the different projects throughout each sanctuary preventing overuse of any specific location. In addition, sanctuary divers and snorkelers are highly trained and will employ ONMS best management practices to avoid improper actions that can cause harm to living marine resources. Thus, these operations are expected to result in less than significant adverse effects, because these effects are short-term and localized.

Activities with only less than significant beneficial impacts

Non-Motorized Craft

In FKNMS, the Team Ocean program trained teams aboard sanctuary non-motorized craft stationed at heavily-visited reef sites during peak recreational boating seasons inform boaters about the sanctuary's zones and regulations, and encourage proper use of resources and moorings. This can result in beneficial but not significant impacts to sanctuary habitats by preventing improper and damaging behavior by the public. In addition, for example, non-motorized craft are sometimes used to assess resource injuries and develop of restoration plans (when appropriate) which will prevent the injuries from expanding in size or increasing in severity, and create the site conditions necessary for the injured areas to recover to pre-incident conditions.

Activities with only less than significant adverse impacts

Vessel Operations

The operation of vessels has the potential to have adverse but less than significant direct impacts to habitat resources from anchoring and from unintentional striking or groundings. Fixed moorings are used whenever possible to minimize impacts from anchoring. Vessel operations are episodic and low intensity. Vessel operators are highly trained and will employ ONMS best management practices and apply the NOAA Small Boat Program and best management practices

and procedures to avoid direct impacts to habitat resources. In addition, the NOAA Small Boat program mandates that all sanctuary vessels longer than 40' feet be operated by personnel with an appropriate tonnage USCG license or equivalent NOAA Corps experience for the vessel size. In general, operators of sanctuary vessels will employ ONMS best management practices to minimize impacts. And, because they are operating assets that are very visible to the public they serve as models of best practices to avoid harm to habitat.

Invertebrates

Activities with less than significant beneficial, less than significant adverse and negligible impacts

Onshore Fieldwork

Programs that involve monitoring biological resources from shore directly benefit the resource directly and indirectly. Removal, disentanglement and monitoring efforts provide a direct, short-term benefit to biological resources as immediate attention and action is employed when necessary to ensure the safety and health of marine and nearshore habitat and species (birds, invertebrates, fish, marine mammals, sea turtles, and cetaceans). Indirect effects are expected from the education and outreach materials generated by these studies to educate the public about the resources. Public awareness and education is vital to helping public stakeholders understand the resources throughout the region. Improved public awareness and understanding of resources may inspire the public to cause fewer negative effects on resources, and to act to improve resource protection, both of which would benefit the resources in the long-term. These benefits remain less than significant effects due to the limited nature of the studies of the entire region. Because these studies need to be repeated over time, impacts are short-term for each particular effect. In the event of a vessel grounding or the presence of marine debris, necessitating the removal of large or bulky items, the prompt removal of such items would result in indirect, short- and long-term benefits to the entire ecosystem by eliminating the threat of further damage to the marine and nearshore environment. Similarly, large congregations of marine debris create entanglement and entrapment hazards and prompt removal eliminates threats to both habitat and species. By the immediate attention to known threats and the elimination of threats caused by foreign objects, such as marine debris, response efforts will allow for species and habitat disentanglements.

Inherent in any effort to remove large or bulky foreign items from the nearshore or marine environment is the potential for impact to the surrounding biological environment. Grounded vessels may be dragged along shoreline areas to eliminate threat to the environment. Similarly, large aggregation of marine debris creates entanglement and entrapment hazards, however, removal efforts may require the use of cranes or other equipment that could cause incidental damage to the surrounding area. Staff (ONMS and specialized contract staff) conducting such mitigation efforts are highly skilled and trained with ONMS best management practices will ensure work is done carefully so as not to unnecessarily harm the surrounding environment. In

addition, while the physical presence of staff conducting monitoring and removal or mitigation efforts may displace or disturb nearshore and marine species, staff are highly trained and will employ ONMS best management practices to ensure disturbance is minimized as much as possible. As such, field work activities that require the removal and relocation of large foreign objects, such as marine debris or grounded vessels are expected to have a less than significant adverse impact on the surrounding biological environment.

Beach-walk and intertidal surveys through the movement of personnel engaged in collection and identification studies are expected to have negligible impacts to the surrounding ecosystem (including habitat, fish, invertebrates, birds, and protected species). Short term and insignificant disturbance to the surrounding area may, but is unlikely to, occur during fieldwork activities through necessary, incidental, and unavoidable contact within the surrounding area. However, the effects of this contact are expected to be negligible as any contact with the environment is localized and short term (activities likely to occur a few days per year in any one area) and care would be taken to avoid unnecessary or potentially harmful contact.

Activities with both less than significant beneficial and less than significant adverse impacts

Aircraft Operations

Monitoring efforts conducted via manned and unmanned operations can lead to better characterization of habitat and species in remote areas and reduce the need for a physical presence in remote areas, which may cause a disturbance to the areas physical and biological surroundings. As such, while infrequent in occurrence, the use of aircraft for research activities are expected to result in the further characterization and protection of sanctuary resources, resulting in less than significant beneficial, indirect and long-term effects to the general biological environment.

While aircraft operations are infrequent (less than ten UAS flights each year across the Southeast and Gulf of Mexico sanctuaries, all of which occur in FKNMS), no adverse effects are anticipated on invertebrates from UAS noise.

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters, used for scientific or educational purposes, increases the understanding and appreciation of the biological environment, thus enhancing management strategies to protect habitat, invertebrates, fish, birds and protected species. The scientific and education results also serve to improve public stewardship. Thus, these activities are expected to result in less than significant beneficial, indirect and long-term effects.

Deployment of AUV/ROV/gliders/drifters is expected to result in less than significant adverse effects on the behavior of mobile invertebrates, fish, protected species and birds due to the generally minor, limited, and short-term impact caused by these tools. While intentional or accidental improper operator techniques are possible, such occurrences are unlikely given that operators are required to complete training courses specific to the craft that would be operated. In

addition, operators utilize highly visible assets and, accordingly, serve as models of best practices. In addition, the high mobility of these tools prevents overuse of any specific location. As a result of the low number of annual deployments and the care in which the devices are operated, these activities are expected to result in less than significant, short term, adverse effects.

Deployment of Equipment on the Seafloor

The use of seafloor deployed equipment has several indirect beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity and habitats; monitoring; boating and transit safety; and the indirect benefits of developing education and outreach materials. Increased public education, awareness and understanding of resource protection may inspire users to cause fewer negative effects on resources, and to act in ways that benefit resources in the long-term. These indirect beneficial effects are expected to be less than significant, because they are long-term.

The physical placement of equipment on the seafloor, the direct contact with sessile benthic organisms by the gear itself, and the possible deterioration of buoy material that subsequently lands on the bottom may lead to the smothering and mortality of some invertebrates, but the transitory nature of most of these devices, as well as the limited scope of each study with regards to the size of the region, is expected to keep these effects less than significant.

Deployment of Remote Sensing Equipment

Most remote sensors measure parameters (e.g., temperature, wave height, oxygen) in the water. Multibeam and sidescan sonars used to map habitat from autonomous or tethered vehicles, or shipboard mounts, penetrate the water column and seafloor with high frequency sound waves that are the lowest estimated sensation levels of active acoustic sources (MacGillivray et al. 2013). Remote sensing can have several indirect beneficial impacts on biological resources including increased understanding of individual species, biodiversity and habitats; better education and outreach materials for public education, which can lead to indirect benefits to living marine resources; and the use of hydrographic mapping as a means to improve habitat characterization and protection of seabed living resources. Increased public education, awareness and understanding of resource protection may inspire users to cause fewer negative effects on resources, and to act in ways that benefit resources in the long-term. These indirect beneficial effects are expected to be less than significant, because they are long-term.

The possible adverse or beneficial effects of remote sensing operations on invertebrates have not been well studied or documented, and are therefore not well known. However, it’s possible that remote sensing equipment may indirectly adversely affect invertebrates through behavioral disturbances caused by the instruments themselves; or more directly through direct contact of sessile (i.e., attached) benthic organisms by the gear itself. The transitory nature of these devices, as well as the limited scope of each study with regards to the size of the region, is expected to keep these effects less than significant.

Current scientific understanding of the acoustic sensitivity and sound-production by invertebrate species remains limited. However, many species such as crabs, lobsters, urchins and corals are known to either produce sounds in intraspecific interactions and/or use acoustic cues in settlement phases. For these species, and these documented acoustic use contexts, the highest risk associated with human-induced impacts would be associated with more continuous and prevalent source types that could, in conditions of high or biologically vulnerable co-occurrence, lead to reduced ability to detect important cues ("masking"). The highly localized, relatively rare and impulsive nature of echo-sounder and multi-beam sonar use suggests that impacts on settlement cueing and communication by species such as crabs, lobsters, urchins and other known acoustically-active species are likely to be negligible.

Other Sampling Activities

Other sampling activities can have several indirect beneficial impacts on invertebrates including data collection for future study; increased understanding of individual species, biodiversity and habitats, which leads to improved conservation and management of resources; as well as the indirect benefits of increased awareness and the development of education and outreach materials for public education that may inspire the public to cause fewer negative effects on resources, and to act in ways that benefit the sanctuary in the long-term. These indirect beneficial effects are expected to be less than significant, because they are long-term.

It is possible that other sampling activities may indirectly adversely affect invertebrates through behavioral disturbances caused by the instruments themselves; or more directly through contact of sessile benthic organisms (including some invertebrates) by the gear itself. The transitory nature of these devices, as well as the limited scope of each study with regards to the size of the region, is expected to keep these effects less than significant.

SCUBA/Snorkel Operations

The results of SCUBA/snorkel operations - that are predominantly for scientific or educational purposes - increase the understanding and appreciation of biological resources enhancing management strategies to protect biological habitat, invertebrates, fish, birds and protected species. The scientific and educational results also serve to improve public stewardship. Thus this activity is expected to result in less than significant beneficial, indirect, and long-term effects.

SCUBA/snorkel operations are expected to result in less than significant adverse effects on mobile invertebrates due to the minor and limited, short-term impact on animal behavior in each sanctuary. While intentional or accidental improper techniques and overuse of specific locations can result in increased disturbance of animals, sanctuary dive sites vary according to the different projects throughout each sanctuary preventing increased disturbance of animals in any one location. In addition, sanctuary divers and snorkelers are highly trained and will employ ONMS best management practices to avoid improper actions that can cause undue harm to sanctuary living marine resources. Thus, these operations are expected to result in less than significant adverse effects, because these effects are short-term and localized.

Vessel Operations

In general, conducting vessel operations allows sanctuary personnel to be on the water providing direct and indirect beneficial less than significant impacts to habitat, invertebrates, fish, birds and protected species through enforcing compliance and by providing education to users so that they may avoid impacts to biological resources. In addition, conducting vessel operations allows sanctuary personnel to respond to emergency incidents involving other users and wildlife.

The operation of vessels has the potential to have adverse, but less than significant direct and indirect impacts to invertebrates from anchoring and from temporary displacement due to vessel movement. The effects of anchoring are short term and whenever possible are conducted in locations (i.e., sand) where concentrations of invertebrates are low.

Activities with negligible impacts

Non-Motorized Craft

Due to their non-motorized nature, low speed, light weight, and high maneuverability, non-motorized craft are likely to have only negligible impacts on invertebrates, fish, birds, and protected species.

Vessel Maintenance

The routine maintenance of sanctuary owned vessels is episodic, low intensity and accomplished by trained NOAA personnel and contractors to avoid impacts to the biological environment. Where possible, bio-based lubricants and fluids (and, in some cases bio-based fuels are used) further reducing the threat to invertebrates, fish, birds, and protected species in the unlikely event of an unintentional spill. Because these vessels are small and limited in total number at any location, heavy maintenance (e.g., welding, grinding, and painting) is typically accomplished on land in self-contained contractor facilities which are highly regulated for industrial safety and environmental compliance including spill prevention by local, state and other federal entities. Therefore, the effects of vessel maintenance on these biological resources are expected to be negligible.

Fish

Activities with less than significant beneficial, less than significant adverse and negligible impacts

Onshore Fieldwork

Programs that involve monitoring biological resources from shore directly benefit the resource directly and indirectly. Removal, disentanglement and monitoring efforts provide a direct, short-term benefit to biological resources as immediate attention and action is employed when necessary to ensure the safety and health of marine and nearshore habitat and species (birds, invertebrates, fish, marine mammals, sea turtles, and cetaceans). Indirect effects are expected

from the education and outreach materials generated by these studies to educate the public about the resources. Public awareness and education is vital to helping public stakeholders understand the resources throughout the region. Improved public awareness and understanding of resources may inspire the public to cause fewer negative effects on resources, and to act to improve resource protection, both of which would benefit the resources in the long-term. These benefits remain less than significant effects due to the limited nature of the studies of the entire region. Because these studies need to be repeated over time, impacts are short-term for each particular effect. In the event of a vessel grounding or the presence of marine debris, necessitating the removal of large or bulky items, the prompt removal of such items would result in indirect, short- and long-term benefits to the entire ecosystem by eliminating the threat of further damage to the marine and nearshore environment. Similarly, large congregations of marine debris create entanglement and entrapment hazards and prompt removal eliminates threats to both habitat and species. By the immediate attention to known threats and the elimination of threats caused by foreign objects, such as marine debris, response efforts will allow for species and habitat disentanglements.

Inherent in any effort to remove large or bulky foreign items from the nearshore or marine environment is the potential for impact to the surrounding biological environment. Grounded vessels may be dragged along shoreline areas to eliminate threat to the environment. Similarly, large aggregation of marine debris creates entanglement and entrapment hazards, however, removal efforts may require the use of cranes or other equipment that could cause incidental damage to the surrounding area. In addition, while the physical presence of staff conducting monitoring and removal or mitigation efforts may displace or disturb nearshore and marine species, staff are highly trained and will employ ONMS best management practices to ensure disturbance to the surrounding environment is minimized as much as possible. As such, field work activities that require the removal and relocation of large foreign objects, such as marine debris or grounded vessels are expected to have a less than significant adverse impact on the surrounding biological environment.

Beach-walk and intertidal surveys through the movement of personnel engaged in collection and identification studies are expected to have negligible impacts to the surrounding ecosystem (including habitat, fish, invertebrates, birds, and protected species). Short term and insignificant disturbance to the surrounding area may, but is unlikely to, occur during fieldwork activities through necessary, incidental, and unavoidable contact within the surrounding area. However, the effects of this contact are expected to be negligible as any contact with the environment is localized and short term (activities likely to occur a few days per year in any one area) and care would be taken to avoid unnecessary or potentially harmful contact.

Activities with both less than significant beneficial and less than significant adverse impacts

Aircraft Operations

Monitoring efforts conducted via manned and unmanned operations can lead to better characterization of habitat and species in remote areas and reduce the need for a physical presence in remote areas, which may cause a disturbance to the areas physical and biological surroundings. As such, while infrequent in occurrence, the use of aircraft for research activities are expected to result in the further characterization and protection of sanctuary resources, resulting in less than significant beneficial, indirect and long-term effects to the general biological environment.

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters, used for scientific or educational purposes, increases the understanding and appreciation of the biological environment, thus enhancing management strategies to protect habitat, invertebrates, fish, birds and protected species. The scientific and education results also serve to improve public stewardship. Thus, these activities are expected to result in less than significant beneficial, indirect and long-term effects.

Deployment of AUV/ROV/gliders/drifters is expected to result in less than significant adverse effects on the behavior of mobile invertebrates, fish, protected species and birds due to the generally minor, limited, and short-term impact caused by these tools. While intentional or accidental improper operator techniques are possible, such occurrences are unlikely given that operators are required to complete training courses specific to the craft that would be operated. In addition, operators utilize highly visible assets and, accordingly, serve as models of best practices. In addition, the high mobility of these tools prevents overuse of any specific location. As a result of the low number of annual deployments and the care in which the devices are operated, these activities are expected to result in less than significant, short term, adverse effects.

Deployment of Equipment on the Seafloor

The use of seafloor deployed equipment has several indirect beneficial impacts on fish including data collection; increased understanding of individual species, biodiversity and habitats; monitoring; boating and transit safety; and the indirect benefits of developing education and outreach materials. Increased public education, awareness and understanding of resource protection may inspire users to cause fewer negative effects on resources, and to act in ways that benefit resources in the long-term. These indirect beneficial effects are expected to be less than significant, because they are long-term.

The normal use of equipment anchored to the seafloor causes no or negligible disturbance to fish through the emission of noise unless the device emits sound as part of its operation. Then, less than significant impacts to certain organisms may occur.

Deployment of Remote Sensing Equipment

Most remote sensors measure parameters (e.g., temperature, wave height, oxygen) in the water. Multibeam and sidescan sonars used to map habitat from autonomous or tethered vehicles, or

shipboard mounts, penetrate the water column and seafloor with high frequency sound waves that are the lowest estimated sensation levels of active acoustic sources (MacGillivray et al. 2013).

Remote sensing can have several indirect beneficial impacts on fish including increased understanding of individual species, biodiversity and habitats; better education and outreach materials for public education, which can lead to indirect benefits to living marine resources; and the use of hydrographic mapping as a means to improve habitat characterization and protection of seabed living resources. Increased public education, awareness and understanding of resource protection may inspire users to cause fewer negative effects on resources, and to act in ways that benefit resources in the long-term. These indirect beneficial effects are expected to be less than significant, because they are long-term.

Information on the movements of commercially and recreationally important fish species gained from remote sensing operations and tagging could be used to better manage species and protect fish habitat, which could result in potential long-term, indirect less than significant beneficial impacts on fish.

While manned and unmanned aircraft operations are infrequent (e.g., less than ten UAS flights each year across the Southeast and Gulf of Mexico sanctuaries, all of which occur in FKNMS), no adverse effects are anticipated on fish from manned and unmanned operations. The transitory nature of these devices, as well as the limited scope of each study with regards to the size of the region, is expected to keep these effects less than significant.

Other Sampling Activities

Other sampling activities can have several indirect beneficial impacts on biological resources including data collection for future study; increased understanding of individual species, biodiversity and habitats, which leads to improved conservation and management of resources; as well as the indirect benefits of increased awareness and the development of education and outreach materials for public education that may inspire the public to cause fewer negative effects on resources, and to act in ways that benefit the sanctuary in the long-term. These indirect beneficial effects are expected to be less than significant, because they are long-term.

Information gleaned from other sampling operations may be helpful in determining the movements of commercially and recreationally important fish species (e.g., the tagging of fish can be used to better manage species and protect their habitat), which could result in potential long-term, indirect less than significant beneficial impacts on fish.

Other sampling activities may indirectly adversely affect fish through behavioral disturbances caused by the instruments themselves; or more directly through contact of fish by the gear itself. The transitory nature of these devices, as well as the limited scope of each study with regards to the size of the region, is expected to keep these effects less than significant.

Activities with only less than significant beneficial impacts

SCUBA/Snorkel Operations

The results of SCUBA/snorkel operations - that are predominantly for scientific or educational purposes - increase the understanding and appreciation of biological resources enhancing management strategies to protect biological habitat, invertebrates, fish, birds and protected species. The scientific and educational results also serve to improve public stewardship. However, benefits, such as increased protection of fish species, are expected to result in less than significant beneficial, indirect, and long-term effects.

Vessel Operations

In general, conducting vessel operations allows sanctuary personnel to be on the water providing direct and indirect beneficial less than significant impacts to habitat, invertebrates, fish, birds and protected species through enforcing compliance and by providing education to users so that they may avoid impacts to biological resources. In addition, conducting vessel operations allows sanctuary personnel to respond to emergency incidents involving other users and wildlife.

Activities with negligible impacts

Non-Motorized Craft

Due to their non-motorized nature, low speed, light weight, and high maneuverability, non-motorized craft are likely to have only negligible impacts on invertebrates, fish, birds, and protected species.

Vessel Maintenance

The routine maintenance of sanctuary owned vessels is episodic, low intensity and accomplished by trained NOAA personnel and contractors to avoid impacts to the biological environment. Where possible, bio-based lubricants and fluids (and, in some cases bio-based fuels are used) further reducing the threat to invertebrates, fish, birds, and protected species in the unlikely event of an unintentional spill. Because these vessels are small and limited in total number at any location, heavy maintenance (e.g., welding, grinding, painting, etc.) is typically accomplished on land in self-contained contractor facilities which are highly regulated for industrial safety and environmental compliance including spill prevention by local, state and other federal entities. Therefore, the effects of vessel maintenance on these biological resources are expected to be negligible.

Birds

Activities with less than significant beneficial, less than significant adverse and negligible impacts

Onshore Fieldwork

Programs that involve monitoring biological resources from shore directly benefit the resource directly and indirectly. Removal, disentanglement and monitoring efforts provide a direct, short-

term benefit to biological resources as immediate attention and action is employed when necessary to ensure the safety and health of marine and nearshore habitat and species (birds, invertebrates, fish, marine mammals, sea turtles, and cetaceans). Indirect effects are expected from the education and outreach materials generated by these studies to educate the public about the resources. Public awareness and education is vital to helping public stakeholders understand the resources throughout the region. Improved public awareness and understanding of resources may inspire the public to cause fewer negative effects on resources, and to act to improve resource protection, both of which would benefit the resources in the long-term. These benefits remain less than significant effects due to the limited nature of the studies of the entire region. Because these studies need to be repeated over time, impacts are short-term for each particular effect. In the event of a vessel grounding or the presence of marine debris, necessitating the removal of large or bulky items, the prompt removal of such items would result in indirect, short- and long-term benefits to the entire ecosystem by eliminating the threat of further damage to the marine and nearshore environment. Similarly, large congregations of marine debris create entanglement and entrapment hazards and prompt removal eliminates threats to both habitat and species. By the immediate attention to known threats and the elimination of threats caused by foreign objects, such as marine debris, response efforts will allow for species and habitat disentanglements.

Inherent in any effort to remove large or bulky foreign items from the nearshore or marine environment is the potential for impact to the surrounding biological environment. Grounded vessels may be dragged along shoreline areas to eliminate threat to the environment. Similarly, large aggregation of marine debris creates entanglement and entrapment hazards, however, removal efforts may require the use of cranes or other equipment that could cause incidental damage to the surrounding area. In addition, while the physical presence of staff conducting monitoring and removal or mitigation efforts may displace or disturb nearshore and marine species, staff are highly trained and will employ ONMS best management practices to ensure disturbance to the surrounding environment is minimized as much as possible. Further, removal of marine debris often results in overall positive impacts by eliminating immediate physical, biological, and/or chemical threats to the survival of living coastal and marine resources and their habitats. As such, field work activities that require the removal and relocation of large foreign objects, such as marine debris or grounded vessels are expected to have a less than significant adverse impact on the surrounding biological environment.

Beach-walk and intertidal surveys through the movement of personnel engaged in collection and identification studies are expected to have negligible impacts to the surrounding ecosystem (including habitat, fish, invertebrates, birds, and protected species). Short term and insignificant disturbance to the surrounding area may, but is unlikely to, occur during fieldwork activities through necessary, incidental, and unavoidable contact within the surrounding area. However, the effects of this contact are expected to be negligible as any contact with the environment is localized and short term (activities likely to occur a few days per year in any one area) and care would be taken to avoid unnecessary or potentially harmful contact.

Activities with both less than significant beneficial and less than significant adverse impacts

Aircraft Operations

Monitoring efforts conducted via manned and unmanned operations can lead to better characterization of habitat and species in remote areas and reduce the need for a physical presence in remote areas, which may cause a disturbance to the areas physical and biological surroundings. As such, while infrequent in occurrence, the use of aircraft for research activities are expected to result in the further characterization and protection of sanctuary resources, resulting in less than significant beneficial, indirect and long-term effects to the general biological environment.

While aircraft operations are infrequent (less than ten UAS flights each year across the Southeast and Gulf of Mexico sanctuaries, all of which occur in FKNMS), some adverse direct effects are anticipated on biological resources associated with potential seabird strikes and behavioral disturbance from UAS noise. UAS operating at low altitudes conducting remote sensing surveys may have indirect effects on biological resources via seabird disturbances (i.e., low overflights could result in seabird flushing). In order to minimize the likelihood of interactions with birds, aircraft operations do not generally occur below 200 feet in elevation and generally operate at elevations of 500 feet or more. Aircraft operations are also very limited in number, scope and duration. Therefore, they are expected to result less than significant adverse effects on biological resources, because these effects are short-term and localized.

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters, used for scientific or educational purposes, increases the understanding and appreciation of the biological environment, thus enhancing management strategies to protect habitat, invertebrates, fish, birds and protected species. The scientific and education results also serve to improve public stewardship. Thus, these activities are expected to result in less than significant beneficial, indirect and long-term effects.

Deployment of AUV/ROV/gliders/drifters is expected to result in less than significant adverse effects on the behavior of birds due to the generally minor, limited, and short-term impact caused by these tools. While intentional or accidental improper operator techniques are possible, such occurrences are unlikely given that operators are required to complete training courses specific to the craft that would be operated. In addition, operators utilize highly visible assets and, accordingly, serve as models of best practices. In addition, the high mobility of these tools prevents overuse of any specific location. As a result of the low number of annual deployments and the care in which the devices are operated, these activities are expected to result in less than significant, short term, adverse effects.

Deployment of Equipment on the Seafloor

The use of seafloor deployed equipment has several indirect beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity

and habitats; monitoring; boating and transit safety; and the indirect benefits of developing education and outreach materials. Increased public education, awareness and understanding of resource protection may inspire users to cause fewer negative effects on resources, and to act in ways that benefit resources in the long-term. These indirect beneficial effects are expected to be less than significant, because they are long-term.

The normal use of equipment anchored to the seafloor causes no or negligible disturbance to the biological environment through the emission of noise unless the device emits sound as part of its operation. Then, less than significant impacts to certain organisms, particularly marine mammals, may occur. The use of seafloor deployed equipment will have no impact on bird resources.

Other Sampling Activities

Other sampling activities can have several indirect beneficial impacts on biological resources including data collection for future study; increased understanding of individual species, biodiversity and habitats, which leads to improved conservation and management of resources; as well as the indirect benefits of increased awareness and the development of education and outreach materials for public education that may inspire the public to cause fewer negative effects on resources, and to act in ways that benefit the sanctuary in the long-term. These indirect beneficial effects are expected to be less than significant, because they are long-term.

Sampling activities that focus on learning more about birds that reside in or visit a sanctuary, such as surveys, applying satellite tags for tracking, and studying tissue samples, aid the management and protection of these animals, which could result in potential long-term, indirect less than significant beneficial impacts on birds.

Some other sampling operations my adversely impact birds in a sanctuary, although their effects are expected to be short-term and less than significant. These include conducting standardized transects with a research vessel to count seabirds which may temporarily affect their behavior; and applying micro-satellite tracking tags and obtaining tissue samples from seabirds which will result in short-term, temporary injury.

Vessel Operations

In general, conducting vessel operations allows sanctuary personnel to be on the water providing direct and indirect beneficial less than significant impacts to habitat, invertebrates, fish, birds and protected species through enforcing compliance and by providing education to users so that they may avoid impacts to biological resources. In addition, conducting vessel operations allows sanctuary personnel to respond to emergency incidents involving other users and wildlife.

The operation of vessels has the potential to have adverse, but less than significant short term direct and indirect impacts to birds due to temporary displacement or changes in behavior due to presence of vessel or from vessel movement. While highly unlikely, because birds are able to fly away at the sound or sight of an incoming vessel, floating and diving birds have the potential to be struck by a moving vessel.

Activities with only less than significant beneficial impacts

Deployment of Remote Sensing Equipment

Remote sensing can have several indirect beneficial impacts on biological resources including increased understanding of individual species, biodiversity and habitats; better education and outreach materials for public education, which can lead to indirect benefits to living marine resources; and the use of hydrographic mapping as a means to improve habitat characterization and protection of seabed living resources. Increased public education, awareness and understanding of resource protection may inspire users to cause fewer negative effects on resources, and to act in ways that benefit resources in the long-term. These indirect beneficial effects are expected to be less than significant, because they are long-term.

SCUBA/Snorkel Operations

The results of SCUBA/snorkel operations - that are predominantly for scientific or educational purposes - increase the understanding and appreciation of biological resources enhancing management strategies to protect biological habitat, invertebrates, fish, birds and protected species. The scientific and educational results also serve to improve public stewardship. Thus this activity is expected to result in less than significant beneficial, indirect, and long-term effects.

Activities with negligible impacts

Non-Motorized Craft

Due to their non-motorized nature, low speed, light weight, and high maneuverability, non-motorized craft are likely to have only negligible impacts on invertebrates, fish, birds, and protected species.

Vessel Maintenance

The routine maintenance of sanctuary owned vessels is episodic, low intensity and accomplished by trained NOAA personnel and contractors to avoid impacts to the biological environment. Where possible, bio-based lubricants and fluids (and, in some cases bio-based fuels are used) further reducing the threat to invertebrates, fish, birds, and protected species in the unlikely event of an unintentional spill. Because these vessels are small and limited in total number at any location, heavy maintenance (e.g., welding, grinding, and painting) is typically accomplished on land in self-contained contractor facilities which are highly regulated for industrial safety and environmental compliance including spill prevention by local, state and other federal entities. Therefore, the effects of vessel maintenance on these biological resources are expected to be negligible.

Protected Species

Activities with less than significant beneficial, less than significant adverse and negligible impacts

Onshore Fieldwork

Programs that involve monitoring biological resources from shore directly benefit the resource directly and indirectly. Removal, disentanglement and monitoring efforts provide a direct, short-term benefit to biological resources as immediate attention and action is employed when necessary to ensure the safety and health of marine and nearshore habitat and species (birds, invertebrates, fish, marine mammals, sea turtles, and cetaceans). Indirect effects are expected from the education and outreach materials generated by these studies to educate the public about the resources. Public awareness and education is vital to helping public stakeholders understand the resources throughout the region. Improved public awareness and understanding of resources may inspire the public to cause fewer negative effects on resources, and to act to improve resource protection, both of which would benefit the resources in the long-term. These benefits remain less than significant effects due to the limited nature of the studies of the entire region. Because these studies need to be repeated over time, impacts are short-term for each particular effect. In the event of a vessel grounding or the presence of marine debris, necessitating the removal of large or bulky items, the prompt removal of such items would result in indirect, short- and long-term benefits to the entire ecosystem by eliminating the threat of further damage to the marine and nearshore environment. Similarly, large congregations of marine debris create entanglement and entrapment hazards and prompt removal eliminates threats to both habitat and species. By the immediate attention to known threats and the elimination of threats caused by foreign objects, such as marine debris, response efforts will allow for species and habitat disentanglements.

Inherent in any effort to remove large or bulky foreign items from the nearshore or marine environment is the potential for impact to the surrounding biological environment. Grounded vessels may be dragged along shoreline areas to eliminate threat to the environment. Similarly, large aggregation of marine debris creates entanglement and entrapment hazards, however, removal efforts may require the use of cranes or other equipment that could cause incidental damage to the surrounding area. In addition, while the physical presence of staff conducting monitoring and removal or mitigation efforts may displace or disturb nearshore and marine species, staff are highly trained and will employ ONMS best management practices to ensure disturbance to the surrounding environment is minimized as much as possible. As such, field work activities that require the removal and relocation of large foreign objects, such as marine debris or grounded vessels are expected to have a less than significant adverse impact on the surrounding biological environment.

Beach-walk and intertidal surveys through the movement of personnel engaged in collection and identification studies are expected to have negligible impacts to the surrounding ecosystem (including habitat, fish, invertebrates, birds, and protected species). Short term and insignificant disturbance to the surrounding area may, but is unlikely to, occur during fieldwork activities through necessary, incidental, and unavoidable contact within the surrounding area. However, the effects of this contact are expected to be negligible as any contact with the environment is

localized and short term (activities likely to occur a few days per year in any one area) and care would be taken to avoid unnecessary or potentially harmful contact.

Activities with both less than significant beneficial and less than significant adverse impacts

Aircraft Operations

Monitoring efforts conducted via manned and unmanned aerial operations can lead to better characterization of habitat and species in remote areas and reduce the need for a physical presence in remote areas, which may cause a disturbance to the areas physical and biological surroundings. As such, while infrequent in occurrence, the use of aircraft for research activities are expected to result in the further characterization and protection of sanctuary resources, resulting in less than significant beneficial, indirect and long-term effects to the general biological environment.

While manned and unmanned aircraft operations are infrequent (e.g., less than ten UAS flights each year across the Southeast and Gulf of Mexico sanctuaries, all of which occur in FKNMS), some adverse direct effects are anticipated on biological resources associated with potential seabird strikes and behavioral disturbance from UAS noise. UAS operating at low altitudes conducting remote sensing surveys may have indirect effects on biological resources via seabird disturbances (i.e., low overflights could result in seabird flushing). In order to minimize the likelihood of interactions with birds, aircraft operations do not generally occur below 200 feet in elevation and generally operate at elevations of 500 feet or more. Aircraft operations are also very limited in number, scope and duration. In addition, ONMS will follow all minimization and mitigation measures offered by NMFS to reduce effects on marine mammals and sea turtles. Therefore, they are expected to result in less than significant adverse effects on biological resources, because they are short-term and localized.

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters, used for scientific or educational purposes, increases the understanding and appreciation of the biological environment, thus enhancing management strategies to protect habitat and protected species, particularly marine mammals and sea turtles. The scientific and education results also serve to improve public stewardship. Thus, these activities are expected to result in less than significant beneficial, indirect and long-term effects.

Deployment of AUV/ROV/gliders/drifters is expected to result in less than significant adverse effects on the behavior of mobile invertebrates and protected species, particularly marine mammals and sea turtles due to the generally minor, limited, and short-term impact caused by these tools. While intentional or accidental improper operator techniques are possible, such occurrences are unlikely given that operators are required to complete training courses specific to the craft that would be operated. In addition, operators utilize highly visible assets and, accordingly, serve as models of best practices. In addition, the high mobility of these tools prevents overuse of any specific location. As a result of the low number of annual deployments

and the care in which the devices are operated, these activities are expected to result in less than significant, short term, adverse effects.

Entanglement of protected resources – primarily marine mammals - in ROV cable is possible, but unlikely because the duration of operations is very limited and the operation is attended at all times. Should an animal be observed in the vicinity the ROV can be quickly retrieved. Thus, these operations are expected to result in less than significant, direct, short-term adverse effects.

Deployment of Equipment on the Seafloor

The use of seafloor deployed equipment has several indirect beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity and habitats; monitoring; boating and transit safety; and the indirect benefits of developing education and outreach materials. Increased public education, awareness and understanding of resource protection may inspire users to cause fewer negative effects on resources, and to act in ways that benefit resources in the long-term. These indirect beneficial effects are expected to be less than significant, because they are long-term.

Seafloor deployed equipment can be used for monitoring marine mammal behavior, thus providing information that may be useful in reducing the possible deleterious impacts of human interactions with these animals by alerting vessel operators of marine mammal presence and thereby giving them the chance to take precautions to avoid harassing or injuring the animals. These effects are both short-term and long-term (avoiding impact to individual marine mammals), indirect and less than significant beneficial.

If the seafloor-deployed equipment uses active sonar or other noise-generating technology as part of its normal operations there is a possibility that marine mammals may be adversely affected, perhaps causing behavioral changes such as altering their foraging, diving or vocalization patterns. Another possible adverse impact to marine mammals may be the slight chance of entanglement with a mooring cable. These adverse impacts are expected to be short-term and localized, and therefore considered to be less than significant.

Deployment of Remote Sensing Equipment

Remote sensing operations include the use of active sonar that may adversely impact species, particularly marine mammals (some endangered) through increased noise in the environment. See Chapter 2 Tables 2-4 for information on the type of equipment used and their specs. For example, hydrographic survey data collection uses multibeam sonar in varying frequency ranges to map the seafloor. These systems are typically either hull-mounted multibeam or towed side-scan sonar systems. Active sonar devices emit pulses of sound waves that travel through the water, reflect off objects, and return to a receiver on the ship. This and other anthropogenic underwater noise may adversely affect marine mammals in several ways including causing some behavioral changes such as altering their foraging, diving or vocalization patterns, but they would not likely result in injury to the marine mammals; however, multibeam and single sonars use sound waves that are the lowest estimated sensation levels of active acoustic sources (MacGillivray et al.

2013). These adverse impacts are expected to be short-term and localized, and therefore considered to be less than significant.

Remote sensing activities include the use of both active (sound producing) and passive (listening only) technologies for a variety of uses (e.g., characterizing and inventorying resources, monitoring for spawning aggregations of fish and documenting maritime heritage sites)) and can have several indirect beneficial impacts on biological resources. Such benefits include increased understanding of individual species, biodiversity and habitats for improved protective management; better education and outreach materials for improved enhanced public stewardship; and high-resolution hydrographic mapping for better habitat characterization and adaptive management of living and maritime heritage resources. No impacts to maritime heritage resources are anticipated. Enhanced public education, awareness and understanding of resource protection will boost public stewardship, leading to fewer negative cumulative impacts on sanctuary protected resources. Remote sensing impacts are expected to be less than significant due to the limited nature of the studies of the entire region.

For the purposes of understanding and addressing their impacts, sounds are characterized by their frequency, intensity, duration and duty cycle, among other features. Frequency can be understood as “pitch”, where the higher the frequency the higher the pitch, and is measured in Hertz (Hz). Intensity is a measure of “loudness”, or sound amplitude, and can be measured in decibels (dB). For single and multibeam sonar, duration can be measured in seconds from the on to offset of a single signal. Duty cycle is measured in number emitted signals (pings) per minute.

As discussed above, active acoustic sources (single and multi-beam sonars) are used in FGBNMS and GRNMS for habitat mapping. Generally, single beam systems are used for scientific fish finders, and multi-beam systems are used for high-resolution fish surveys and bottom mapping. When using either type of system, higher frequencies are used in shallower depths, and lower frequencies are used for surveying at depths greater than 200 ft. Power, amplitude, pulse, width and ping rate vary depending on the depths of the ocean in the area being mapped. Because of the relatively shallow depth at FGBNMS, higher frequencies (120 and 200 kHz) will be used to acoustically-reflecting targets such as fish. Both sanctuaries will employ Reson 7125 (multibeam, dual frequency, 200/400 kHz) typical source levels (SL) are 225-229 dB re 1 µPa @ 1m, and all depths surveyed are less than 250 m. Biomass is surveyed with a single beam Simrad EK60 Fisheries Acoustic suite (38 kHz, 120 kHz and 200 kHz).

Evaluation of noise impacts to individual species necessitates characterization of source features and use profiles, and affiliation of those features with co-occurrence, context and sensitivity of exposed animals. In extreme cases, the aligning of these risk factors can result, in soft tissue injuries and even fatality if animals are exposed to very high intensity sounds in very proximate conditions. Higher intensity exposures within animal’s frequency range of hearing also can cause injury in the form of permanent hearing damage, also referred to as permanent threshold shift (PTS). Exposure to moderate intensity sounds within relevant frequency ranges can cause temporary threshold shifts (TTS) in hearing, which are recoverable over a subsequent period of non-exposure. Sometimes over great distances from the source, exposure to sound can result in

behavioral effects for affected species that can result in alteration of biologically important activities such as feeding, mating or migration. In more extreme cases, behavioral responses can lead indirectly to death, such as animals having strong aversion responses and rising from deep waters too quickly or traveling into shallow waters and beaching. Finally, also over a broad range of distances, exposure to non-invasive sounds or cumulative acoustic energy from a variety of sound sources leading to higher "background" noise levels, can result in masked communications and/or degraded ability for animals to hear acoustic environmental cues used to support biologically important activities (again, such as navigation, feeding, reproduction).

In order to predict whether a marine mammal's exposure to a sound source will result in either temporary or permanent changes in their hearing ability, NMFS has developed Technical Guidance[11] which provides acoustic thresholds for onset of PTS and TTS in marine mammals for all sound sources (NMFS 2016). Specifically, it identifies the levels of received sound at which individual marine mammals are predicted to experience changes in their hearing sensitivity (either temporary or permanent) for acute, incidental exposure to underwater anthropogenic sound sources. The current NMFS threshold for the onset of PTS in cetaceans from exposure to in-water sounds is ≥ 180 dB re 1 µPa. The same threshold for pinnipeds is ≥ 190 dB re 1 µPa. Exposure to impulsive in-water sounds at ≥ 160 dB re 1 µPa is the threshold for the onset of TTS and behavioral disturbance for all marine mammals, whereas the same threshold for exposure to non-impulsive sound (continuous noise) is ≥ 120 dB re 1 µPa.

The sonar systems to be used in this action are considered impulsive sources. Thus, the 160 dB re 1 µPa threshold for predicting the onset of TTS and behavioral disturbance is applied, and significant exposure above that level at a frequency within the animal's hearing range is considered an adverse impact. However, not all cetaceans and pinnipeds will experience TTS or behavioral responses at the 160 dB threshold. Hearing capabilities vary among marine mammal groups, and mapping sonars only overlap with the hearing range of regionally-occurring mid-frequency cetaceans (toothed whales/Sperm whale).

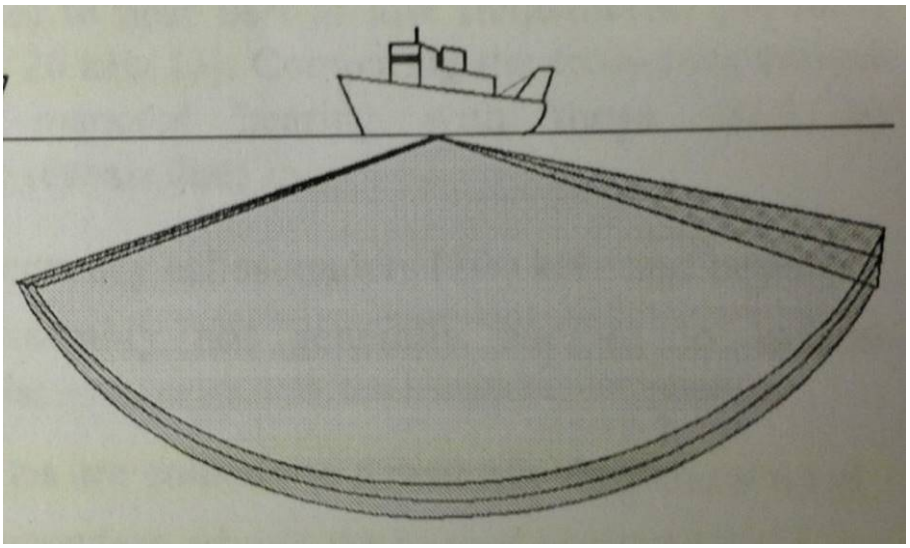
In order to assess the likelihood that an animal will be exposed to sound levels at or greater than 160 dB re 1 µPa, we must determine the propagation, or spreading, in meters, of the sound from the source (in this case, the vessel). Figures 2a and 2b provides diagrams excerpted from Lurton & DeRuiter (2011) that show the general sound propagation (isopleth) of a multibeam sonar system from both horizontal (Fig 2a) and overhead (Fig. 2b) perspectives. The 160 dB received level isopleth forms a ring around the vessel at 200 meters, except within the fan-shaped ensonification volume (as pictured in Figure 1) where it extends out to approximately 750 meters. Any marine mammal within this isopleth would receive sound levels of 160 dB or higher.

Accurately predicting the 160 dB re 1 µPa isopleth from any sound source is difficult, but particularly so for multibeam sonar. First, propagation of sound produced underwater is highly

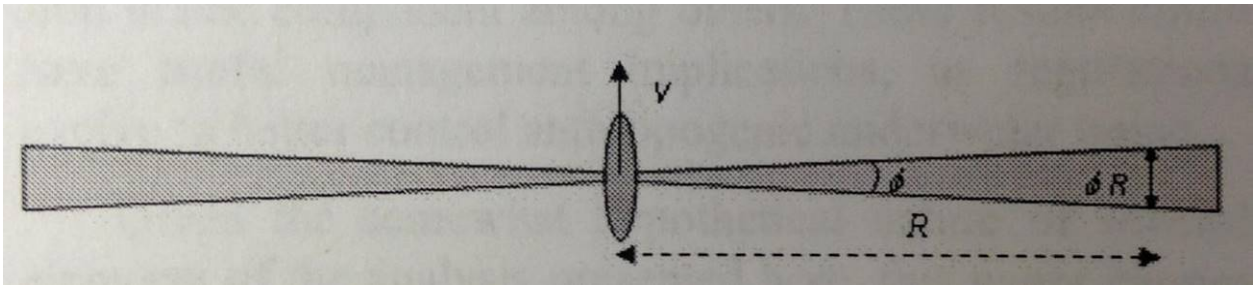
[11] http://www.nmfs.noaa.gov/pr/acoustics/Acoustic%20Guidance%20Files/opr-55_acoustic_guidance_tech_memo.pdf accessed on April 18, 2018.

dependent on environmental characteristics such as bathymetry, bottom type, water depth, temperature, and salinity. The sound received at a particular location will be different than near the source due to the interaction of many factors, including propagation loss; how the sound is reflected, refracted, or scattered; the potential for reverberation; and interference due to multi-path propagation. In addition, absorption greatly affects the distance over which higher-frequency sounds propagate. Detailed information on these naturally occurring factors in the marine environment is rarely available and consequently they are generally not considered in the equations.

Multibeam sonar are focused sonar arrays that use "selective angular directivity" and furthermore transmit "very short pulses at limited ping rates" (Lurton & DeRuiter 2011). These two characteristics of this type of sonar decrease the probability of the animals being subjected to TTS threshold intensity levels (see Figure 2).



a)



b)

Figure 2. Diagrams showing a typical multibeam ensonification volume from a) the horizontal and b) the overhead prospective (From Lurton & DeRuiter 2011).

Submerged animals more than 200m from the ship that are caught in the ensonification volume as the ship passes will be only briefly subjected to the elevated sound levels occurring inside the

transmitter beam pattern. Furthermore, the narrow fan-shaped beam patterns of the multibeam systems provide ample possibilities for the animals to quickly escape the sound. The only possible scenario for more extended exposure would be if the animal were to suddenly start moving in the exact direction and speed as the ship, which is unlikely.

Finally, transmit pulse forms and rates further distinguish multibeam sonar from other types of sonar and acoustic sources and further reduce their potential threat to marine mammals. Sound is not transmitted continuously from these systems but rather in extremely short pulses (i.e., pings).

Another consideration is the hearing range of the various species found in the survey areas. Mid-frequency cetaceans may be affected by the use of multibeam sonar systems. See Appendix C for a representative list of cetacean hearing ranges.

To further address the unlikely impacts to marine mammals, observers on the vessel's bridge or the marine mammal observation deck will carefully monitor for the presence of marine protected species, and permitted personnel will follow the best management practices found in Appendix E to minimize disturbance. Shallow water mapping will be conducted during daylight hours as much as possible and only with cetacean observers present. If cetaceans are present ONMS will follow BMPs listed in Appendix E. The multibeam systems will remain on throughout the cruises to avoid the possibility of startle responses by marine mammals that could be in the vicinity of the ship, particularly at night. Leaving them on also provides marine mammals advanced warning that the ship is in the vicinity, further reducing the possibility of a collision.

For those cetaceans exposed to the 160 isobeth, the impacts are likely limited to temporary, minor behavioral disturbances. Based on the best information available, including the mobility of marine mammals in the water column, the propensity for marine mammals to avoid obtrusive sounds, and the proposed mitigation measures above, mild alert and startle responses, avoidance of the survey vessel, and brief or minor modification of vocal behaviors are the most probable responses to exposure. In addition, the relatively rare, impulsive and highly localized implications of these source types result in nonexistent (for humpbacks) to negligible (for toothed whales) implications for acoustic masking of communication signals or other important biological signals within mid-higher frequency hearing ranges. No measurable impacts are expected to occur on the ability of exposed cetaceans to forage, shelter, navigate, reproduce, and avoid predators and other threats such as vessels. Therefore, the impacts expected to result from exposure to noise from active acoustic research sources would have insignificant effects on cetaceans that may be in the area.

There are a number of other ESA-listed species around the region including five sea turtles and Atlantic Sturgeon. Kemp's Ridley, Hawksbill, Leatherback, and Green turtles are endangered and Loggerhead is threatened. The mid to higher frequencies emitted by the sources assessed here have not been documented to disturb these species. Turtle species that have been evaluated have been found to be mostly low-frequency sensitive.

ONMS staff incorporates operational mitigation measures into its research, monitoring and sonar survey activities to reduce or avoid impacts wherever practicable. Vessels operate a slow speed (4-8 knots) during research in the sanctuary and use downward-facing, mid to high frequency sources outside of the highest hearing sensitivity ranges for local cetacean species. In addition, the sonars are operated at the lowest power setting and are turned off when any marine mammals have been sighted per the BMPs listed in Appendix E. ONMS policies requires that a designated lookout stand watch during transit and survey operations, scanning the water for humans, animals, vessels, and other objects. In FKNMS, staff follows standard precautions when operating in manatee areas, and does not conduct acoustic activities that affect manatees. Therefore, less than significant adverse impacts to manatees are expected from the ONMS use of acoustic equipment.

Personnel on board NOAA vessels monitor and report locations of marine mammal and sea turtle sightings as part of their regular operational protocol. Currently, the lookout records any sightings of marine mammals and turtles with a specially-designed logging system. The observation report records the species, number of animals, behavior, time, and location of the sighting. Each year, NOAA ships are required to include 24 hours of "safety stand down" training activities for on-board personnel. NOAA is incorporating basic strategies for marine mammal detection and monitoring into standard ocean observatory roles for personnel.

Wildlife Management Areas (WMAs) within FKNMS seek to minimize disturbance to especially sensitive or endangered wildlife and their habitats. These zones typically include bird nesting, resting, or feeding areas; turtle-nesting beaches; and other sensitive habitats. Regulations are designed to protect these species and may include no-access buffers, no-motor zones, idle-speed only/no-wake zones, and closed zones. Some restrictions may apply to time periods, others to areas. There are currently 27 WMAs in the Sanctuary. Twenty WMAs are co-managed with the U.S. Fish and Wildlife Service as part of their plan for managing backcountry portions of the Key West, Key Deer, Great White Heron, and Crocodile Lake National Wildlife Refuges. FKNMS manages the remaining seven WMAs.

Non-Motorized Craft

In the sanctuaries which promote the Team Ocean program, trained teams aboard sanctuary non-motorized craft stationed at heavily-visited reef sites during peak recreational boating seasons inform boaters about the sanctuary's zones and regulations and encourage proper use of resources and mooring, which results in beneficial but not significant impacts to ESA-listed species and marine mammals by preventing improper and damaging behavior by the public. These effects are both short-term and long-term (avoiding impact to individual marine mammals and ESA-listed species), indirect and less than significant beneficial.

Non-motorized craft are likely to have adverse but not significant effects on protected species or marine mammals due to some temporary disturbance resulting in displacing some marine mammals or altering their behavior if they are close. One of the ways in which NOAA avoids the

risk of disturbance to protected species or marine mammals is by always attempting to maintain a safe distance between them and NOAA-operated craft. Non-motorized craft are only used only in FKNMS in the southeast and Gulf of Mexico region at a rate of about 300 trips/year.

Other Sampling Activities

Other sampling activities can have several indirect beneficial impacts on biological resources including data collection for future study; increased understanding of individual species, biodiversity and habitats, which leads to improved conservation and management of resources; as well as the indirect benefits of increased awareness and the development of education and outreach materials for public education that may inspire the public to cause fewer negative effects on resources, and to act in ways that benefit the sanctuary in the long-term. These indirect beneficial effects are expected to be less than significant, because they are long-term.

Various sampling operations aimed at better protection and management of marine mammals include applying tags to record and study whale behavior, and deploying instruments into the water column to measure internal waves as a means of understanding their effects on whale foraging. These long-term scientific studies that aid sanctuary managers with resource protection are expected to yield less than significant beneficial impacts.

Further, large whale disentanglements are often very public opportunities for direct interaction with these large, often endangered mammals. These operations directly benefit the animals by freeing them from harmful, entangling fishing gear, and provide a substantial indirect benefit from public attention and educational opportunities. The effects of this type of activity are expected to be beneficial and less than significant, but may be short-term as the publicity from any single event may fade quickly unless education and outreach programs continue to inform the public of the dangers of entanglements.

Other sampling activities, as described in the last line of Table 5, are varied across the three national marine sanctuaries. These activities include tagging of whales, whale sharks, manta rays, and fish with small tags that are not permanently attached to the animal or small tissue sampling for genetic analysis and sampling of non-listed corals. These activities have no or a negligible effect on sanctuary biological resources as they have little impact on each specific, individual organism. This sampling would cause mortality in the few individuals sampled, but due to the small number of individual affected, it is not expected to have any long-term or significant impacts on those protected resources. Activities such as the placement of transect lines and quadrats; placement of anchors or cables; trawling for scientific purposes; planning recruitment tiles; and water quality sampling would have very localized and negligible impacts on protected species because they would be placed away in locations with a low likelihood of interference with those species. These adverse impacts are expected to be short-term and localized, and therefore considered to be less than significant.

Vessel Operations

In general, conducting vessel operations allows sanctuary personnel to be on the water providing direct and indirect beneficial less than significant impacts to habitat, invertebrates, fish, birds and protected species through enforcing compliance and by providing education to users so that they may avoid impacts to biological resources. In addition, conducting vessel operations allows sanctuary personnel to respond to emergency incidents involving other users and wildlife.

The operation of vessels has the potential to have adverse, but less than significant short term direct and indirect impacts to ESA listed species and marine mammals due to temporary displacement or changes in behavior due to presence of vessel or from vessel movement. While unlikely, protected species have the potential to be struck by a moving vessel. Smaller vessels are typically faster, but have higher maneuverability and shallow draft compared to larger vessels. Therefore, the small vessels primarily used by ONMS are even less likely to collide with and injure protected species because they can change direction to avoid collisions and do not ride as low in the water. Except for law enforcement vessels, larger, hard-bottom hull vessels tend to move slower and have increased crew requirements per the NOAA Small Boat Program and sanctuary program standing orders to make up for their lesser maneuverability compared to small vessels.

Operating a research vessel in close proximity to protected species during the course of other sampling activities can have short-term temporary effects on their behavior, and presents a remote risk of the vessel striking the animal.

Regardless of boat size, operators of sanctuary vessels have heightened awareness of sanctuary, ESA and MMPA regulations. And, because they are highly trained and will employ ONMS best management practices and are operating assets that are very visible to the public they serve as models of best practices to avoid harm to protected species and sanctuary resources. Examples of best practices include maintaining lookouts for protected species, interacting with other vessel operators (e.g., whale watch boats), receiving real time survey information on the locations and concentration of marine mammals in particular, reducing speeds, and maintaining safe distances.

The combination of a limited number of days at sea, and the corridors used by vessels to travel from port to the sanctuaries, and small number of vessels operated by ONMS further decreases the likelihood of impacts to protected species residing in the sanctuaries and other areas where ONMS vessels are operating. 24 ONMS vessels (plus numerous non-motorized craft) spend less than 1600 days on the water each year in the SEGOM. Many of these days are “on station”, either drifting, anchored or moving at very slow speed. Transits to and from research sites are conducted by trained personnel who are very familiar with the routes and the habitats and organisms likely to be encountered during transit.

Although unlikely, vessel strikes on sea turtles are possible due to the sheer numbers of turtles found in some areas such as GRNMS. In fact, a GRNMS vessel struck and killed a leatherback turtle in 2015, in spite of the fact that multiple lookouts were posted on the vessel while in transit prior to the sea turtle strike. Vessel speed was optimized for efficiency and was by no means

excessive. Best practices were followed. Because of partial recovery of sea turtle populations, and the fact that they are submerged, partially submerged, and regularly coming up for air, sea turtle strikes such as those that have happened rarely in the past can happen again, particularly in light of increased conservation and population sizes. Because of due diligence by vessel crews, the likelihood of collision with a sea turtle is likely much lower than it is for the thousands of recreational vessels operating in the sanctuaries. GADNR Sea Turtle Coordinator, NOAA OLE, NOAA Fisheries Protected Resources, and ONMS Marine Operations Committee were consulted to discuss potential ways in which this could be avoided. While no mitigations are guaranteed to eliminate the potential for strikes, they have been implemented in the hopes that they will reduce strikes and/or injury. Mitigation strategies include: route selections that avoid murky waters as best as possible; transiting live bottom/artificial habitats at slower speeds; or avoiding transiting near tide lines where turtles feeding on jellyfish often are observed.

Due to all of these factors it is very unlikely that sanctuary vessel operations would have significant impacts on protected species.

Activities with only less than significant beneficial impacts

SCUBA/Snorkel Operations

The results of SCUBA/snorkel operations - that are predominantly for scientific or educational purposes - increase the understanding and appreciation of biological resources enhancing management strategies to protect biological habitat, invertebrates, fish, birds and protected species. The scientific and educational results also serve to improve public stewardship. Thus this activity is expected to result in less than significant beneficial, indirect, and long-term effects.

Activities with negligible impacts

Vessel Maintenance

The routine maintenance of sanctuary owned vessels is episodic, low intensity and accomplished by trained NOAA personnel and contractors to avoid impacts to the biological environment. Where possible, bio-based lubricants and fluids (and, in some cases bio-based fuels are used) further reducing the threat to invertebrates, fish, birds, and protected species in the unlikely event of an unintentional spill. Because these vessels are small and limited in total number at any location, heavy maintenance (e.g., welding, grinding, painting, etc.) is typically accomplished on land in self-contained contractor facilities which are highly regulated for industrial safety and environmental compliance including spill prevention by local, state and other federal entities. Therefore, the effects of vessel maintenance on these biological resources are expected to be negligible.

Summary of Effects on Biological Resources

The effects on biological resources from the preferred alternative would generally be negligible or less than significant (beneficial and adverse, depending on the type of operations). The

beneficial effects can be summarized as: improved compliance with sanctuary regulations, increased characterization of biological resources enhancing conservation and management of living resources; data collection for future study and long-term monitoring of changes; and increased awareness and educational opportunities.

The adverse effects on biological resources are expected to be short-term and temporary from all field operations including those that physically alter or cause a reaction in a biological resource. They would result from protected species disturbance or, very infrequently, strike, as a result of vessel operations, seabird disturbance from aircraft operations; behavior modification for mobile invertebrates, fish, protected species and birds by AUV/ROV/gliders/drifters; habitat modification as well as invertebrate, fish, bird, and protected species disturbance due to removal of debris during fieldwork and anchoring or unintentionally grounding vessels, and diving. Small changes to habitat or behavior of protected species could also result from remote sensing equipment or equipment deployed on the seafloor. ONMS has determined that active acoustic activities would result in very little risk of injury to marine mammals and other endangered species in FGBNMS, as well as very little risk of injury to additional sanctuary resources such as fish and marine invertebrates. Risk is minimized due to source characteristics (higher frequency highly directional sources), their use context (during time periods and within regions of the sanctuary with less overlap with protected and endangered species), and additional mitigations applied (observer-triggered shut downs, low power selections).

4.1.3 Socioeconomic Environment

Maritime Transportation

Activities with both less than significant beneficial and less than significant adverse impacts

Other Sampling Activities

The information gleaned from the use of other sampling operations is expected to advance scientific study and inquiry, create greater awareness and appreciation of sanctuary resources, and promote public and commercial uses. The socioeconomic environment stands to indirectly benefit since trade, tourism, recreation, research and commercial ventures depend on the vitality of the sanctuary. Given the long-term nature of scientific study and sanctuary resource management these beneficial effects are expected to be less than significant. A less than significant long-term benefit to many users, however, would be the increased knowledge of sanctuary resources that leads to better resource management, more public education and outreach, and improved partnerships between sanctuary managers, users and constituents.

Occasionally, other sampling operations conducted by sanctuary staff and partners may temporarily interfere with the conduct of commercial or recreational activities, but these effects are expected to be less than significant if not negligible because they are short-term and localized.

Activities with less than significant beneficial and negligible impacts

Deployment of Equipment on the Seafloor

The use of buoys to aid navigation is beneficial to marine transport as they assist in preventing groundings in shallow areas; however, these benefits are negligible because they only incrementally add to the already extensive network of navigation buoys from other agencies used to aid in marine navigation.

The data generated by seabed deployed equipment can increase knowledge of sanctuary resources, leading to better resource management, more public awareness and appreciation, increased safety, improved partnerships between sanctuary managers, users and constituents, and the promotion of public and commercial uses. Thus, the socioeconomic environment stands to indirectly benefit since trade, tourism, recreation, research and commercial ventures depend on the vitality of the sanctuary. Given the long-term nature of scientific study and sanctuary management these beneficial effects are expected to be less than significant.

Occasionally, buoys, mooring lines and other equipment may temporarily interfere with the conduct of commercial or recreational activities (such as fishing or transit), but the effect is expected to be short-term and negligible as most of the operations are limited in scope and time.

Deployment of Remote Sensing Equipment

The use of remote sensing to develop bathymetric maps is beneficial to marine navigation as they assist in preventing groundings; however, these benefits are negligible because they only incrementally add to the already large body of bathymetry knowledge used to aid in marine navigation. The data generated by remote sensing operations can increase knowledge of sanctuary resources and better characterizations of habitats may lead to better resource management, more public education and outreach, and improved partnerships between sanctuary managers, users and constituents. Given the long-term nature of scientific study and sanctuary management these beneficial effects are considered less than significant.

Occasionally, scientific activities conducted by sanctuaries such as transect surveys may temporarily interfere with the conduct of commercial or recreational activities, but the effect is expected to be short-term and negligible.

Activities with only less than significant beneficial impacts

Aircraft Operations

In general, aircraft operations, whether primarily used for species and habitat surveys within sanctuary boundaries, are expected to have a less than significant beneficial effect on the socioeconomic environment resulting in both long-term and short-term benefits. Additional research can lead to better characterization of habitats and species aiding in education and outreach efforts, which aim to increase informed management decisions and policy. Thus, less than significant beneficial, indirect and short and long-term effects are expected to result from aircraft operations.

Activities with negligible impacts

Vessel Maintenance

It is estimated that approximately 24 days of vessel maintenance will be required each year to support the ONMS vessels which operate in the SEGOM sanctuaries. Vessel maintenance activities are highly unlikely to have detectable effect on marine transport because they are low intensity, episodic and typically conducted pier-side or on land, and therefore would not overlap with areas where marine transportation takes place.

Research and Education

Activities with both less than significant beneficial and less than significant adverse impacts

Other Sampling Activities

Sanctuary research and education that derives from other sampling operations include such activities as reef assessment and monitoring programs; video and photographic documentation of whales; maritime heritage field activities; whale disentanglement training; and the development of public outreach materials, which are all designed to both better protect and manages sanctuary resources and offer related socioeconomic opportunities to users and constituents. These activities can result in benefits to the socioeconomic environment that are short or long-term, direct or indirect, and less than significant.

Occasionally, other sampling operations conducted by sanctuary staff and partners may temporarily interfere with the conduct of commercial or recreational activities, but these effects are expected to be less than significant if not negligible because they are short-term and localized.

Activities with less than significant beneficial and negligible impacts

Deployment of Equipment on the Seafloor

Research and educational materials developed from data gathered from buoys and other seabed-deployed instrumentation foster a greater awareness and appreciation for sanctuary resources, which in turn promotes public use of the sanctuary (e.g., diving, kayaking, snorkeling, glass bottom boat excursions). Local businesses benefit from this dynamic. For example, small, weighted buoys temporarily deployed for dive operations provide safety for divers, and thus are expected to exhibit less than significant beneficial, short-term and direct effects.

Occasionally, buoys, mooring lines and other equipment may temporarily interfere with the conduct of commercial or recreational activities (such as fishing or transit), but the effect is expected to be short-term and negligible as most of the operations are limited in scope and time.

Deployment of Remote Sensing Equipment

The data generated by remote sensing operations can increase knowledge of sanctuary resources and better characterizations of habitats may lead to better resource management, more public

education and outreach, and improved partnerships between sanctuary managers, users and constituents. Given the long-term nature of scientific study and sanctuary management these beneficial effects are considered less than significant. Nevertheless, these benefits are negligible because they only incrementally add to opportunities for research and education in the sanctuaries.

Occasionally, scientific activities conducted by sanctuaries such as transect surveys may temporarily interfere with the conduct of commercial or recreational activities, but the effect is expected to be short-term and negligible.

Activities with only less than significant beneficial impacts

Aircraft Operations

In general, aircraft operations, whether primarily used for species and habitat surveys within sanctuary boundaries, are expected to have a less than significant beneficial effect on the socioeconomic environment resulting in both long-term and short-term benefits. Additional research can lead to better characterization of habitats and species aiding in education and outreach efforts, which aim to increase informed management decisions and policy. Thus, less than significant beneficial, indirect and short and long-term effects are expected to result from aircraft operations.

Deployment of AUV/ROV/Gliders/Drifters

Deployments of AUV/ROV/gliders/drifters in sanctuaries are expected to have a less than significant, long-term beneficial effect on sanctuary research and education resources. This is because all projects are designed to gain information about each sanctuary so that managers can better protect all of its resources. By undertaking these projects, resources will be better protected, restored, or preserved. Because of this, the socioeconomic environment stands to gain a benefit since many research and education ventures depend on the vitality of the sanctuaries.

Onshore Fieldwork

ONMS projects associated with onshore fieldwork activities are intended to enhance awareness and understanding of sanctuary natural and cultural resources. This heightened awareness can have a direct and indirect beneficial effect on socioeconomic resources. Research and monitoring efforts lead to a better understanding of interactions of species with each other and their surrounding environment, which in turn aids in better and more informed management of resources. For example, an understanding of seabird foraging habits can help fishermen employ measures and techniques to reduce the risk of interacting and harming seabirds. In addition, the presence of staff conducting onshore survey and monitoring efforts can afford an opportunity for public interaction and education. Public education is vital to helping public stakeholders understand the resources throughout the region. Improved public awareness and understanding of resources may inspire the public to cause fewer negative effects on resources, and to act to improve resource protection, both of which would benefit the resources in the long-term. Thus,

these indirect effects are expected to be beneficial but less than significant, because they are short-term and long-term and localized.

SCUBA/Snorkel Operations

SCUBA/snorkel operations are expected to have a less than significant long-term beneficial effect on sanctuary research and education resources. This is because all projects are designed to gain information about each sanctuary so that managers can better protect sanctuary resources. By undertaking these projects, resources will be better protected, restored, or preserved. Because of this, the socioeconomic environment stands to gain a benefit since many research and education ventures depend on the vitality of the sanctuaries.

Vessel Operations

Vessel operations are expected to have a less than significant long-term beneficial effect on sanctuary research and education resources. Beneficial impacts include educational opportunities, and at sea research, all of which are activities dependent on vessel operations. However, vessel operations are episodic and of low intensity, and few vessels are used to operate in a large area, so the beneficial impact to education and research would not be concentrated in a small area, resulting in expected less than significant beneficial impacts overall. Vessel operations allow sanctuary personnel to be on the water providing direct and indirect less than significant beneficial impact to human uses through education, research and general awareness provided to users so that they may avoid impacts to sanctuary resources and learn more about sanctuary resources through science.

Activities with negligible impacts

Vessel Maintenance

It is estimated that approximately 24 days of vessel maintenance will be required each year to support the ONMS vessels which operate in the SEGOM sanctuaries. Vessel maintenance activities are highly unlikely to have detectable effect on research and education because they are low intensity, episodic and typically conducted pierside or on-land, and therefore would not overlap with areas were research and education activities take place.

Human Use (Fishing, Recreation, Tourism)

Activities with both less than significant beneficial and less than significant adverse impacts

Deployment of Equipment on the Seafloor

The data generated by seabed deployed equipment can increase knowledge of sanctuary resources, leading to better resource management, more public awareness and appreciation, increased safety, improved partnerships between sanctuary managers, users and constituents, and the promotion of public and commercial uses. Thus, the socioeconomic environment stands to indirectly benefit since trade, tourism, recreation, research and commercial ventures depend on

the vitality of the sanctuary. Given the long-term nature of scientific study and sanctuary management these beneficial effects are expected to be less than significant.

Information on the movements of commercially and recreationally important fish species from seabed deployed instrumentation can be used to better manage species and protect their habitat. This may represent a less than significant benefit to fishermen and those associated with the fishing industry as sanctuary partners.

The only possible adverse impact to human uses from seabed deployed instrumentation is the slight possibility of contact with or entanglement in mooring lines. This is expected to be a less than significant effects, because it is very localized and short-term.

Other Sampling

The information gleaned from the use of other sampling operations is expected to advance scientific study and inquiry, create greater awareness and appreciation of sanctuary resources, and promote public and commercial uses. The socioeconomic environment stands to indirectly benefit since trade, tourism, recreation, research and commercial ventures depend on the vitality of the sanctuary. For example, applying digital tags to whales benefits whale watching activities by providing additional information for the on-board naturalists to discuss with their passengers thus enhancing their experience and appreciation for whales, and promoting the whale-watching industry. Given the long-term nature of scientific study and sanctuary resource management these beneficial effects are expected to be less than significant. A less than significant long-term benefit to many users, however, would be the increased knowledge of sanctuary resources that leads to better resource management, more public education and outreach, and improved partnerships between sanctuary managers, users and constituents.

Further, information on the movements of commercially and recreationally important fish species from sampling techniques and tagging can be used to better manage species, protect their habitat and streamline fishing effort. This may represent a less than significant but measurable benefit to fishermen and those associated with the fishing industry as sanctuary partners.

Occasionally, other sampling operations conducted by sanctuary staff and partners may temporarily interfere with the conduct of commercial or recreational activities, but these effects are expected to be less than significant if not negligible, because they are short-term and localized.

Extractive sampling efforts would result in take of less than a fraction of a percent of the total population of species and plants being studied and would not be expected to interfere with other users' ability to legally harvest and/or collect marine species for subsistence or commercial purposes. In addition, much of the material being studied is invasive species, of which, abundance is great.

Activities with less than significant beneficial and negligible impacts

Aircraft Operations

In general, aircraft operations, whether primarily used for species and habitat surveys within sanctuary boundaries, are expected to have a less than significant beneficial effect on the socioeconomic environment resulting in both long-term and short-term benefits. Additional research can lead to better characterization of habitats and species aiding in education and outreach efforts, which aim to increase informed management decisions and policy. Thus, less than significant beneficial, indirect and short and long-term effects are expected to result from aircraft operations.

Aircraft operations are not expected to impact maritime users as no manned aircraft operations occur on or near the ocean. Because most unmanned aerial systems are operated from a vessel and the system remains within eyesight and under the control of the operator at all times, adverse impacts to interactions with human use activities such as fishing (recreational or commercial) and tourism are expected to be negligible.

Deployment of Remote Sensing Equipment

The data generated by remote sensing operations can increase knowledge of sanctuary resources and better characterizations of habitats may lead to better resource management, more public education and outreach, and improved partnerships between sanctuary managers, users and constituents. Given the long-term nature of scientific study and sanctuary management these beneficial effects are considered less than significant.

Further, information on the movements of commercially and recreationally important fish species from remote sensing operations and tagging can be used to better manage species and protect their habitat. This may represent a less than significant benefit to fishermen and those associated with the fishing industry as sanctuary partners.

Occasionally, scientific activities conducted by sanctuaries such as transect surveys may temporarily interfere with the conduct of commercial or recreational activities, but the effect is expected to be short-term and negligible.

Activities with only less than significant beneficial impacts

Non-Motorized Craft

Trained teams aboard sanctuary non-motorized craft stationed at heavily-visited reef sites during peak recreational boating seasons inform recreational boaters about the sanctuary's zones and regulations, encourage proper use of resources and mooring buoys, promote dive flag safety, and promote safe and responsible boating behavior, which is expected to result in better and safer visitor experience. These activities would result in less than significant beneficial impacts.

Vessel Operations

Conducting vessel operations allows sanctuary personnel to be on the water providing direct and indirect less than significant beneficial impact to human uses through enforcing compliance with

sanctuary and other regulations and by providing education and general awareness to other users so that they may avoid impacts to sanctuary resources. In addition, conducting vessel operations allows sanctuary personnel to respond to emergency incidents involving other users.

Activities with only less than significant adverse impacts

SCUBA/Snorkel Operations

SCUBA/snorkel operations are expected to have a less than significant adverse effect on sanctuary users due to the potential for temporary displacement of fishing activity when divers or snorkelers are present conducting sanctuary operations. These effects are less than significant, because they are short-term and localized.

Activities with negligible impacts

Vessel Maintenance

Vessel maintenance activities are highly unlikely to have detectable effect on other human uses because they are low intensity, episodic and typically conducted pier-side or on-land.

Summary of Effects on Socioeconomic Resources

The effects on socioeconomic resources would be predominantly positive and beneficial. The information gained from scientific study and inquiry would create greater awareness and appreciation of sanctuary resources, and promote public and some commercial uses. These advantages would outweigh the short-term adverse effects on socioeconomic activities.

4.1.4 Maritime Heritage and Cultural Environment

Maritime Heritage Resources

Activities with both less than significant beneficial and less than significant adverse impacts

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters in sanctuaries is expected to have a less than significant, long-term beneficial effect on maritime heritage resources, cultural resources and historic properties. All projects are designed to learn more about each sanctuary so that managers can better protect sanctuary resources. By undertaking these projects, the historical environment will be better protected, restored, or preserved. Thus, these resources stand to gain a benefit from these activities.

Deployment of AUV/ROV/gliders/drifters in sanctuaries is expected to have a less than significant adverse effect on maritime heritage resources, cultural resources and historic properties. While intentional or accidental improper operator techniques are possible, trained operators are utilizing assets that are very visible to the public and operators serve as models of

best practices. Thus, these operations are expected to result in less than significant adverse effects.

Deployment of Equipment on the Seafloor

The use of seabed deployed equipment is expected to have an overall positive and beneficial effect on maritime heritage resources in a sanctuary because it helps sanctuary managers locate and document new archaeological sites, and better characterize and monitor these resources.

These operations locate and document new archaeological sites; lead to enhanced resource characterization, protection and management; raise public awareness; prevents anchoring on historic resources; and allow researchers and all interested people to gain a better understanding and appreciation of a sanctuary's maritime archaeological history. Further, the measurement of oceanographic and water quality conditions at an archaeological site aids researchers in developing more efficient field work protocols. Thus, given the nature of archaeological research and documentation these impacts are expected to be less than significant, because they are long-term and localized.

The NHPA mandates that a sanctuary inventory and document historic resources. Consequently, every effort is made to survey areas prior to sampling and to use all available technologies to contribute to the inventory of historic resources. Precautionary measures are taken to avoid disturbance of known historic resources.

A possible adverse impact to maritime heritage resources from seabed deployment of instrumentation is the highly improbable physical impact of the equipment on a heritage resource such as a shipwreck. Maritime archaeological operations are performed by highly skilled and experienced researchers and divers with complete knowledge of NHPA protocols so the possibility of any serious harm to historic artifacts is quite small. Therefore, the effects of these operations are expected to be less than significant, because they are long-term and localized.

Some other benthic sampling activities could potentially occur in the vicinity of historic and cultural resources and may, thus, adversely affect these resources, but as these operations are evaluated in advance for proximity to historic resources on the seafloor, the chance of adverse impacts is remote.

There is also a slight risk in studying and identifying historic and culturally-significant sites as this may lead to looters and memento-seekers carrying off important historic resources, but again the possibility of this is quite small as the great majority of divers respect the historic and culturally significance of these artifacts. Moreover, great care is given to how and when information is made public for newly discovered sites, resulting in less than significant adverse impacts.

Deployment of Remote Sensing Equipment

The effects on historic and cultural resources are expected to be predominantly positive and beneficial. These operations locate and document new archaeological sites; lead to enhanced resource characterization, protection and management; raise public awareness; and allow researchers and all interested people to gain a better understanding and appreciation of a sanctuary's maritime archaeological history. These would be less than significant beneficial impacts.

The use of remote sensing helps sanctuary managers locate and document new archaeological sites, and better characterize and monitor these resources. For example, hydrographic mapping can be used to locate and protect maritime heritage resources, improve understanding of these resources, and allow researchers to better assess the significance of these resources to develop more refined management approaches. Further, the measurement of oceanographic and water quality conditions at an archaeological site aids researchers in developing more efficient field work protocols.

The National Historic Preservation Act mandates that a sanctuary inventory and document historic resources. Consequently, every effort is made to survey areas prior to sampling and to use all available technologies to contribute to the inventory of historic resources. Precautionary measures are taken to avoid disturbance of known historic resources.

There is a remote possibility of adverse impact to maritime heritage resources from remote sensing operations are the highly improbable physical impact of the equipment on a heritage resource such as a shipwreck. There is also a slight risk in studying and identifying historic and culturally-significant sites as this may lead to looters and memento-seekers carrying off important historic resources. As a result, less than significant adverse impacts are expected on maritime heritage resources.

Onshore Fieldwork

Onshore fieldwork that involves resource documentation and monitoring has a less than significant beneficial effect on the study and preservation of historic and maritime heritage sanctuary resources as well as the practice of cultural activities within sanctuary sites. Such activities promote improved understanding and protection of these resources that can lead to enhanced environmental stewardship. All projects are of a short duration and limited scope and are not expected to interfere with cultural resources; instead they serve to characterize better what is in the region. Additionally, these projects are not expected to interfere with historical artifacts that may be found in the region.

During routine fieldwork, great care of taken to avoid historic and cultural resources, therefore during incident response efforts, there is a small likelihood to disturb maritime heritage, historical and/or cultural resources. Staff (ONMS and specialized contract staff) conducting incident response efforts are highly skilled and trained with ONMS best management practices to ensure work is done carefully so as not to unnecessarily harm the surrounding environment. In addition, if these activities are conducted in areas near historic or cultural resources, appropriate experts

(e.g., cultural or archeological) experts are consulted prior to extraction. As a result, less than significant adverse impacts are expected on maritime heritage and cultural resources.

Other Sampling Activities

The use of other sampling activities in a sanctuary has many positive and beneficial effects on maritime heritage resources because they may help sanctuary managers locate and document new archaeological sites, lead to enhanced resource characterization, protection and management; raise public awareness; and allow researchers and all interested people to gain a better understanding and appreciation of a sanctuary's maritime archaeological history. Further, the measurement of oceanographic and water quality conditions at an archaeological site aids researchers in developing more efficient field work protocols.

This process of discovery, documentation, collection and sometimes extraction of artifacts for educational and research purposes are designed to gain knowledge about these sanctuary resources so that managers and partners can work together to better protect and preserve our history. Given the nature of maritime archaeological operations the impacts from these activities are expected to be long-term, localized, and therefore, less than significant.

Some sampling activities could potentially occur in the vicinity of historic and cultural resources and may, thus, adversely affect these resources, but as these operations are evaluated in advance for proximity to historic resources on the seafloor, and are conducted by personnel with experience and knowledge of the protocols laid out in the National Historic Preservation Act, the possibility of any serious harm is expected to be remote.

However, possible but highly unlikely adverse impacts to maritime heritage resources from other sampling operations do exist and include physical impact of the equipment on a shipwreck, anchoring by research vessels, and destruction of historic resources by damaging extraction techniques such as using grabs or corers on the seafloor in close proximity to an artifact. All of these scenarios would be unintentional as every effort would be made to scan the area for historic properties prior to sampling, resulting in less than significant impact.

SCUBA/Snorkel Operations

SCUBA/snorkel operations are expected to have a less than significant beneficial effect on maritime heritage resources, cultural resources and historic properties, because these effects are long-term. All projects are designed to learn more about each sanctuary so that managers can better protect all these resources. By undertaking these projects, historical resources will be better protected, restored, or preserved; thus gaining benefit from these activities. While intentional or accidental improper diving or snorkeling techniques and overuse of specific locations can result in damage to these resources, sanctuary divers and snorkelers are highly trained and will employ ONMS best management practices to avoid improper actions that can cause harm to historical resources. Thus, these operations are expected to result in less than significant adverse effects.

Activities with less than significant beneficial and negligible impacts

Non-Motorized Craft

Non-motorized craft, as described in Chapter 2, are sometimes used to inform boaters about the sanctuary's zones and regulations and encourage proper use of resources and mooring buoys, which can result in beneficial but not significant impacts to maritime heritage and cultural resources by preventing improper and damaging behavior by the public.

Non-motorized craft are expected to have negligible effects on any maritime heritage resources, cultural resources or historic properties because they are lightweight, slow and maneuverable, and therefore able to avoid contact with sensitive historic and cultural resources. Therefore, non-motorized crafts are generally unlikely to have an impact on such resources.

Activities with negligible impacts

Aircraft Operations

Aircraft operations, while infrequent, can aid in the identification or historic and cultural sites within sanctuary boundaries. However, due to the infrequency of flights (less than ten flights per year), the fact that most sanctuary resources are underwater, and the need for specialized equipment to survey marine resources from aircrafts, effects on historic and cultural resources are expected to be negligible.

Vessel Maintenance

Vessel maintenance activities are highly unlikely to have detectable effect on historical or cultural resources uses because they are low intensity, episodic and typically conducted pierside or on-land.

Vessel Operations

Vessel operations are highly unlikely to have a detectable effect on maritime heritage resources, cultural resources or historical properties. Anchoring and unintentional striking or groundings are rare, but may occur. Vessel operations are episodic and of low intensity, and few vessels are used to operate in a large area, so the risk of impact would not be concentrated in a small area. To mitigate potential impacts from anchoring a vessel, fixed moorings are used whenever possible. Vessel operators are highly trained and will employ ONMS best management practices and apply the NOAA Small Boat Program, and follow sanctuary standing orders and procedures as described in Chapter 2 to avoid direct impacts to physical resources as well as maritime heritage or cultural resources. This would result in negligible impacts from vessel operations.

Cultural Resources

Activities with both less than significant beneficial and less than significant adverse impacts

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters in sanctuaries is expected to have a less than significant, long-term beneficial effect on maritime heritage resources, cultural resources and historic properties. All projects are designed to learn more about each sanctuary so that managers can better protect sanctuary resources. By undertaking these projects, the historical environment will be better protected, restored, or preserved. Thus, these resources stand to gain a benefit from these activities.

Deployment of AUV/ROV/gliders/drifters in sanctuaries is expected to have a less than significant adverse effect on maritime heritage resources, cultural resources and historic properties. While intentional or accidental improper operator techniques are possible, trained operators are utilizing assets that are very visible to the public and operators serve as models of best practices. Thus, these operations are expected to result in less than significant adverse effects.

Onshore Fieldwork

Onshore fieldwork that involves resource documentation and monitoring has a less than significant beneficial effect on the study and preservation of historic and maritime heritage sanctuary resources as well as the practice of cultural activities within sanctuary sites. Such activities promote improved understanding and protection of these resources that can lead to enhanced environmental stewardship. All projects are of a short duration and limited scope and are not expected to interfere with cultural resources; instead they serve to characterize better what is in the region. Additionally, these projects are not expected to interfere with historical artifacts that may be found in the region.

In addition, in many locations, cultural beliefs, traditions, and practices provide a foundational context in which sanctuary activities function. As a result, local and traditional knowledge is utilized to further protect cultural sanctuary resources, which leads to more culturally sensitive management of cultural resources and practices, and therefore is expected to provide a less than significant beneficial impact to cultural resources.

During routine fieldwork, great care of taken to avoid historic and cultural resources, therefore during incident response efforts, there is a small likelihood to disturb maritime heritage, historical and/or cultural resources. Staff (ONMS and specialized contract staff) conducting incident response efforts are highly skilled and trained with ONMS best management practices to ensure work is done carefully so as not to unnecessarily harm the surrounding environment. In addition, if these activities are conducted in areas near historic or cultural resources, appropriate experts (e.g., cultural or archeological) experts are consulted prior to extraction. As a result, less than significant adverse impacts are expected on maritime heritage and cultural resources.

SCUBA/Snorkel Operations

SCUBA/snorkel operations are expected to have a less than significant beneficial effect on maritime heritage resources, cultural resources and historic properties, because these effects are long-term. All projects are designed to learn more about each sanctuary so that managers can

better protect all these resources. By undertaking these projects, historical resources will be better protected, restored, or preserved; thus gaining benefit from these activities. While intentional or accidental improper diving or snorkeling techniques and overuse of specific locations can result in damage to these resources, sanctuary divers and snorkelers are highly trained and will employ ONMS best management practices to avoid improper actions that can cause harm to historical resources. Thus, these operations are expected to result in less than significant adverse effects.

Activities with less than significant beneficial and negligible impacts

Non-Motorized Craft

Non-motorized craft, as described in Chapter 2, are sometimes used to inform boaters about the sanctuary's zones and regulations and encourage proper use of resources and mooring buoys, which can result in beneficial but not significant impacts to maritime heritage and cultural resources by preventing improper and damaging behavior by the public.

Non-motorized craft are expected to have negligible effects on any maritime heritage resources, cultural resources or historic properties because they are lightweight, slow and maneuverable, and therefore able to avoid contact with sensitive historic and cultural resources. Therefore, non-motorized crafts are generally unlikely to have an impact on such resources.

Activities with negligible impacts

Aircraft Operations

Aircraft operations, while infrequent, can aid in the identification or historic and cultural sites within sanctuary boundaries. However, due to the infrequency of flights (less than ten flights per year), the fact that most sanctuary resources are underwater, and the need for specialized equipment to survey marine resources from aircrafts, effects on historic and cultural resources are expected to be negligible.

Deployment of Remote Sensing Equipment

Some remote sensing operations will have no or negligible effect on maritime heritage and cultural resources as they usually will not come in contact with these resources at all.

Vessel Maintenance

Vessel maintenance activities are highly unlikely to have detectable effect on historical or cultural resources uses because they are low intensity, episodic and typically conducted pier-side or on-land.

Vessel Operations

Vessel operations are highly unlikely to have a detectable effect on maritime heritage resources, cultural resources or historical properties. Anchoring and unintentional striking or groundings are rare, but may occur. Vessel operations are episodic and of low intensity, and few vessels are used

to operate in a large area, so the risk of impact would not be concentrated in a small area. To mitigate potential impacts from anchoring a vessel, fixed moorings are used whenever possible. Vessel operators are highly trained and will employ ONMS best management practices and apply the NOAA Small Boat Program, and follow sanctuary standing orders and procedures as described in Chapter 2 to avoid direct impacts to physical resources as well as maritime heritage or cultural resources.

Summary of Effects on Maritime Heritage and Cultural Resources

The effects on maritime heritage and cultural resources would be predominantly less than significant and beneficial. These field operations locate and document new archaeological sites; lead to enhanced resource characterization, protection and management; raise public awareness; and allow researchers and all interested people to gain a better understanding and appreciation of a sanctuary's maritime archaeological history, all of which are beneficial effects to historic and cultural resources. Precautionary measures are taken to avoid disturbance of known historic resources.

4.2 Alternative 2: Conduct Field Operations without Voluntary and Precautionary Procedures for Vessel Operations

The environmental consequences of Alternative 2 would be very similar to those of Alternative 1 because the majority of field operations would be identical between the two alternatives. Vessel operations in all three sanctuaries would be slightly different in Alternative 2. Current ONMS vessel operations best management practices would be discontinued.

4.2.1 Biological Environment

Sanctuary vessel best management practices, as described in Chapter 2, focus on reducing potential impacts to marine mammals and other federally-listed species from vessel strikes as well as on reducing the risk of introducing invasive species. Therefore, discontinuing these best management practices is expected to have an effect on habitat, invertebrates, birds, and protected species.

Habitat

In the sanctuaries and surrounding waters, operating without following the best management practices could result in the introduction of invasive species or diseases, which could have an indirect, less than significant adverse impact specifically on the coral reef habitat by altering the current balance of species creating that habitat.

Invertebrates

In the sanctuaries and surrounding waters, operating without following the best management practices could result in the introduction of invasive species or diseases, which could have an

indirect, less than significant adverse impact specifically on the coral species as well as other invertebrate species by altering the current balance of invertebrate species in the coral ecosystem.

Birds

In the sanctuaries and surrounding waters, operating without following the best management practices could result in vessel strikes or behavioral disturbance of seabirds, as the vessels would operate a higher speeds and would not have a dedicated observer on board to reduce the risk of collision. A collision or disturbance would likely only affect an individual bird and not a bird colony, since it would occur on the water and not on land, reducing the impact to bird communities as a whole. Therefore, this could have a direct, less than significant adverse impact on seabirds.

Protected Species

In the sanctuaries and surrounding waters, operating without following the best management practices could result in vessel strikes or behavioral disturbance of marine mammals and turtles, as the vessels would operate a higher speeds and would not have a dedicated observer on board to reduce the risk of collision. This could therefore have a direct, less than significant adverse impact on protected species.

4.4 Cumulative Impacts

The cumulative effect of the proposed action is the incremental environmental effect that the proposed action has when added to other past, present, and foreseeable future actions in the affected environment. Cumulative effects are critical to explore because it is often the combined effect of many actions in one area or region that causes the most significant adverse impacts. ONMS reviewed the projects identified under the proposed action as causing any beneficial or adverse effects on resources in order to identify potential cumulative issues.

Categories of field operations with some potential to contribute to cumulative effects include those that could result in seafloor disturbance and/or noise pollution, those that include vessel operations, and those aimed at resource protection. These effects are described below. The three alternatives analyzed in this document are very similar, with differences pertaining mainly to small changes in best management practices and agency recommendations for vessel operations. When compared to the much broader scale of impacts contemplated in a cumulative impacts assessment, the differences between the alternatives would not be discernable. Organizing this section by alternative, as is commonly done, would be unnecessarily repetitive. Therefore, the cumulative impacts described below are intended to apply to the three alternatives presented in this document.

4.4.1 Cumulative Effects on Physical Environment

Field operations that could result in disturbance to the physical environment include:

- Deployment of equipment on the seafloor
- Vessel Operations
- SCUBA and Snorkel Operations
- Other Sampling Activities
- Aircraft Operations
- Deployment of Remote Sensing Equipment

The following sanctuary-directed scientific activities could contribute adversely to the cumulative effects of seafloor disturbance: deploying moored buoys, obtaining benthic samples, anchoring research vessels, and exploring shipwrecks and archaeological artifacts. These activities are likely to all result in minor, short-term disturbance of the seafloor. In addition to these sanctuary-directed activities, there are a host of other external activities that when combined with the sanctuary-directed activities may have cumulative effects on the seafloor. The principal external activity that disturbs the seafloor is commercial fishing (e.g. trawling, dredging, gillnetting, lobster trapping), except in GRNMS where commercial fishing is prohibited. Anchoring is not a prevalent activity either by external activities or by sanctuary activities due prohibition and/or availability of mooring buoys, with the exception of FKNMS where small sanctuary vessels (mostly outboards) anchor about 250 times/year. Compared to the large-scale, long-term effects of commercial fishing, the sanctuary-directed activities mentioned above are minor, short-term, and affect a very small area, and thus are not expected to contribute significantly to overall cumulative effects on the seafloor. More detail on each activity can be found in Table 5 in Chapter 2.

The following sanctuary-directed scientific activities could contribute adversely to the cumulative effects of noise pollution: operating research vessels to conduct surveys and transects; the transiting of a research vessel; and deploying shipboard sonar, AUVs/ROVs and towed arrays to survey habitats and biological activity. In addition to these sanctuary-directed activities, there are a host of other external activities that when combined with the sanctuary-directed activities may have cumulative effects on noise pollution. The principal external activities that contribute to noise pollution are commercial shipping, energy exploration and development, military operations and fishing. Compared to the large-scale, chronic effects of commercial shipping, the sanctuary-directed sources of noise are minor, short-term, and have a small footprint and thus are not expected to contribute significantly to overall cumulative effects of noise pollution. More detail on each activity can be found in Table 5 in Chapter 2.

4.4.2 Cumulative Effects on Biological Environment

Field operations that could result in disturbance to the biological environment include:

- Deployment of equipment on the seafloor

- Vessel Operations
- SCUBA and Snorkel Operations
- Other Sampling Activities
- Aircraft Operations
- Deployment of AUVs/ROVs
- Deployment of Remote Sensing Equipment

The following sanctuary-directed scientific activities could contribute adversely to the cumulative effects of living marine resource disturbance such as striking whales: operating research vessels and SCUBA dives to conduct surveys and transects; transiting of a research vessel; deploying AUVs/ROVs and towed arrays to survey or map habitats and archeological artifacts, or to measure biomass or biological activity. In addition to these sanctuary-directed activities, there are a host of other external activities that when combined with the sanctuary-directed activities may have cumulative effects on water quality or living marine resources. The principal external activities that contribute to the effects from vessel operations are commercial shipping, fishing, wildlife watching, and recreational boating. Compared to the considerable level of external (i.e., non-sanctuary related) vessel operations and the fact that sanctuary-directed vessel operations are speed-restricted, conducted by highly trained personnel, and prohibit wastewater discharge, the sanctuary-directed vessel operations are minor and highly regulated and thus are not expected to contribute significantly to overall cumulative effects on biological resources.

The proposed action would not result in significant cumulative adverse impacts on biological resources. Other external activities that contribute to marine resource protection are other NOAA research, research conducted by local non-profits, cooperative fishery research sponsored by NOAA, and research conducted by academic institutions. Given that these marine resource protection activities are intended to improve the health of species and ecosystems through improved understanding and knowledge, and that these activities are conducted in a precautionary manner by highly trained professionals, it is highly unlikely that the cumulative effect of these activities would be adverse.

4.4.3 Cumulative Effects on Socioeconomic Environment

The field operations analyzed in this environmental assessment are expected to result in overall direct and less than significant beneficial impact to the socioeconomic environment throughout the SEGOM. Continued marine protection and enforcement capacity would result in a healthy marine ecosystem, which in turn provides a socioeconomic benefit to all marine users. Other commercial and recreational operations that are external to ONMS field operations and occur in the surrounding marine environments may result in a long-term adverse impact the socioeconomic environment, however, ONMS field operations and other local government

agency efforts to manage and protect the marine environment aim to balance the use and impact to marine resources through continued conservation efforts and a mere presence at sea. As discussed above, the preferred alternative operations are not expected to significantly contribute to any adverse cumulative effects on the socioeconomic environment and would further protect marine resources from overuse by recreational and commercial users.

4.4.4 Cumulative Effects on Maritime Heritage and Cultural Environment

None of the field operations analyzed in this environmental assessment are expected to result in disturbance to the maritime heritage and cultural environment; however, it is possible that accidental or improper physical contact with an historic artifact could occur as a result of these activities. This is highly unlikely as ONMS divers and snorkelers are highly trained and will employ ONMS best management practices to avoid actions that can cause harm to historic resources. In addition, maritime archaeological operations are performed by highly skilled and experienced researchers and divers with complete knowledge of NHPA protocols so the possibility of any serious harm to historic artifacts is quite small. With operations not affiliated with ONMS field operations there is a slight risk of impact to cultural or maritime heritage resources due to improper handling or contact with resources. All of the effects to the maritime heritage and cultural environment would thus be either negligible or less than significant beneficial to the protection and management of sanctuary resources. As such, the preferred alternative operations are not expected to tangibly contribute to any cumulative effects on the maritime heritage and cultural environment.

4.5 Conclusions

Alternative 1 (No Action/Status Quo field operations with additional required mitigations resulting from consultations and permits) has overall beneficial effects to the environment as managers gain more information and take actions to better protect resources; the public becomes more educated about sanctuary resources; and damaged resources are restored. While there are some adverse effects associated with this alternative, these effects are not expected to be significant and are short-term. Through the consultation and permitting process, NOAA would gain a better understanding of any additional beneficial effects or operational costs associated with the required mitigation. However, it is intended that any additional required mitigation would further reduce potential adverse effects on protected resources such as marine mammals and threatened and endangered species.

In comparison, Alternative 2 would still yield beneficial effects to the environment, but would have more potential risk for adverse effects to protected resources and habitat.

Table 9. Summary of Anticipated Effects of Status Quo Alternative to Conduct Field Operations in the Southeast and Gulf of Mexico Region

Legend		Effects Across Resource Categories
Ø	Not applicable	

~ Negligible				
+ Less than significant, beneficial				
- Less than significant, adverse				
Categories of Field Operations	**Physical**	**Biological**	**Socioeconomic**	**Historic and Cultural**
Vessel Operations Projects	~/-	+/-	+	~
Vessel Maintenance	~/-	~	~	~
Aircraft Operations	Ø	Ø	Ø	Ø
Non-Motorized Craft	Ø	Ø	Ø	Ø
SCUBA or Snorkel Operations	~	+/-	≈	+/-
Onshore Fieldwork	Ø	Ø	Ø	Ø
Deployment of AUVs/ROVs	~/-	+/-	+	+/-
Deployment of Remote Sensing Equipment	~/+/-	~/+/-	~/+/-	~/+/-
Deployment of Equipment on the Seafloor	~/+/-	~/+/-	~/+/-	~/+/-
Other Sampling Activities	~/+/-	~/+/-	~/+/-	~/+/-

Table 10. Summary of Effects by Resource Element and Alternative

	Alternative 1	**Alternative 2**
RESOURCE ELEMENTS		
Physical Environment		
Geology	Activities have both less than significant adverse and less than significant beneficial impacts (onshore fieldwork, deployment of equipment on the seafloor, deployment of remote sensing equipment, other sampling activities). One activity has only less than significant adverse impacts (vessel operations). Justification: Adverse impacts caused by onshore marine debris removal activities, seafloor disturbance from deployment activities, anchoring, unintentional groundings, and other sampling activities are expected to be short-term, of low intensity, and localized. Temporary buoys are less than 10lbs and are designed for quick release to prevent damage to habitat. Anchor damage would be minimized by	Similar to Alternative 1

	BMPs, requiring users to avoid sensitive areas, & would be small scale. The benefits of removing marine debris and grounded vessels is short-term and localized. Increased understanding of sanctuary resources may aid in the development of education and outreach materials and indirectly increase protection and management of resources, but these benefits are limited in scope.	
Water Quality	Activities have less than significant adverse impacts (onshore fieldwork, vessel operations). Justification: Impacts caused by emissions from vessel operations and onshore fieldwork are expected to be short-term and of low intensity. The risk of fuel, lubricant, sewage and garbage spills is low because state and federal regulations prohibit most discharges. ONMS vessel operators are trained to follow the NOAA Small Boat Program mandates and BMPs to avoid impacts; removal efforts are conducted by experienced ONMS staff when necessary.	Similar to Alternative 1
Air Quality	Activities have less than significant adverse impacts (aircraft operations, vessel operations). Justification: The adverse impacts caused by vessel and aircraft emissions are expected to be short-term and of low intensity. Large vessels have EPA Tier 3-compliant diesel engines and small vessels have four stroke and low emission motors. Thus, they contribute only a small about of emissions relative to other activities.	Similar to Alternative 1
Acoustics	Activities have less than significant adverse impacts (aircraft operations, deployment of AUV/ROV/gliders/drifters, deployment of equipment on the seafloor, deployment of remote sensing equipment, other sampling activities, vessel operations). Justification: Noise disturbance from activities is expected to be short-term and of low intensity. We do not know how loud the sound scape is currently, but we believe the contribution of these activities is small relative to the whole.	Similar to Alternative 1
Biological Environment		
Habitat	Activities have both less than significant adverse and less than significant beneficial impacts (onshore fieldwork, aircraft operations, deployment of AUV/ROV/gliders/drifters, deployment of equipment on the seafloor, deployment of remote sensing equipment, other sampling activities, SCUBA/snorkel operations). One activity has only less than significant beneficial impacts (non-motorized craft). One activity only has less than significant adverse impacts (vessel operations).	Same as Alternative 1, but there will be an additional indirect, less than significant adverse impact on coral reef habitat due to the discontinuation of current vessel procedures. Operating without best management practices could increase the likelihood of introducing

	Justification: Adverse impacts from removal of debris during fieldwork, anchoring, other sampling activities, unintentionally grounding vessels, deployment of equipment, and diving are expected to be short-term, localized and limited in scope. Training and BMPs teach users to avoid harm to habitat and inform users how to avoid improper operation of equipment. Temporary buoys are less than 10lbs and designed for quick release to prevent damage to habitat. Non-motorized craft help inform the public of regulations and proper use of resources, and provide an assessment of injury to resources. Characterization of habitat leads to the formation of management plans to address environmental changes. However, benefits are localized and limited in scope.	invasive species. These invasive species could alter existing coral reef habitat. However, harm will be limited in scope.
Invertebrates	Activities have both less than significant adverse and less than significant beneficial impacts (onshore fieldwork, aircraft operations, deployment of AUV/ROV/gliders/drifters, deployment of equipment on the seafloor, deployment of remote sensing equipment, other sampling activities, SCUBA/snorkel operations, vessel operations). Justification: Indirect adverse impacts (e.g., temporary behavior modification), are expected to be short-term and localized. Injury or mortality are expected to be minimal due to the limited scope and transitory nature of activities. ONMS divers and snorkelers are trained to avoid harm to resources and avoid over collection. Temporary displacement from vessel movement is expected to be short-term and localized. Users are trained using BMPs to anchor in sandy areas where the density of invertebrates is low. Characterizing species movements will improve species management and habitat protection, but both will be limited in scope.	Same as Alternative 1, but there will be an additional indirect, less than significant adverse impact due to the discontinuation of current vessel procedures. Vessels would no longer be required to be free of biofouling or not be transporting any live organisms. This would increase the likelihood of introducing invasive species or disease. These invasive species may impact coral and other invertebrate species. However, harm will be limited in scope.
Fish	Activities have both less than significant adverse and less than significant beneficial impacts (onshore fieldwork, aircraft operations, deployment of AUV/ROV/gliders/drifters, deployment of equipment on the seafloor, deployment of remote sensing equipment, other sampling activities). Some activities have less than significant beneficial impacts (SCUBA/snorkel operations, vessel operations). Justification: Adverse impacts, like temporary behavior modification, direct contact with gear, and tagging are expected to be short-term and localized. Characterizing species movements will improve species management and habitat protection, but benefits will be limited in scope.	Same as Alternative 1, but there will be an additional indirect, less than significant adverse impact due to the discontinuation of current vessel procedures. With no BMPs, the impact on fish will be the same as Alternative 1 or worse. However, harm will be limited in scope.
Birds	Activities have both less than significant adverse impacts and less than significant beneficial impacts (onshore fieldwork, aircraft operations, deployment of AUV/ROV/gliders/drifters, deployment of equipment on the seafloor, other sampling activities, vessel operations).	Same as Alternative 1, but there will be an additional direct, less than significant adverse impact due to increased collisions and

	Some activities have less than significant beneficial impacts (deployment of remote sensing equipment, SCUBA/snorkel operations). Justification: Adverse impacts, like temporary behavior modification or displacement from the presence of vessels and aircraft or onshore fieldwork, are expected to be short-term and localized. Direct collisions with aircraft are expected to unlikely because aircraft operate above 200 feet in elevation. Injury from sampling is expected to be temporary. Research will aid in management of species, but will be limited in scope.	disturbance due to the discontinuation of current vessel procedures. Collision or disturbance by vessels would likely only affect an individual bird or bird colony. Thus, the impact is not significant.
Protected Species	Activities have both less than significant adverse and less than significant beneficial impacts (onshore fieldwork, aircraft operations, deployment of AUV/ROV/gliders/drifters, deployment of equipment on the seafloor, deployment of remote sensing equipment, non-motorized craft, other sampling activities, vessel operations). One activity has only less than significant beneficial impacts (SCUBA/snorkel operations). One activity has only less than significant adverse impacts (use of acoustic equipment). Justification: Adverse impacts (e.g., behavior modification from AUV/ROV/gliders/drifters, equipment deployed on the seafloor, and onshore activities), are expected to be short-term and localized. ROV entanglement is unlikely due to the presence of observers on deck to avoid contact with species and the small duration of operations. Impacts from vessel operations are minimized through the use of small, maneuverable vessels that have shallow draft. Larger vessels move slower and implement BMPs which require an observer to be on deck, conduct activities during daylight hours, and use multibeam systems that use focused sonar arrays and emit short pulses at limited ping rates. The sonar used is outside of the hearing range of low-frequency sensitive turtles in the area and is outside the range of local mid to high frequency cetaceans. Sonar is turned off when marine mammals are within 1nm of the vessel. In FKNMS, sonar is turned off when manatees are spotted and important habitats are avoided. Non-motorized craft will inform the public of regulations and proper use of resources, and provide an assessment of injury to resources. Equipment will monitor marine mammal behavior and may lead to management plans to reduce human impacts. Disentanglements provide direct benefits to species and indirect benefits from increased public attention and education. However, benefits will be short-term and limited in scope.	Same as Alternative 1, but there will be an additional direct, less than significant adverse impact due to increased collisions and disturbance due to the discontinuation of current vessel procedures. Harm is expected to be limited in scope.
Socioeconomic Environment		

Maritime Transportation	Activities have less than significant beneficial impacts (deployment of remote sensing equipment, deployment of equipment on the seafloor, aircraft operations). One activity has both less than significant adverse and less than significant beneficial impacts (other sampling activities). One activity has only less than significant beneficial benefits (aircraft operations). Justification: May temporarily interfere with the conduct of commercial or recreational activities, but these effects are expected to be short-term, localized and less than significant if not negligible. Limited scope of benefits; assist in navigation and prevent groundings, but will only incrementally add to body of bathymetry knowledge and network of navigation buoys already in place.	Similar to Alternative 1
Research and Education	Activities have less than significant beneficial impacts (aircraft operations, deployment of AUV/ROV/gliders/drifters, onshore fieldwork, SCUBA/snorkel operations, vessel operations). Some activities have less than significant adverse or negligible and less than significant beneficial impacts (other sampling activities, deployment of equipment on the seafloor, deployment of remote sensing equipment). Justification: Temporary interference of commercial or recreational activities is expected to be short-term and localized. Increased awareness & appreciation of sanctuary resources. Characterization of resources will aid management and research and monitoring will help avoid impacts on seabirds by fishermen. Beneficial impacts are short-term and limited in scope. Activities will only incrementally add to opportunities for research in the sanctuaries.	Similar to Alternative 1
Human Uses	Activities have less than significant beneficial impacts (aircraft operations, deployment of remote sensing equipment, non-motorized craft, vessel operations). Some activities have both less than significant adverse and less than significant beneficial impacts (deployment of equipment on the seafloor, other sampling activities). One activity has less than significant adverse impacts (SCUBA/snorkel operations). Justification: Temporary interference of commercial or recreational activities is expected to be short-term and localized. Benefits include enforcing compliance with regulations, increasing education and awareness, promoting safety, and avoiding harm to sanctuary resources. Characterizing movements of species will benefit commercial and recreational businesses, improve species management and habitat protection, and increase appreciation for sanctuary resources. Benefits are limited in scope.	Similar to Alternative 1

Maritime Heritage and Cultural Environment		
Maritime Heritage Resources	Activities have both less than significant adverse and less than significant beneficial impacts (deployment of AUV/ROV/gliders/drifters, deployment of equipment on the seafloor, deployment of remote sensing equipment, onshore fieldwork, other sampling activities, SCUBA/snorkel operations). One activity has less than significant beneficial impacts (non-motorized craft). Justification: Adverse effects, including disturbance of and damage to known historic and cultural resources, will be mitigated through the application of precautionary measures. These include not divulging information on the location of newly discovered sites. ONMS staff performing research will be trained to employ NHPA protocols that describe how to avoid harm to historic artifacts. Resource characterization and monitoring will aid in protection and management of artifacts, raise public awareness, and increase understanding and appreciation of sanctuary resources. Non-motorized craft help inform the public of regulations and proper use of resources. However, benefits are short-term and limited in scope.	Similar to Alternative 1
Cultural and Historic Resources	Activities have both less than significant adverse and less than significant beneficial impacts (deployment of AUV/ROV/gliders/drifters, onshore fieldwork, SCUBA/ snorkel operations). One activity has only less than significant beneficial impacts (non-motorized craft). Justification: There is a small likelihood of disturbance to resources because staff are trained prior to underwater survey work to minimize their impact. Activities are localized and limited in scope. Benefits include the use of traditional knowledge to ensure culturally sensitive management of resources and informing the public of regulations. Beneficial impacts from locating and documenting new archaeological sites will indirectly lead to enhanced resource characterization, protection and management. These activities will also help raise public awareness, understanding, and appreciation of maritime archaeological history. Benefits are short-term and limited in scope.	Similar to Alternative 1

5.0

CONSULTATIONS

5.1 Magnuson-Stevens Act

In 1976, Congress passed the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801, et seq.). The MSA fosters long-term biological and economic sustainability of the nation's marine fisheries out to 200 nautical miles from shore. Key objectives of the MSA are to prevent overfishing, rebuild overfished stocks, increase long-term economic and social benefits, and ensure a safe and sustainable supply of seafood. Two of the main purposes of the MSA (16 U.S.C. §§ 1801, et seq.) 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.

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. ONMS will use this draft PEA to consult with the Southeast Region EFH Coordinator to assess the impacts of

ONMS field operations on EFH. The EFH assessment submitted to NMFS is below. NMFS concurred with the general concurrence.

5.1.1 Essential Fish Habitat Assessment

Introduction

The consultation requirements of §305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA; 15 U.S.C. 1855(b)) provide that:

- federal agencies must consult with the Secretary on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect essential fish habitat (EFH);
- the Secretary shall provide recommendations (which may include measures to avoid, minimize, mitigate, or otherwise offset adverse effects on EFH) to conserve EFH to federal or state agencies for activities that would adversely affect EFH;
- the federal action agency must provide a detailed response in writing to the National Marine Fisheries Service (NOAA Fisheries) and to any Council commenting under §305(b)(3) of the MSA within 30 days after receiving an EFH Conservation Recommendation.

Program Description

The Programmatic Environmental Assessment of Field Operations in the Southeast and Gulf of Mexico National Marine Sanctuaries developed by NOAA's ONMS describes current and ongoing activities for research and management in three sites: Gray's Reef National Marine Sanctuary, Florida Keys National Marine Sanctuary, and Flower Garden Banks National Marine Sanctuary.

Section 2 of this document, the *Description of Proposed Action and Alternatives*, describes the activities ONMS undertakes as part of its field operations in these sites.

Essential Fish Habitat in the Region

Gray's Reef National Marine Sanctuary, Flower Garden Banks National Marine Sanctuary and Florida Keys National Marine Sanctuary overlap with EFH in the South Atlantic and Gulf of Mexico for Red Drum, Reef Fish (Snapper/Grouper Fishery Management Unit), Coastal Migratory Pelagics, Shrimp, Stone Crab, Spiny Lobster and Coral. A complete description of the EFH designations and the criteria used to determine them is available in the Gulf of Mexico Fishery Management Council's *Final Gulf Council EFH Amendment* (March 2005) and in the South Atlantic Fishery Management Council's *Habitat Plan*.

- Red Drum EFH: all estuaries, including Vermilion Bay, Louisiana, to the eastern edge of Mobile Bay, Alabama; Crystal River, Florida, to Naples, Florida, and Cape Sable,

Florida; and mangroves, unconsolidated sediments and artificial reefs up the east coast of the southeastern U.S. to the boundary between the areas covered by the SAFMC and the Mid Atlantic Fishery Management Council (MAFMC). In addition to all estuaries, this includes: tidal freshwater (palustrine), marine emergent wetlands (e.g., intertidal marshes), estuarine scrub/shrub (mangroves and mangrove fringe), marine submerged aquatic vegetation (e.g., seagrass), oyster reefs and shell banks, unconsolidated bottom, ocean high salinity surf zones, and artificial reefs.

- Reef Fish and Coastal Migratory Pelagics EFH: all estuaries; the US/Mexico border to the boundary between the areas covered by the SAFMC and the MAFMC from estuarine waters out to depths of 100 fathoms.

- Snapper grouper EFH: Estuarine and marine emergent wetlands (e.g., intertidal marshes), estuarine scrub/shrub (mangroves and mangrove fringe), estuarine and marine submerged aquatic vegetation (e.g., seagrass), oyster reefs and shell banks, unconsolidated bottom, Gulf stream, artificial reefs, coral reefs, live/hard bottom, medium to high profile outcroppings on and around the shelf break zone from shore to at least 600 feet (but to at least 2000 feet for wreckfish) where the annual water temperature range is sufficiently warm to maintain adult populations of members of this largely tropical complex, spawning area in the water column above the adult habitat and the additional pelagic environment, including *Sargassum*.

- Shrimp EFH: all estuaries; the US/Mexico border to the boundary between the areas covered by the SAFMC and the MAFMC including offshore marine habitats used for spawning and growth to maturity. In addition to all estuaries, this includes: tidal freshwater (palustrine), marine emergent wetlands (e.g., intertidal marshes), tidal palustrine forested areas, marine submerged aquatic vegetation (e.g., seagrass), subtidal and intertidal non-vegetated flats, off-shore marine habitats used for spawning and growth to maturity, all interconnecting water bodies, offshore terrigenous and biogenic sand bottom habitats from 18-182 meters, shelf current systems near Cape Canaveral Florida, Gulf stream, Upper regions of the continental slope from 180 meters (590 feet) to about 730 meters (2,395 feet) over blue/black mud, sand, muddy sand, or white calcareous mud.

- Golden crab EFH: Gulf stream and U.S. Continental Shelf from Chesapeake Bay south through the Florida Straits (and into the Gulf of Mexico).

- Spiny Lobster EFH: from Tarpon Springs, Florida, to Naples, Florida, between depths of 5 and 10 fathoms; and Cape Sable, Florida, to the boundary between the areas covered by the GMFMC and the SAFMC out to depths of 15 fathoms. In the South Atlantic, EFH includes estuarine scrub/shrub (mangroves and mangrove fringe), estuarine and marine submerged aquatic vegetation (e.g., seagrass), the Gulf Stream, coral reefs and live

bottom reefs, nearshore shelf/oceanic waters, shallow subtidal bottom, sponges, algal communities (Laurencia), and Gulf stream.

- Coral EFH: the total distribution of coral species and life stages throughout the Gulf of Mexico and South Atlantic including: coral reefs in the North and South Tortugas Ecological Reserves, East and West Flower Garden Banks, McGrail Bank, and the southern portion of Pulley Ridge; hard bottom areas scattered along the pinnacles and banks from Texas to Mississippi, at the shelf edge and at the Florida Middle Grounds, the southwest tip of the Florida reef tract, and predominant patchy hard bottom offshore of Florida from approximately Crystal River south to and including the Florida Keys. Coral and live bottom areas of SAFMC jurisdiction, including The Ten-Fathom Ledge, Big Rock, and The Point; Hurl Rocks and The Charleston Bump; Gray's Reef National Marine Sanctuary; the Phragmatopoma (worm reefs) reefs off the central east coast of Florida; nearshore (0-4 meters; 0-12 feet) hard bottom off the east coast of Florida from Cape Canaveral to Broward County); offshore (5-30 meter; 15-90 feet) hard bottom off the east coast of Florida from Palm Beach County to Fowey Rocks; Biscayne Bay, Florida; Biscayne National Park, Florida; and the Florida Keys National Marine Sanctuary, Oculina Banks off the east coast of Florida from Ft. Pierce to Cape Canaveral.

- Coastal migratory pelagic EFH: sandy shoals of capes and offshore bars, High profile rocky bottom and barrier island ocean-side waters, from the surf to the shelf break zone, but from the Gulf stream shoreward, including *Sargassum*, all coastal inlets, all state-designated nursery habitats of particular importance (for example, in North Carolina this would include all Primary Nursery Areas and all Secondary Nursery Areas), high salinity bays, estuaries, and seagrass habitat.

- Dolphin wahoo EFH: Gulf stream, Charleston Gyre, Florida current, and pelagic *Sargassum*.

Assessment of Effects on Essential Fish Habitat

NOAA Fisheries' Office of Habitat Conservation has identified the following ONMS activities as those that may adversely affect Essential Fish Habitat (all activities are described in detail in Section 2, the Description of Proposed Action and Alternative, of the Environmental Assessment).

General ONMS Field Operations across the Southeast and Gulf of Mexico Region:

- Vessel operations
    - Potential impacts may include anchor damage and risk of vessel grounding, which may adversely affect bottom habitat. Pollutant discharge from vessels may adversely affect pelagic habitat in the water column.

- SCUBA or snorkel operations

  - Potential impacts may include divers kicking bottom, which may adversely affect bottom habitat. Diving gear acting as vectors for invasive species spread may adversely affect both bottom habitat and pelagic habitat.

- Deployment of AUVs/ROVs/Gliders/Drifters
  - Potential impacts may include unintentional contact with coral on bottom and grounding risk from either the survey equipment or the main vessel from which it is deployed.
- Deployment of Equipment on the Seafloor (e.g., buoys; instrumentation; permanent anchors)
  - Potential impacts may include contact with coral or seagrass on bottom during installation of such equipment or in the event that such equipment breaks free from its moorings.
- Other Sampling Activities

Specific Projects in Gray's Reef National Marine Sanctuary:

- Gliders and ROVs are occasionally (once a year or less) deployed at GRNMS.

Specific Projects in Florida Keys National Marine Sanctuary:

- ROVs and AUVs are deployed an estimated 10-15 times per year at FKNMS.

Specific Projects in Flower Garden Banks National Marine Sanctuary:

- ROVs are deployed annually during monitoring and characterization surveys at FGBNMS.

Proposed Mitigation Measures

Great care is taken to avoid bottom contact with survey vehicles, as such contact has the potential to damage the vehicle and the habitat. ONMS staff and contractors follow a set of best management practices (BMP) to minimize any potential damage to bottom habitat or the water column to the greatest extent possible. Across all three sites in the region, managers limit activities in accordance with the following BMPs:

- Operation of vessels during daylight hours
  - Due to the increased risk of collision at night, all vessel operations should take place between ½ hour before sunrise and ½ hour after sunset.
- Operation of vessels during night hours

- Standing Order for Nighttime Operations – This order encourages that all operations occur during daylight; however, if operations are essential and integral to the mission the principal investigator must discuss mitigations for avoiding whales and other objects within the vessel operation corridor and incorporate them into the cruise plan.
- If night operations need to occur, the most experienced operator should take the helm, the speed should not exceed 15 knots, a minimum of two lookouts should be posted, and the operator should use all means to enhance visibility (e.g., spotlights, electronics, night vision, FLIR, etc.).

- Anchoring and deployment of instruments
  - Anchoring will be limited to sandy-bottom substrates to avoid damage to seagrasses and coral habitat.
  - Limit interaction with *Sargassum* as much as is reasonable feasible, to prevent impact on sea turtle hatchling habitat.
  - Instruments are deployed and lowered onto sandy substrate whenever possible; deployment of instruments occurs slowly and under constant supervision to minimize risk and mitigate impacts if a collision or entanglement occurs; and while vehicles or personnel are deployed, spotters monitor the activities at all times.
- Safety
  - Safety Briefings: The vessel captain includes information on managed species and their essential habitats during pre-cruise briefings for staff and volunteers.
  - All divers working on ONMS vessels are NOAA certified.

Conclusion

ONMS expects the adverse effects on EFH from the field operations described above to be minimal. This conclusion is based on the relatively small number of days at sea, divers and equipment deployments conducted annually, as well as the rigorous best management practices and training protocols in place for ONMS staff and contractors, specifically as they pertain to anchoring and deployment of instruments on the seafloor, which may be designated as EFH.

Revision, Tracking, and Review

If any changes are made to the ONMS Southeast and Gulf of Mexico field operations such that there may be different adverse effects on EFH, ONMS will notify NOAA Fisheries and the agencies will discuss whether the programmatic Conservation Recommendations should be revised. ONMS will provide NOAA Fisheries with an annual report of all field operations

undertaken under the PEA. Every five years, NOAA Fisheries will review these programmatic EFH Conservation Recommendations and determine whether they should be updated to account for new information or new technology.

5.2 Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) of 1972 (16 U.S.C. §§ 1361 *et seq*.), as amended, prohibits, with certain exceptions, 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. The MMPA defines "take" as: "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture or kill any marine mammal." 16 U.S.C. § 1362. Harassment means any act of pursuit, torment, or annoyance that has the *potential to injure* a marine mammal or marine mammal stock in the wild (Level A harassment); or that 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, but does not have the potential to injure a marine mammal or marine mammal stock in the wild (Level B harassment). 16 U.S.C. § 1362[12]. 16 U.S.C. § 1362[13].

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 that the taking would be of small numbers, have no more than a "negligible impact" on those marine mammal species or stocks, and not have an "unmitigable adverse impact" on the availability of the species or stock for "subsistence" uses. NMFS' issuance of an incidental take authorization also requires NMFS to make determinations under NEPA and Section 7 of the ESA[14].

The purpose of issuing incidental take authorizations (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 Letters of Authorization (LOAs); or 2) Incidental Harassment Authorizations (IHAs). An IHA can only be valid for 1 year and LOAs can be valid for up to 5 consecutive years. An IHA may be issued when the action has the potential to result in harassment only (Level B Harassment, i.e.,

[12] "Harassment" is defined by Level A Harassment, which has the potential to injure a marine mammal or marine mammal stock in the wild; and Level B Harassment which 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

[13] Source: http://www.nmfs.noaa.gov/pr/dontfeedorharass.htm

[14] http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/mmpa_esa.html

injury or disturbance). If the action has the potential to result in serious injury or mortality, or to result in harassment only and is planned for multiple years, then an IHA may not be issued, but an LOA and regulations may be issued if NMFS makes the required findings.
In addition, NMFS can in some circumstances authorize directed take of marine mammals through the following types of permits:

- Scientific Research Permit
- General Authorization for Scientific Research
- Public Display Permit
- Commercial or Educational Photography Permit

Pursuant to Section 101(a)(5)(A) of the MMPA, NMFS, upon application from ONMS, may plan to propose regulations to govern the unintentional taking of marine mammals, by harassment, incidental to the proposed field operations for ONMS in the Atlantic Ocean, Pacific Ocean, and Gulf of Mexico. The issuance of MMPA incidental take regulations and associated LOAs to the ONMS is a federal action, thereby requiring NMFS to analyze the effects of the action on the human environment pursuant to NEPA, which is covered in this PEA.

ONMS intends to submit a request for technical assistance to NMFS as to whether we have provided enough information to support our likely to not adversely affect marine mammals determination. If, based on technical assistance, NMFS recommends that ONMS seek a LOA, then NMS will submit an application for a for the incidental taking of small numbers of marine mammals that could occur during their vessel operations and active acoustic equipment use. This PEA will provide informational support for a LOA application, if needed, and the rulemaking process and provide NEPA compliance for the authorization, if granted.

5.3 Endangered Species Act

The Endangered Species Act (ESA) of 1973 as amended (16 U.S.C. §§ 1531, *et seq*.), provides for the conservation of species that are endangered or threatened throughout all or a significant portion of their range, and the conservation of the ecosystems on which they depend. The ESA directs all federal agencies to work to conserve endangered and threatened species and to use their authorities to further the purposes of the Act. NMFS works with U.S. Fish and Wildlife Service (USFWS) to manage ESA-listed species. Generally, NMFS manages marine species, while USFWS manages land and freshwater species.

A species is considered endangered if it is in danger of extinction throughout all or a significant portion of its range. A species is considered threatened if it is likely to become an endangered species within the foreseeable future. When listing a species as threatened or endangered, NMFS or FWS also designate critical habitat for the species to the maximum extent prudent and determinable. 16 USC § 1533(a)(3).

Section 7(a)(2) of the ESA states that each federal agency shall, in consultation with the Secretary, insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. In fulfilling these requirements, each agency must use the best scientific and commercial data available. The consultation process is further developed in regulations promulgated at 50 CFR § 402.

The ESA requires action agencies to consult or confer with the Services when there is discretionary federal involvement or control over the action. When a federal agency's action "may affect" a protected species, that agency is required to consult formally with NMFS or FWS, depending upon the endangered species, threatened species, or designated critical habitat that may be affected by the action (50 CFR §402.14 (a)). Federal agencies are exempt from this general requirement if they have concluded that an action "may affect, but is not likely to adversely affect" endangered species, threatened species, or designated critical habitat and NMFS or the USFWS concurs with that conclusion (50 CFR §402.14 (b)). This is commonly referred to as "informal consultation". This finding can be made only if ALL of the reasonably expected effects of the proposed action will be beneficial, insignificant, or discountable. An action agency shall confer with the Services if the action is likely to jeopardize the continued existence of a proposed species or result in the destruction or adverse modification of proposed critical habitat.
Most consultations are conducted informally with the federal agency or a designated non-federal representative. When the biological assessment or other information indicates that the action has no likelihood of adverse effect (including evaluation of effects that may be beneficial, insignificant, or discountable), the Services provide a letter of concurrence, which completes informal consultation. The agency is not required to prepare a biological assessment for actions that are not major construction activities, but, if a listed species or critical habitat is likely to be affected, the agency must provide the Services with an account of the basis for evaluating the likely effects of the action.

Action agencies initiate formal consultation through a written request to the Services. To comply with the section 7 regulations, the initiation package is submitted with the request for formal consultation and must include the materials listed in 50 CFR § 402.14(c). If a biological assessment is required, formal consultation cannot be initiated until the biological assessment is completed. The contents of biological assessments prepared pursuant to the Act are largely at the discretion of the action agency although the regulations provide recommended contents (50 CFR § 402.12(f)). Formal consultations determine whether a proposed agency action(s) is likely to jeopardize the continued existence of a listed species (jeopardy) or destroy or adversely modify critical habitat (adverse modification), and they are documented by a biological opinion (BiOp). They also determine and authorize the amount or extent of anticipated incidental take in an incidental take statement, identify reasonable and prudent alternatives, if any, when an action is likely to result in jeopardy or adverse modification, and identify ways the action agencies can help conserve listed species or critical habitat when they undertake an action.

In addition, ESA Section 10(a)(1)(A) authorizes the NMFS and FWS to issue permits for scientific purposes or to enhance the propagation or survival of listed species. The permitted activity must not operate to the disadvantage of the species and must be consistent with the purposes and policy set forth in section 2 of the Act. Section 10(a)(1)(A) permits are also required:

- when a reasonable and prudent alternative calls for scientific research that will result in take of the species (this includes scientific research carried out by the Services);
- when the agency, applicant or contractor plans to carry out additional research not required by an incidental take statement that would involve direct take (if this is part of the action and direct take is contemplated, a permit is not needed); and
- for species surveys associated with biological assessments (usually developed during informal consultation) that result in take, including harassment.

ONMS began informal consultation with NMFS Office of Protected Species Division, at the onset of developing this draft PEA. These discussions have been oriented toward assuring the DPEA covers all listed species and potential effects from ONMS field operations and provides the appropriate analysis in support of formal section 7 consultation, which will begin with the publication of the draft PEA.

5.4 National Historic Preservation Act

Section 106 of the National Historic Preservation Act of 1966 (NHPA) (54 U.S.C. §§ 300101 *et. seq*.) requires federal agencies to take into account the effects of their undertakings on historic properties in accordance with regulations issued by the Advisory Council on Historic Preservation (ACHP) at 36 CFR. Part 800. The regulations require that federal agencies consult with states, tribes, and other interested parties (consulting parties) when making their effect determinations.

The regulations establish four basic steps in the NHPA 106 process: determine if the undertaking is the type of activity that could affect historic properties, identify historic properties in the area of potential effects, assess potential adverse effects, and resolve adverse effects.

The first step in the process is for the responsible federal agency to determine whether the undertaking is a type of activity that could affect historic properties. Undertakings consist of any project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a federal agency, including those carried out by or on behalf of a federal agency; those carried out with federal financial assistance; those requiring a federal permit, license or approval; and those subject to State or local regulation administered pursuant to a delegation or approval by a federal agency. Historic properties are properties that are included in the National Register of Historic Places or that meet the criteria for the National Register. If so, the agency must identify the appropriate State Historic Preservation Officer/Tribal Historic Preservation Officer (SHPO/THPO) to consult with during the process. http://www.achp.gov/shpo.html. It should also

plan to involve the public, and identify other potential consulting parties. Consulting parties may include Indian tribes and Native Hawaiian organizations, local governments, permit or license applicants, and interested members of the public. If it determines that it has no undertaking, or that its undertaking is a type of activity that has no potential to affect historic properties, the agency has no further Section 106 obligations.

If the agency's undertaking could affect historic properties, the agency must identify historic properties in the area of potential effects. If the agency finds that no historic properties are present or affected, it provides documentation to the appropriate SHPO/THPO and, barring any objection in 30 days, proceeds with its undertaking.

If the agency finds that historic properties are present, it proceeds to assess possible adverse effects, in consultation with the SHPO/THPO. If the parties agree that there will be no adverse effect, the agency proceeds with the undertaking and any agreed-upon conditions. If they find that there is an adverse effect, or if the parties cannot agree and ACHP determines within 15 days that there is an adverse effect, the agency begins consultation to seek ways to avoid, minimize, or mitigate the adverse effects.

The agency consults to resolve adverse effects with the SHPO/THPO and others, who may include Indian tribes and Native Hawaiian organizations, local governments, permit or license applicants, and members of the public. ACHP may participate in consultation when there are substantial impacts to important historic properties, when a case presents important questions of policy or interpretation, when there is a potential for procedural problems, or when there are issues of concern to Indian tribes or Native Hawaiian organizations.

Consultation usually results in a Memorandum of Agreement (MOA), which outlines agreed-upon measures that the agency will take to avoid, minimize, or mitigate the adverse effects. In some cases, the consulting parties may agree that no such measures are possible, but that the adverse effects must be accepted in the public interest. The ACHP provides helpful checklists on its website for drafting and reviewing agreements.

If consultation proves unproductive, the agency or the SHPO/THPO, or ACHP itself, may terminate consultation. If a SHPO terminates consultation, the agency and ACHP may conclude an MOA without SHPO involvement. However, if a THPO terminates consultation and the undertaking is on or affecting historic properties on tribal lands, ACHP must provide its comments. The agency head must take into account ACHP's written comments in deciding how to proceed.

ONMS will provide a copy of this DPEA to the SHPOs and THPOs in areas affected by the research activities examined in this DPEA. ONMS will consider all comments from SHPO, THPO, and other consulting parties, and take steps to comply with NHPA.

5.5 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 draft PEA.

5.6 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. ONMS has considered its potential effects on MPAs, such as the sites included in the National Marine Sanctuary System, in this draft PEA and found that the impacts are minor.

5.7 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA, 16 U.S.C. § 1451) was enacted in 1972 to encourage coastal states, Great Lake states, and U.S. Territories and Commonwealths (collectively referred to as “coastal states” or “states”) to preserve, protect, develop, and where possible, to restore or enhance the resources of the nation’s coastal zone. The CZMA is a voluntary program for states; currently, thirty-four coastal states have a federally approved coastal management program except Alaska, which voluntarily withdrew from the program in 2011. Section 307 of the CZMA is known as the “federal consistency” provision.
The federal consistency provision requires federal actions (inside or outside a state’s coastal zone) that affect any land or water use or natural resource of a state’s coastal zone, to be consistent with the enforceable policies of the state coastal management program (CMP). The term “effect on any coastal use or resource” means any reasonably foreseeable effect on any coastal use or resource resulting from the activity, including direct and indirect (cumulative and secondary) effects. The federal consistency regulations at 15 C.F.R. part 930 set forth detailed timeframes and procedures that must be followed carefully.

The two types of federal actions addressed in the federal consistency regulations that NOAA programs most frequently encounter are federal agency activities (15 C.F.R. part 930, subpart C), and federal license or permit activities (subpart D). In addition, subpart E of the regulations addresses outer continental shelf plans and subpart F applies to federal financial assistance provided to state and local governments. A federal action that will have reasonably foreseeable

coastal effects, but which does not fall under 15 CFR. subpart D, subpart E, or subpart F should be treated as a federal agency activity under subpart C.

Federal agency activities (subpart C) are activities and development projects performed by a federal agency, or a contractor for the benefit of a federal agency. For federal agency development projects occurring inside a state's coastal zone, the federal agency must submit a Consistency Determination to the state. For all other federal agency activities, inside or outside the coastal zone, the federal agency must submit a Consistency Determination to the state if the federal agency determines the activity may have reasonably foreseeable effects on the state's coastal uses or resources. Federal agencies need only prepare one Consistency Determination for the proposed action and not for individual authorizations or reviews associated with the proposed action, such as NEPA documents, Endangered Species Act consultations, federal permits the agency may need, etc. Federal agency activities must be consistent to the maximum practicable with the enforceable policies of the state's Coastal Zone Management Plan (CMP). If there are no reasonably foreseeable effects, the federal agency may be required to provide a Negative Determination to the state. *See* 15 CFR. § 930.35.

ONMS will provide a copy of this draft PEA 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 field operations. 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.

6.0

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APPENDIX A

PROTECTED SPECIES LISTS

GRNMS

Inverted Common Name	Scientific Name	ESA Listing Status (E=endangered, T=threatened, F=foreign, XN=nonessential experimental population, SAT=threatened due to similarity of appearance)
Marine & Freshwater Invertebrates:		
Fish:		
Grouper, Nassau	*Epinephelus striatus*	T
Marine/Anadromous Species		
Shark, Scalloped Hammerhead	*Sphyrna lewini*	E in Eastern Pacific DPS; E in Eastern Atlantic DPS; T in Central & Southwest Atlantic and Indo-West Pacific DPSs
Sturgeon, Atlantic	*Acipenser oxyrinchus oxyrinchus*	E in Carolina, Chesapeake Bay, New York Bight, and South Atlantic DPSs; T in Gulf of Maine DPS
Sturgeon, Atlantic (Gulf of Maine subspecies)	*Acipenser oxyrinchus (=oxyrhynchus) desotoi*	T
Sturgeon, Shortnose	*Acipenser brevirostrum*	E
Marine Mammals:		
Dolphins		
Atlantic spotted dolphin	*Stenella frontalis*	MMPA
Bottlenose dolphin	*Tursiops truncates*	MMPA
Clymene dolphin	*Stenella clymene*	MMPA
(Pantropical) spotted dolphin	*Stenella attenuata*	MMPA
Risso's (Grampus) dolphin	*Grampus griseus*	MMPA

Rough-toothed dolphin	*Steno bredanensis*	MMPA
Short-beaked common dolphin/Common dolphin	*Delphinus delphis*	MMPA
Spinner dolphin (long-snouted)	*Stenella longirostris*	MMPA
Spotted dolphin	*Stenella plagiodon*	MMPA
Striped dolphin	*Stenella coeruleoalba*	MMPA
Porpoises		
Harbor porpoise	*Phocoena phocoena*	MMPA
Whales		
Blainsville beaked whale	*Mesoplodon densirostris*	MMPA
Blue Whale	*Balaenoptera musculus*	E, MMPA
Bryde's whale	*Balaenoptera edeni*	MMPA
Cuvier's beaked whale	*Ziphius cavirostris*	MMPA
Dwarf sperm whale	*Kogia simus*	MMPA
False killer whale	*Pseudorca crassidens*	E, MMPA
Fin Whale	*Balaenoptera physalus*	E, MMPA
Gervais' beaked whale	*Mesoplodon europaeus*	MMPA
Humpback Whale	*Megaptera novaeangliae*	E, MMPA
Killer whale	*Orcinus orca*	E (southern resident; pods J, K, & L), MMPA
Melon-headed whale	*Peponocephala electra*	MMPA
Minke whale	*Balaenoptera acutorostrata*	MMPA
North Atlantic/North Atlantic right whale	*Eubalaena glacialis*	E, MMPA
Pygmy killer whale	*Feresa attenuata*	MMPA
Pygmy sperm whale	*Kogia breviceps*	MMPA
Sei Whale	*Balaenoptera borealis*	E, MMPA
Short-finned pilot whale	*Globicephala macrorhynchus*	MMPA
Sperm Whale	*Physeter macrocephalus*	E, MMPA
True's beaked whale	*Mesoplodon mirus*	MMPA
Phocid Pinnipeds (Seals)		
Harbor seal	*Phoca vitulina*	MMPA
Manatees		
West Indian manatee	*Trichechus manatus*	E, MMPA
Reptiles:		
Turtles		
Green Sea Turtle	*Chelonia mydas*	T entire range; Central North Pacific, East Pacific, North Atlantic, South Atlantic DPSs T; E in Central South Pacific, Central West Pacific DPSs

Hawksbill	*Eretmochelys imbricata*	E
Kemp's Ridley	*Lepidochelys kempii*	E
Leatherback	*Dermochelys coriacea*	E
Loggerhead	*Caretta caretta*	E North Pacific Ocean DPS; T Northwest Atlantic DPS
Seabirds/Shorebirds:		
Crane, whooping	*Grus americana*	E, MBTA
Knot, red	*Calidris canutus rufa*	T, MBTA
Plover, piping	*Charadrius melodus*	T in entire range; E in Great Lakes watershed in States of IL, IN, MI, MN, NY, OH, PA, and WI and Canada (Ont.); MBTA
Tern, least	*Sterna antillarum*	E in U.S.A. (AR, CO, IA, IL, IN, KS, KY, LA_Miss. R. and tribs. N of Baton Rouge, MS_Miss. R., MO, MT, ND, NE, NM, OK, SD, TN, TX_except within 50 miles of coast); T in Western Hemisphere and adjacent oceans, incl. U.S.A. (FL, PR, VI), where not listed as endangered; MBTA

FKNMS

Inverted Common Name	Scientific Name	ESA Listing Status (E=endangered, T=threatened, F=foreign, XN=nonessential experimental population, SAT=threatened due to similarity of appearance)
Marine & Freshwater Invertebrates:		
Corals		
Coral, Boulder star	*Orbicella franksi*	T
Coral, Elkhorn	*Acropora palmata*	T
Coral, Lobed Star	*Orbicella annularis*	T
Coral, Mountainous Star	*Orbicella faveolata*	T
Coral, Pillar	*Dendrogyra cylindricus*	T
Coral, Rough Cactus	*Mycetophyllia ferox*	T
Coral, Staghorn	*Acropora cervicornis*	T
Fish:		
Grouper, Nassau	*Epinephelus striatus*	T
Marine/Adromous Species		
Sawfish, Smalltooth	*Pristis pectinata*	E

Shark, Scalloped Hammerhead	*Sphyrna lewini*	E in Eastern Pacific DPS; E in Eastern Atlantic DPS; T in Central & Southwest Atlantic and Indo-West Pacific DPSs
Sturgeon, Atlantic	*Acipenser oxyrinchus oxyrinchus*	E in Carolina, Chesapeake Bay, New York Bight, and South Atlantic DPSs; T in Gulf of Maine DPS
Marine Mammals:		
Dolphins		
Atlantic spotted dolphin	*Stenella frontalis*	MMPA
Bottlenose dolphin	*Tursiops truncates*	MMPA
Clymene dolphin	*Stenella clymene*	MMPA
Fraser's dolphin	*Lagenodelphis hosei*	MMPA
(Pantropical) spotted dolphin	*Stenella attenuata*	MMPA
Risso's (Grampus) dolphin	*Grampus griseus*	MMPA
Rough-toothed dolphin	*Steno bredanensis*	MMPA
Short-beaked common dolphin/Common dolphin	*Delphinus delphis*	MMPA
Spinner dolphin (long-snouted)	*Stenella longirostris*	MMPA
Spotted dolphin	*Stenella plagiodon*	MMPA
Striped dolphin	*Stenella coeruleoalba*	MMPA
Whales		
Blainsville beaked whale	*Mesoplodon densirostris*	MMPA
Blue Whale	*Balaenoptera musculus*	E, MMPA
Bryde's whale	*Balaenoptera edeni*	MMPA
Cuvier's beaked whale	*Ziphius cavirostris*	MMPA
Dwarf sperm whale	*Kogia simus*	MMPA
False killer whale	*Pseudorca crassidens*	E, MMPA
Fin Whale	*Balaenoptera physalus*	E, MMPA
Gervais' beaked whale	*Mesoplodon europaeus*	MMPA
Humpback Whale	*Megaptera novaeangliae*	MMPA
Killer whale	*Orcinus orca*	E (southern resident; pods J, K, & L), MMPA
Melon-headed whale	*Peponocephala electra*	MMPA
Minke whale	*Balaenoptera acutorostrata*	MMPA
North Atlantic/North Atlantic right whale	*Eubalaena glacialis*	E, MMPA
Pygmy killer whale	*Feresa attenuata*	MMPA
Pygmy sperm whale	*Kogia breviceps*	MMPA
Sei Whale	*Balaenoptera borealis*	E, MMPA

Short-finned pilot whale	*Globicephala macrorhynchus*	MMPA
Sperm Whale	*Physeter macrocephalus*	E, MMPA
True's beaked whale	*Mesoplodon mirus*	MMPA
Phocid Pinnipeds (Seals)_		
Manatees		
West Indian manatee	*Trichechus manatus*	E, MMPA
Reptiles:		
Turtles		
Green Sea Turtle	*Chelonia mydas*	T entire range; Central North Pacific, East Pacific, North Atlantic, South Atlantic DPSs T; E in Central South Pacific, Central West Pacific DPSs
Hawksbill	*Eretmochelys imbricata*	E
Kemp's Ridley	*Lepidochelys kempii*	E
Leatherback	*Dermochelys coriacea*	E
Loggerhead	*Caretta caretta*	E North Pacific Ocean DPS; T Northwest Atlantic DPS (includes FL)
Alligators/Crocodiles		
American alligator	*Alligator mississippiensis*	T
American crocodile	*Crocodylus acutus*	T
Seabirds/Shorebirds:		
Crane, whooping	*Grus americana*	E, MBTA
Knot, red	*Calidris canutus rufa*	T, MBTA
Plover, piping	*Charadrius melodus*	T in entire range; E in Great Lakes watershed in States of IL, IN, MI, MN, NY, OH, PA, and WI and Canada (Ont.); MBTA
Stork, wood	*Mycteria americana*	E, (USFWS recommends reclassifying to T)
Tern, least	*Sterna antillarum*	E in U.S.A. (AR, CO, IA, IL, IN, KS, KY, LA_Miss. R. and tribs. N of Baton Rouge, MS_Miss. R., MO, MT, ND, NE, NM, OK, SD, TN, TX_except within 50 miles of coast); T in Western Hemisphere and adjacent oceans, incl. U.S.A. (FL, PR, VI), where not listed as endangered; MBTA
Tern, roseate	*Sterna dougallii dougallii*	T (FL, PR, VI); MBTA
Land Species:		
Birds		

Plover, piping	*Charadrius melodus*	T in entire range; E in Great Lakes watershed in States of IL, IN, MI, MN, NY, OH, PA, and WI and Canada (Ont.); MBTA
Sparrow, Cape Sable seaside	*Ammodramus maritimus mirabilis*	E
Warbler, Bachman's	*Vermivora bachmanii*	E
Woodpecker, red-cockaded	*Picoides borealis*	E
Invertebrates		
Miami blue butterfly	*Cyclargus thomasi bethunebakeri*	E
Stock Island tree snail	*Orthalicus reses*	T
Mammals		
Deer, Key	*Odocoileus virginianus clavium*	E
Mouse, Key Largo cotton	*Peromyscus gossypinus allapaticola*	E
Rabbit, Lower Keys marsh	*Sylvilagus palustris hefneri*	E
Rice rat	*Oryzomys palustris natator*	E
Woodrat, Key Largo	*Neotoma floridana smalli*	E
Reptiles		
Eastern indigo snake	*Drymarchon corais couperi*	T

FGBNMS

Inverted Common Name	Scientific Name	ESA Listing Status (E=endangered, T=threatened, F=foreign, XN=nonessential experimental population, SAT=threatened due to similarity of appearance)
Marine & Freshwater Invertebrates:		
Corals		
Coral, Boulder star	*Orbicella franksi*	T
Coral, Mountainous Star	*Orbicella faveolata*	T
Coral, Lobed Star	*Orbicella annularis*	T
Coral, Elkhorn	*Acropora palmata*	T
Coral, Staghorn	*Acropora cervicornis*	T
Fish:		

Grouper, Nassau	*Epinephelus striatus*	T
Ray, Manta	*Manta birostris*	T
Marine/Adromous Species		
Sawfish, Smalltooth	*Pristis pectinata*	E
Shark, Scalloped Hammerhead	*Sphyrna lewini*	E in Eastern Pacific DPS; E in Eastern Atlantic DPS; T in Central & Southwest Atlantic and Indo-West Pacific DPSs
Marine Mammals:		
Dolphins		
Atlantic spotted dolphin	*Stenella frontalis*	MMPA
Bottlenose dolphin	*Tursiops truncates*	MMPA
Clymene dolphin	*Stenella clymene*	MMPA
Fraser's dolphin	*Lagenodelphis hosei*	MMPA
(Pantropical) spotted dolphin	*Stenella attenuata*	MMPA
Risso's (Grampus) dolphin	*Grampus griseus*	MMPA
Rough-toothed dolphin	*Steno bredanensis*	MMPA
Spinner dolphin (long-snouted)	*Stenella longirostris*	MMPA
Spotted dolphin	*Stenella plagiodon*	MMPA
Striped dolphin	*Stenella coeruleoalba*	MMPA
Whales		
Blainsville beaked whale	*Mesoplodon densirostris*	MMPA
Blue Whale	*Balaenoptera musculus*	E, MMPA
Bryde's whale	*Balaenoptera edeni*	MMPA
Cuvier's beaked whale	*Ziphius cavirostris*	MMPA
Dwarf sperm whale	*Kogia simus*	MMPA
False killer whale	*Pseudorca crassidens*	E, MMPA
Fin Whale	*Balaenoptera physalus*	E, MMPA
Gervais' beaked whale	*Mesoplodon europaeus*	MMPA
Humpback Whale	*Megaptera novaeangliae*	E, MMPA
Killer whale	*Orcinus orca*	E (southern resident; pods J, K, & L), MMPA
Melon-headed whale	*Peponocephala electra*	MMPA
Minke whale	*Balaenoptera acutorostrata*	MMPA
North Atlantic/North Atlantic right whale	*Eubalaena glacialis*	E, MMPA
Pygmy killer whale	*Feresa attenuata*	MMPA
Pygmy sperm whale	*Kogia breviceps*	MMPA

Sei Whale	*Balaenoptera borealis*	E, MMPA
Short-finned pilot whale	*Globicephala macrorhynchus*	MMPA
Sperm Whale	*Physeter macrocephalus*	E, MMPA
True's beaked whale	*Mesoplodon mirus*	MMPA
Manatees		
West Indian manatee	*Trichechus manatus*	E, MMPA
Reptiles:		
Turtles[15]		
Green Sea Turtle	*Chelonia mydas*	T entire range; Central North Pacific, East Pacific, North Atlantic, South Atlantic DPSs T; E in Central South Pacific, Central West Pacific DPSs
Hawksbill	*Eretmochelys imbricata*	E
Kemp's Ridley	*Lepidochelys kempii*	E
Leatherback	*Dermochelys coriacea*	E
Loggerhead	*Caretta caretta*	E North Pacific Ocean DPS; T Northwest Atlantic DPS
Seabirds/Shorebirds:		
Crane, whooping	*Grus americana*	E, MBTA
Curlew, Eskimo	*Numenius borealis*	E, MBTA
Knot, red	*Calidris canutus rufa*	T, MBTA
Plover, piping	*Charadrius melodus*	T in entire range; E in Great Lakes watershed in States of IL, IN, MI, MN, NY, OH, PA, and WI and Canada (Ont.); MBTA
Plover, western snowy	*Charadrius alexandrinus nivosus*	T; MBTA; WA state listed as E
Tern, least	*Sterna antillarum*	E in U.S.A. (AR, CO, IA, IL, IN, KS, KY, LA_Miss. R. and tribs. N of Baton Rouge, MS_Miss. R., MO, MT, ND, NE, NM, OK, SD, TN, TX_except within 50 miles of coast); T in Western Hemisphere and adjacent oceans, incl. U.S.A. (FL, PR, VI), where not listed as endangered; MBTA

[15] Loggerheads and Hawksbill's are the only two species documented in the sanctuary. The others are known regionally.

APPENDIX B

ONMS VESSELS IN THE SOUTHEAST AND GULF OF MEXICO REGION

Name	Sanctuary	Home Port	Length	Range	Cruising Speed
R/V *Joe Ferguson*	Gray's Reef	Savannah, GA	41 ft	350 nm	24 kts
R/V *Sam Gray*	Gray's Reef	Savannah, GA	36 ft	300 nm	36 kts
R/V *Manta*	Flower Garden Banks	Galveston, TX	83 ft	600 nm	27 kts
R2402 Proline	Florida Keys	Key Largo, FL	23 ft	175 nm	20-25 kts
R3002 Sea Vee	Florida Keys	Key Largo, FL	29 ft	350 nm	20-25 kts
R3902 Agassiz	Florida Keys	Key Largo, FL	39 ft	300 nm	20-25 kts
R2002 Carolina Skiff	Florida Keys	Key Largo, FL	20 ft	175 nm	20-25 kts
R2204 Twin Vee	Florida Keys	Key Largo, FL	22 ft	175 nm	20-25 kts
R2902 Sea Hunter	Florida Keys	Key Largo, FL	29 ft	300 nm	20-25 kts
R2903 Sea Hunter	Florida Keys	Key Largo, FL	29 ft	300 nm	20-25 kts
R1604 Carolina Skiff	Florida Keys	Key West, FL	16 ft	75 nm	20-25 kts
R2001 Twin Vee	Florida Keys	Key West, FL	19 ft	175 nm	20-25 kts
R2303 Dusky	Florida Keys	Key West, FL	23 ft	175 nm	20-25 kts
R2304 Proline	Florida Keys	Key West, FL	23 ft	175 nm	20-25 kts
R2803 Gulfstream	Florida Keys	Key West,	28 ft	175 nm	20-25 kts

		FL			
R3004 Manta	Florida Keys	Key West, FL	30 ft	175 nm	20-25 kts
R3007 Manta	Florida Keys	Key West, FL	30 ft	175 nm	20-25 kts
R3008 Manta	Florida Keys	Key West, FL	30 ft	175 nm	20-25 kts
R3009 Manta	Florida Keys	Key West, FL	30 ft	175 nm	20-25 kts
R3010 Manta	Florida Keys	Key West, FL	30 ft	175 nm	20-25 kts
R3903 Rachel Carson	Florida Keys	Key West, FL	39 ft	300 nm	20-25 kts
TX6156AE Pathfinder	Florida Keys	Key West, FL	19 ft	125 nm	20-25 kts
R2502 R/V *Crush* (Mako)	Florida Keys	Key Largo, FL	25 ft	125 nm	20-25 kts
R1801 R/V *Douglas* (Parker)	Florida Keys	Key Largo, FL	18 ft	125 nm	20-25 kts
R2509 Frontier Whaler	Florida	Key West, FL	23 ft	123 nm	20-25 kts

APPENDIX C

MARINE MAMMALS AND HEARING RANGES IN ALL SEGOM SANCTUARIES

Common Name	Scientific Name	Local Population ESA Listing	Functional Hearing Group*	Functional Hearing Range	Present in GRNMS	Present in FKNMS	Present in FGBNMS
North Atlantic Right Whale	*Eubalaena glacialis*	Endangered	LFC	7 Hz to 35 kHz	✓	✓	✓
Humpback Whale	*Megaptera novaeangliae*	Endangered	LFC	7 Hz to 35 kHz	✓	✓	✓
Minke Whale	*Balaenoptera acutorostrata*	None	LFC	7 Hz to 35 kHz			✓
Bryde's Whale	*Balaenoptera edeni*	None	LFC	7 Hz to 35 kHz			✓
Fin Whale	*Balaenoptera physalus*	Endangered	LFC	7 Hz to 35 kHz	✓		
Sperm Whales	*Physeter macrocephalus*	Endangered	MFC	150 Hz to 160 kHz	✓	✓	✓
Pygmy Sperm Whale	*Kogia breviceps*	None	HFC	275 Hz to 160 kHz	✓	✓	✓
Killer Whale	*Orcinus orca*	None	MFC	150 Hz to 160 kHz		✓	✓
Pygmy Killer Whale	*Feresa attenuata*	None	MFC	150 Hz to 160 kHz		✓	✓
False Killer Whale	*Pseudorca crassidens*	None	MFC	150 Hz to 160 kHz	✓	✓	✓
Cuvier's Beaked Whale	*Ziphius cavirostris*	None	MFC	150 Hz to 160 kHz			✓
Mesoplodon Whales	*Mesoplodon densirostris,*	None	MFC	150 Hz to 160 kHz			✓

	M. europaeus, M. mirus						
Melon-Headed Whale	*Peponocephala electra*	None	MFC	150 Hz to 160 kHz			✓
Risso's Dolphin	*Grampus griseus*	None	MFC	150 Hz to 160 kHz	✓	✓	✓
Short-Finned Pilot Whale	*Globicephala macrorhynchus*	None	MFC	150 Hz to 160 kHz		✓	✓
Short-Beaked Common Dolphin	*Delphinus delphis*	None	MFC	150 Hz to 160 kHz		✓	
Atlantic Spotted Dolphin	*Stenella frontalis*	None	MFC	150 Hz to 160 kHz	✓	✓	✓
Pantropical Spotted Dolphin	*Stenella attenuata*	None	MFC	150 Hz to 160 kHz	✓	✓	✓
Striped Dolphin	*Stenella coeruleoalba*	None	MFC	150 Hz to 160 kHz	✓	✓	✓
Fraser's Dolphin	*Lagenodelphis hosei*	None	MFC	150 Hz to 160 kHz			✓
Rough-Toothed Dolphin	*Steno bredanensis*	None	MFC	150 Hz to 160 kHz		✓	✓
Clymene Dolphin	*Stenella clymene*	None	MFC	150 Hz to 160 kHz			✓
Spinner Dolphin	*Stenella longirostris*	None	MFC	150 Hz to 160 kHz			✓
Bottlenose Dolphin	*Tursiops truncates*	None	MFC	150 Hz to 160 kHz	✓	✓	✓
Harbor Seal	*Phoca vitulina*	None	MFP	50 Hz to 86 kHz (in water)	✓		
West Indian Manatee	*Trichechus manatus*	Endangered	U	400 Hz - 46 kHz	✓	✓	

APPENDIX D

CONSULTATION LETTERS FOR THE SOUTHEAST AND GULF OF MEXICO REGION

As described in Chapter 5, ONMS will use this draft PEA to meet consultation requirements under a variety of environmental statutes. The final PEA will include copies of all consultation documentation in this Appendix.

APPENDIX E

ONMS Best Management Practices (BMPs) for Vessel Operations

All ONMS vessels must comply with the operational protocols and procedures in the NOAA Small Boats Policy (NAO 209-125). In addition, the following BMP's, which ONMS intends to include in the PEAs, are used as applicable by vessels during ONMS related operations:

Lookouts/Staying at the helm

- While underway, vessel operators should always stay alert for marine mammals, sea turtles, and other collision hazards.
- While transiting in areas where marine mammals and sea turtles are likely to occur, vessel operators should post a minimum of one dedicated lookout and operators should remain vigilant at the helm controls (keeping hands on the wheel and throttle at all times) and be ready to take action immediately to avoid an animal in their path.
- When operating in areas where marine mammals and sea turtles are present, a dedicated lookout is required in addition to the operator. A second lookout may be posted in circumstances where visibility is restricted.
- When marine mammals are riding the bow wake, or porpoising nearby, operators should exercise caution and take actions that avoid possible contact or collisions.
- When operating within visual range of whales, vessel operators should follow NOAA National Marine Fisheries Service (NMFS) Whale Watching guidelines unless otherwise covered by a NMFS permit, and only then with extreme caution.

Vessel Speed

- All vessels must reduce to prudent speed when marine mammals and sea turtles are visible within 1 nautical mile (nm) of the vessel and should not exceed 10 knots.

Maintaining Distance

- Once large whales[16] are sighted, vessel operators should stay at least 100 yards away, 200 yards away from killer whales and 50 yards away from sea turtles.

[16] For the purposes of this document, large whales include: blue, bowhead, bryde's, fin, grey, humpback, minke, right, sei, and sperm whales. Information based on Marine Wildlife Laws & Guidelines for Boaters, Paddlers and Viewers

- If large whales surface within 100 yards, vessel operators should stop immediately and use prudent seamanship to decide to either move away slowly or wait for the animal to move away on its own.
- In the case of North Atlantic right whales, a distance of at least 500 yards should be maintained per NMFS regulations.

Towing Divers

- Divers will be towed at approximately 3 kts/hour.

Operation of vessels during daylight hours

- Due to the increased risk of collision at night, vessel operations, whenever possible, should be planned for daylight hours (*i.e.*, between ½ hour before sunrise and ½ hour after sunset when possible).
- Restricted visibility can hinder an operator's ability to see and respond to a marine mammals and sea turtles. Prudent seamanship should be applied, including posting an additional lookout when there is the potential for marine animals in the vicinity.

Operation of vessels during night hours

- Standing Order for Nighttime Operations – If night time operations are essential and integral to the mission, the principal investigator must discuss mitigations for avoiding whales and other objects within the vessel operation corridor and incorporate them into the cruise plan. Mitigation measures could include: speed restrictions, additional lookouts, use of navigation lights, and use of sound signals, etc.

Standing Order for Operations around Marine Mammals

- This order requires several precautionary measures such as: incorporating whale sighting information in cruise planning, slowing to 10 kts in a Seasonal or Dynamic Management Area, following the Whale Watching Guidelines, maintaining a constant lookout for whales, and following specific procedures if a whale is struck.

Anchoring and deployment of instruments

- In the Southeast and Gulf of Mexico region, anchoring will be limited to sandy-bottom substrates to avoid damage to seagrasses and coral habitat.
- In the Southeast and Gulf of Mexico region, sargassum interaction is limited, as much as is reasonable feasible, to prevent impact on sea turtle hatchling habitat.
- In general, instruments are deployed and lowered onto sandy substrate whenever possible; deployment of instruments occurs slowly and under constant supervision to minimize risk and mitigate impacts if a collision or entanglement occurs; and

while vehicles or personnel are deployed, spotters monitor the activities at all times.

Safety

- Safety Briefings: All ONMS vessel captains include safety information during pre-cruise briefings for staff and volunteers.
- All divers working on ONMS vessels are diver-certified.

AMERICA'S UNDERWATER TREASURES