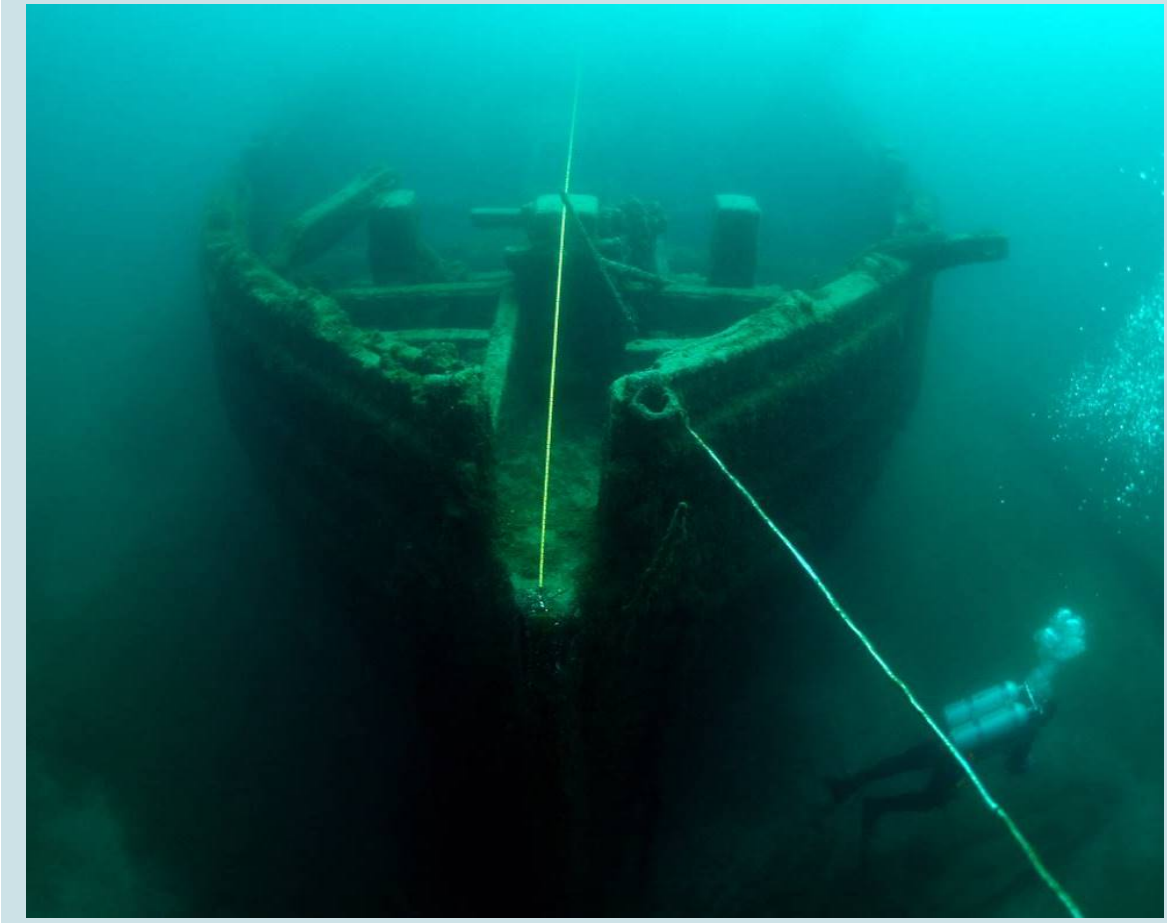
Office of National Marine Sanctuaries
National Oceanic and Atmospheric Administration

Programmatic Environmental Assessment of Field Operations in the Northeast and Great Lakes National Marine Sanctuaries



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National Oceanic and
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Cover Photo
The bow of the two-masted schooner *EB Allen*, sunk in 1871, and now lies within Thunder Bay National Marine Sanctuary.
Photo: Tane Casserley/NOAA, Thunder Bay NMS

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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 environmental assessment addresses field operations at the three national marine sanctuaries in the Northeast and Great Lakes Region: Thunder Bay, Stellwagen Bank, and Monitor national marine sanctuaries.

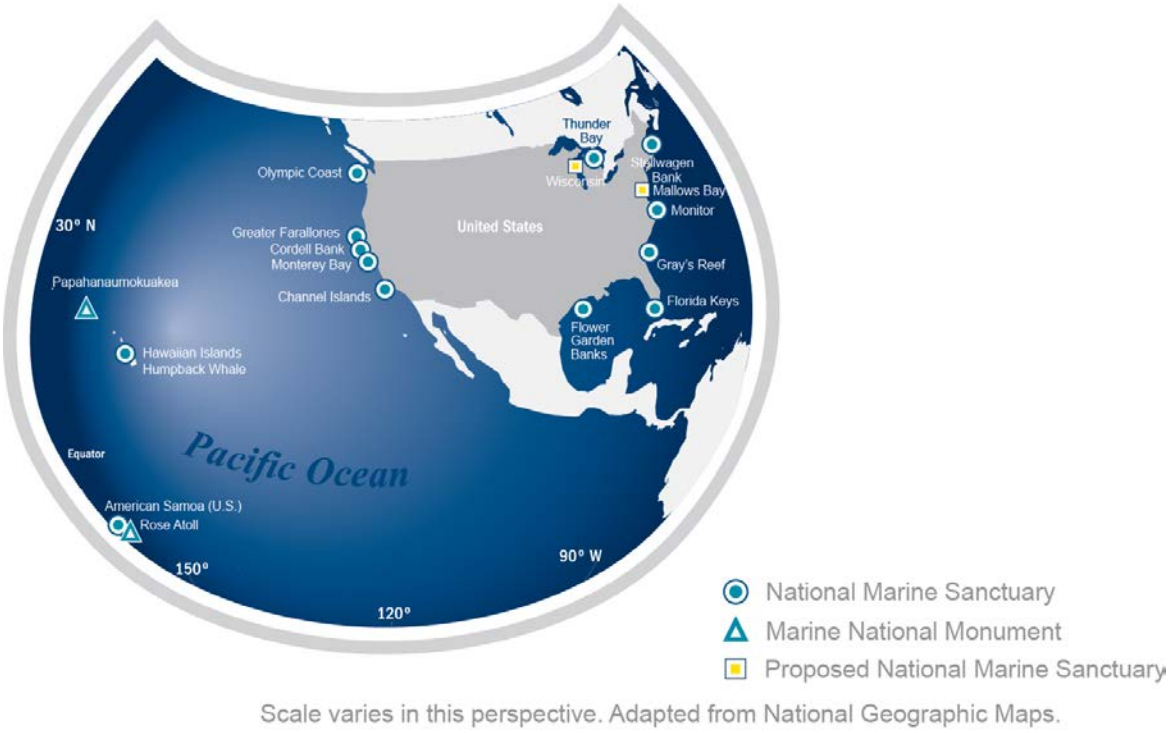
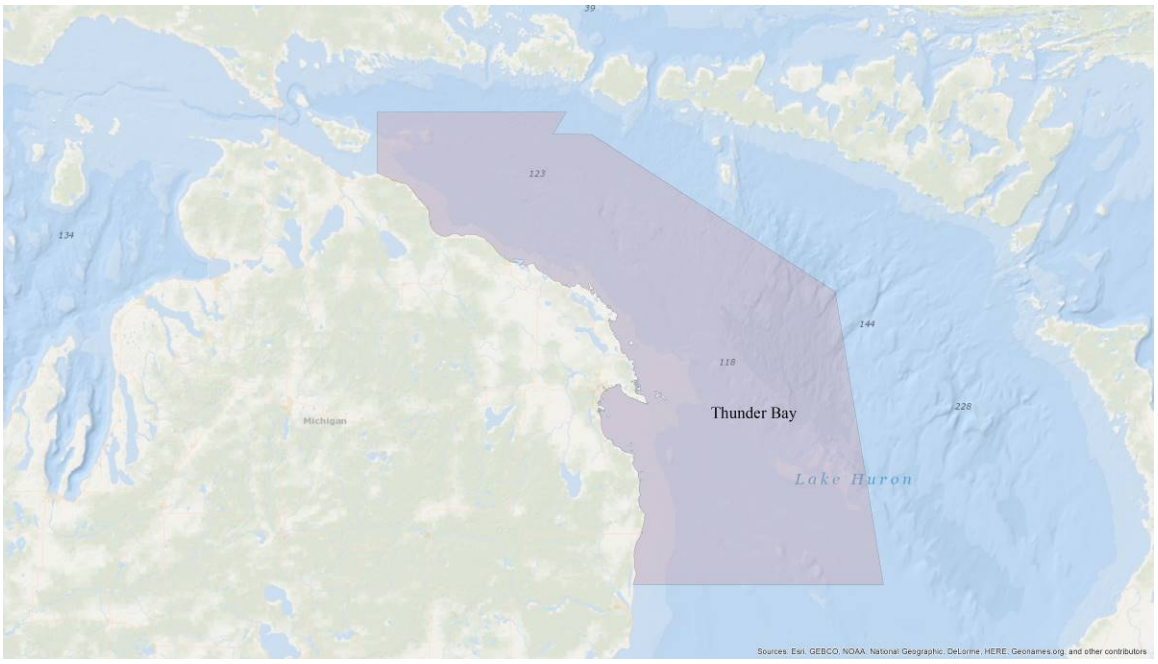


Figure 1: The National Marine Sanctuary System

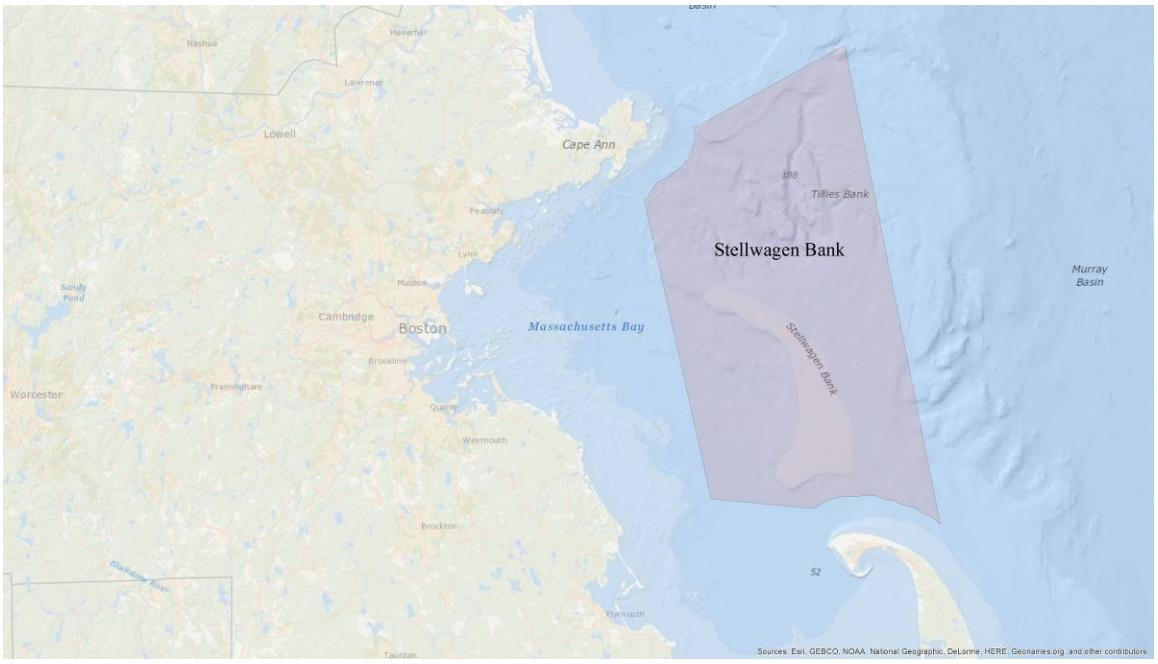
The NMSA requires that ONMS develop and periodically review the management plans for each national marine sanctuary (Sec. 304 (a)(2)(A) and Sec. (e)). Since revision of a management plan often constitutes a federal action, ONMS typically analyzes changes to the management plan under the National Environmental 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 Northeast and Great Lakes National Marine Sanctuaries

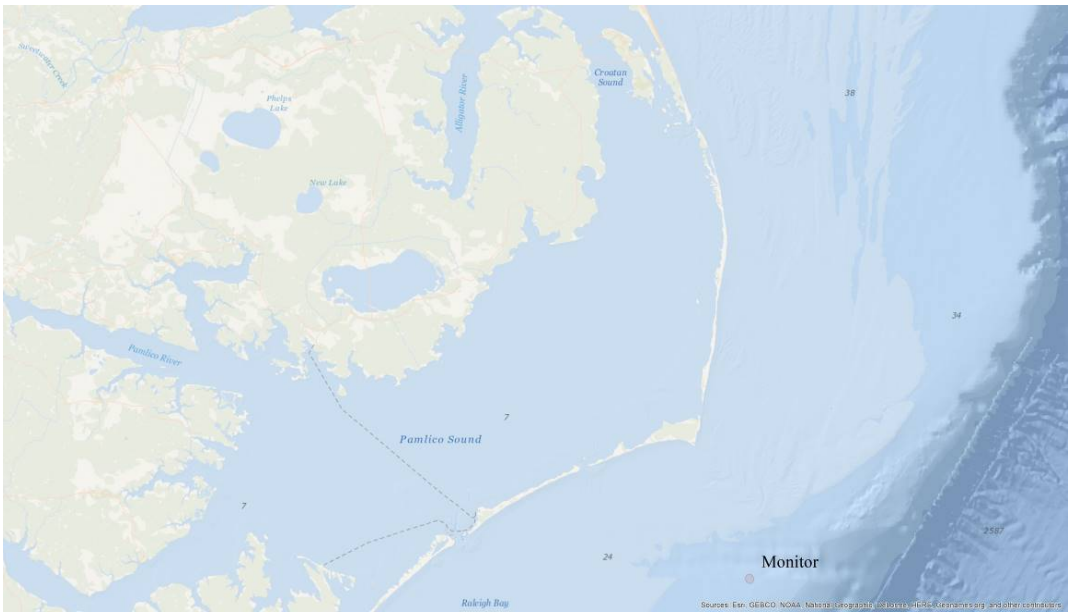
On October 7, 2000, NOAA designated **Thunder Bay National Marine Sanctuary (TBNMS)** as the nation's 13th national marine sanctuary. Located in northwestern Lake Huron, Thunder Bay is adjacent to one of the most treacherous stretches of water within the Great Lakes system. Unpredictable weather, murky fog banks, sudden gales, and rocky shoals earned the area the name "Shipwreck Alley." Today, the 4300-square-mile TBNMS protects one of America's best-preserved and nationally-significant collections of shipwrecks. Fire, ice, collisions, and storms have claimed over 200 vessels in and around Thunder Bay. To date, nearly 100 shipwrecks have been discovered within the sanctuary. Although the sheer number of shipwrecks is impressive, it is the range of vessel types located in the sanctuary that makes the collection nationally significant. From an 1844 sidewheel steamer to a modern 500-foot-long German freighter, the shipwrecks of Thunder Bay represent a microcosm of maritime commerce and travel on the Great Lakes. Northeastern Michigan's maritime landscape also encompasses cultural and natural features related to maritime heritage including lifesaving stations, lighthouses, historic boats and ships, commercial fishing camps, docks, and working ports. Managing the sanctuary as a maritime cultural landscape reveals a broad historical canvas that can encompass many different perspectives to foster an interconnected understanding of the maritime past. For more information please visit http://thunderbay.noaa.gov/.



Stellwagen Bank National Marine Sanctuary (SBNMS) was designated in 1992 and stretches between Cape Ann and Cape Cod at the mouth of Massachusetts Bay in the southwestern corner of the Gulf of Maine. Its primary mission is to conserve, protect and enhance the biological diversity, ecological integrity and cultural legacy of the sanctuary while facilitating uses that are compatible with the primary goal of resource protection. SBNMS contains a complex system of habitats that support benthic and pelagic species by providing cover and anchoring locations for invertebrates; they also provide feeding and nursery grounds for more than a dozen cetacean species including the endangered North Atlantic right, sei, and fin whales. The area also supports foraging activity by diverse seabird species. Fish and invertebrate populations subject to seasonal and migration shifts include both demersal and pelagic species, such as bluefin tuna, herring, cod, flounders, lobster, and scallops. Further, data strongly suggest the presence of over 50 shipwreck sites within the sanctuary, including the historically significant wreck of the steamship Portland which sank in 1898. Large vessel traffic is steady due to the fact that the major shipping lanes to Boston pass through the sanctuary. The presence of whales and fish, in turn, also attracts vessels engaged in watching the former and catching the latter. For more information please visit http://stellwagen.noaa.gov/.



Monitor National Marine Sanctuary was designated the nation's first national marine sanctuary in 1975. The site protects the wreck of the famed Civil War ironclad USS Monitor, best known for its 1862 battle with the Confederate ironclad CSS Virginia at Hampton Roads, VA. It is located approximately 16 miles southeast of Cape Hatteras, N.C. where it sank in a storm while under tow on December 31, 1862 with the loss of sixteen sailors. The sanctuary consists of a column of water one mile in diameter extending from the seabed to the surface, centered on the shipwreck. The highest priority management goal for Monitor sanctuary is resource protection through comprehensive and coordinated conservation and management of the wreck and its surroundings. The Mariners' Museum in Newport News, Virginia is the principal museum for the sanctuary's artifact conservation and exhibition. The *Monitor*, the archaeological information at the site, the artifact collection, and the *Monitor*'s records are all part of the sanctuary's resources. For more information please visit http://monitor.noaa.gov/.



This programmatic environmental assessment 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 advances 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 within 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 System of National Marine Sanctuaries 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 protecting sanctuary resources. 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 considered in this PEA.

Alternative (1) (No Action) is to conduct 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 ESA, MMPA, National Historic Preservation Act (NHPA), and the EFH provisions of the MSA.

Alternative (2) is to conduct field operations as currently conducted with the exception of 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. These measures are described in the sanctuary standard operations and procedures described below.

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 is ongoing 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 EA.

2.1 Alternative Considered but Not Analyzed in Further Detail

NOAA considered an alternative in which no field operations would be conducted at TBNMS, SBNMS or MNMS. Under this alternative, field operations occurring on, in or above the water conducted as part of projects and programs that support sanctuary management, research and education objectives would not occur. This alternative is not further analyzed in this PEA because it would not meet the goals and objectives of the sanctuary management plans, 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 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. With respect to ONMS vessel operations, all vessels follow the protocols and procedures of the NOAA Small Boats Program. Vessel operators are highly trained, apply the NOAA Small Boat Program (https://www.omao.noaa.gov/learn/small-boat-program/about/policy), and follow 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. ONMS also employs site-specific standing orders and procedures at various sites. These orders and procedures are described in further detail below. In general, operators of sanctuary vessels employ ONMS best management practices to minimize impacts. In addition, because they are operating ONMS assets that are very visible to the public,

ONMS vessel operators 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 during 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)[1] and the best management practices identified in Appendix D. This category includes the activities of all personnel, including crew, staff, visitors, volunteers, and students who conduct activities aboard or from (e.g., equipment or other smaller vessels launched from the ONMS vessel) any ONMS vessel, regardless of mission sponsor. It includes vessel transits to/from port, locations of vessel activity, cruise duration, and other activities to accomplish cruise purpose.
Vessel Maintenance	Regular activities are directed 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

[1]https://www.omao.noaa.gov/sites/default/files/documents/SBS%26PM%204th%20Ed%20FINAL_signed%20Corrected%202017%200919.pdf

	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 AUVs/ROVs/gliders/drifters	Activities include deployments of equipment from a vessel such as 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. Some vessels used include sanctuary research vessels R/V *Storm* (TBNMS), R/V *Auk* (SBNMS), and the R/V *Peter Gladding* (MNMS), and NOAA research vessels such as the *R/V Bigelow* or the *R/V Nancy Foster*[2]. These activities may also be accomplished on contractor vessels. Hydroacoustic activities may also be conducted by ONMS or by partners on behalf of ONMS, such as NOAA's Office of Coast Survey[3], and they may occur on ONMS vessels or on NOAA ships.
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, and to prevent anchor damage to cultural sites.
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

[2] The *Nancy Foster* uses Furuno FE-700 (200 kHz shallow, 50 kHz deep) and Knudsen 3200 (200 kHz/12 kHz) echosounders for navigation. Multibeam: Reson 7125 SV2, dual frequency (200kHz or 400kHz) shallow water system. Optimal range: 5-250m. Simrad EM1002, 95kHz. Optimal range: 200- 1000m. Source: https://www.omao.noaa.gov/learn/marine-operations/ships/nancy-foster/about/specifications

[3]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).

	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 TBNMS, SBNMS and MNMS, respectively. These projects range from shipwreck monitoring to whale tagging and include the categories of field operations listed in Table 1. The potential environmental consequences of these projects at each site will be 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 Thunder Bay National Marine Sanctuary Projects and Field Operations

The sanctuary's main research platform is the 50-foot Research Vessel (R/V) *Storm*. Originally built in 1992 as a United States Coast Guard prototype, the *Storm* served in Baltimore, Md., and later at the U.S. Merchant Marine Academy in Long Island, N.Y. Acquired on surplus and extensively refitted in 2009 by the NOAA Great Lakes Environmental Research Lab (GLERL), the 50-foot vessel is a "Green Ship" (one that minimizes harmful emissions during design, manufacturing, service and laying up in order to reduce the pollution to air, water and soil, save resources, and improve economic and social benefits). It is equipped with a multibeam echo sounder and a Klein 300 side scan sonar. As an example of a typical year of field operations in TBNMS, in 2014 the sanctuary research team operated 48 days under way in the sanctuary; performed 285 scientific and working dives in Thunder Bay; deployed 7 AUVs/ROVs, 15 remote sensors, and 2 buoys; and maintained moorings at 27 shipwreck sites. The *Storm* is typically docked within the sanctuary at Alpena, Michigan, but does transit outside the sanctuary to Muskegon, Michigan, on Lake Michigan for routine maintenance. Table 2 below summarizes the various projects undertaken at TBNMS on an ongoing basis. A detailed description of each project follows.

Table 2. TBNMS Projects under Alternative 1

Project Title	Summary Description of Project	Categories of Field Operations
Shipwreck Mooring Program	The sanctuary's shipwreck mooring program is one of its primary on-water resource protection efforts. The sanctuary currently maintains seasonal wreck moorings at 27 historic sites and continues to add new sites each year (*e.g.*, the sanctuary has approved permits for 30 new mooring sites).	Vessel Operations Deployment of Equipment on the Seafloor
Resource Documentation and Monitoring	TBNMS staff documents TBNMS resources using SCUBA divers who produce hand-drawn site maps. The data serves as a baseline for future monitoring.	Vessel Operations SCUBA or Snorkel Operations Other Sampling Activities
Remote Sensing	TBNMS staff conducts sonar surveys with towed vehicles and autonomous underwater vehicles (AUVs) to help locate new resources and provide data on existing resources. These are often done in partnership with other organizations.	Vessel Operations Deployment of Remote Sensing Equipment Deployment of AUVs/ROVs
Support Diving	TBNMS staff contributes dive support to several non-cultural resources projects being completed by sanctuary partners; tasks include photo and video documentation and sampling performed by divers.	Vessel Operations Deployment of Remote Sensing Equipment SCUBA or Snorkel Operations
Education	TBNMS staff contributes ship time to enable on-water time for local students, primarily in connection with Marine Advanced Technology Education Remotely Operated Vehicles (MATE ROVs).	Vessel Operations Deployment of AUVs/ROVs SCUBA or Snorkel Operations
Vessel Maintenance and Crew Training	Includes general maintenance, transit to and from boat yard repair facilities, vessel crew training and safety drills	Vessel Maintenance

General Vessel Operations

General vessel operations support many of the sanctuary's field projects. The small boats are operated according to the NOAA Small Boat Program guidelines and follow ONMS Best Management Practices (BMPs) (see Appendix D).

NOAA operates a fleet of research vessels and small boats on the Great Lakes through its Great Lakes Environmental Research Laboratory (GLERL). As part of its larger stewardship mission in

the marine environment, NOAA has explored options to convert its research vessels from petroleum-based fuels and lubricants to renewable and environmentally-friendly products that reduce fossil fuel emissions. GLERL's Green Ship Initiative, begun in 1999, has led the Nation by successfully converting the laboratory's entire diesel-powered vessel fleet to biofuels and bio-lubricants. In 2002, GLERL formed the Green Ship Working Group, which has helped more than 150 small vessels from both the government and private sectors convert to biofuel. At the sanctuary, the R/V Storm is run on biodiesel much of the time. Data collected by GLERL since the conversion of its vessel fleet to biofuels show significant environmental benefits and cost savings. In 2014, sanctuary researchers operated 48 days on the water, the vast majority of which were day operations on the R/V *Storm*.

Vessel Maintenance and Crew Training

The R/V *Storm* (see Appendix B) is maintained by NOAA's Great Lakes Environmental Research Lab (GLERL)[4], and its home port is in Muskegon, Michigan (on Lake Michigan, outside the sanctuary). The vessel returns there once every other year for routine maintenance and upgrades. In alternate years it is hauled out in Alpena, MI. The vessel was built in the mid-1990s for the USCG, and later retrofitted for scientific research by TBNMS. Part of GLERL's "green fleet," the RV *Storm* has the ability to run completely free of petroleum products.

Shipwreck Mooring Program

Divers, as well as vessel operations to support divers, generally have a negligible impact on sanctuary resources, although vessel anchoring equipment may potentially damage sunken vessels and artifacts. To eliminate such anchor damage to shipwrecks sites, the sanctuary, through its vessel operations, installs and maintains a growing number of permanent moorings at popular sites, which reduce the need for vessel anchoring in the vicinity of sanctuary resources. The first system was installed in 2003. Currently, 27 sites are marked with U.S. Coast Guard-approved moorings, and the state has approved permits for 30 new sites. Because TBNMS is jointly managed with the State of Michigan, the state applies for the mooring permits. The permits are reviewed by Michigan Department of Environmental Water Quality, U.S. Army Corps of Engineers, and the U.S. Coast Guard. Moorings also eliminate the need for non-permitted moorings at shipwreck sites, which can become derelict over time, posing a risk to divers and potentially damaging the site. Finally, moorings encourage public accessibility and safer diving by providing a sturdy means of descent and ascent for divers, and an easy-to-find surface marker for kayakers. Mooring buoys are installed and recovered seasonally to avoid ice and storm damage during winter months. Moorings are typically available from May 15 through October 1, but weather can occasionally delay seasonal redeployments. The sanctuary's website provides divers with up-to-date status of each mooring. Sanctuary regulations prohibit the use of grappling hooks or other anchoring devices at maritime archaeological resource sites if a mooring buoy is

[4] The NOAA GLERL and its partners conduct innovative research on the dynamic environments and ecosystems of the Great Lakes to provide information for resource use and management decisions that lead to safe and sustainable ecosystems, ecosystem services, and human communities. See www.glerl.noaa.gov for more information.

available at the site. TBNMS mooring buoys are anchored on the bottom to a railroad tie, and are approximately 5 feet high, weighing approximately 150 lbs.

Resource Documentation

Once archaeological sites are located, they are assessed and documented with support from vessel operations. Site location, integrity and depth generally dictate the methodology and equipment with which a site is assessed and later documented archaeologically. Methodology in this case refers to the mode of access and the survey technique used. Water depth will dictate the SCUBA diving equipment – rebreathers vs. open circuit SCUBA. The state of the site, whether broken and disarticulated or completely upright and intact will influence the survey technique or other sampling activity (*e.g.*, typically either basic measurements recorded with a measuring tape or photo and video documentation done by divers, or, the use of sonar surveys). In any event, all methodological approaches undertaken by ONMS staff are designed to be non-invasive and impermanent.

Assessments provide baseline data to evaluate a site's current state of preservation, and to plan and prioritize future documentation and permanent mooring installations. They also allow for the initial identification of threats to sites, such as invasive mussel coverage, natural deterioration, anchor damage, looting and other impacts. Sanctuary staff have conducted field assessments at 44 of the 45 known shipwreck sites within the sanctuary's original 448-square-mile boundary. Of the 47 known wrecks in the newly expanded area (in September 2014 the sanctuary expanded to 4,300 square-miles), the sanctuary has conducted field assessments at 32 sites. Assessments are conducted using various methods, including diver observations, sonar images, video and still imagery. The sanctuary continues to explore new assessment technologies. In 2014, for example, working in partnership with 2G Robotics, the sanctuary produced a laser scan/point cloud data of the steamer *Monohansett*. This pilot project sought to better understand laser scanning technology and the required operations. Further, the creation of bathymetry maps of the lake bed as part of shipwreck documentation is a useful product for biologists as they seek to better characterize habitat.

Remote Sensing

With support from a sanctuary vessel, TBNMS staff work with a variety of partners and equipment to conduct remote sensing in the sanctuary. Autonomous underwater vehicles (AUV) have been used, as well as towed systems. The Applied Research Lab at University of Texas-Austin has deployed a REMUS 600 AUV in the sanctuary to conduct a wide area search, and the University of Michigan has deployed an Iver2 AUV for higher resolution sonar imagery of specific features. The majority of remote sensing is done with a towed Klein 3000 side scan and a RESON 8101 multibeam sonar installed on the R/V *Storm*.

In the past, the team has also utilized a Klein 3900 and Kongsberg 2040c multibeam sonar, belonging to the Office of Coast Survey, to obtain higher resolution imagery of 30 sites and to conduct a pilot project in cooperation with the U.S. Fish and Wildlife Service aimed at

characterizing bottom type. This equipment was used opportunistically and there is no current plan to use it again. Only the two following sonars are used regularly in Thunder Bay NMS:

Product name and model: RESON 8101 Extended Range Multibeam Echosounder
Operating frequencies (kHz): 240 kHz
Maximum source level (dB re 1 µPa at 1 m): 220 dB
Single ping duration or repetition rate (if applicable): N/A
Ping Range is 1-40 pings/sec
Nominal beam width (degrees): Along-Track 1.5 degrees; Across Track 1.5 degrees
Duration/frequency of use: 2-4 weeks per season.

Product name and model: Klein 3000 sidescan sonar; single beam
Operating frequencies (kHz): 100/500 kHz
Maximum source level (dB re 1 µPa at 1 m): Unknown
Single ping duration or repetition rate (if applicable): N/A
Nominal beam width (degrees): Horizontal 0.7 degrees at 100 kHz; 0.21 degrees at 500 kHz; Vertical 40 degrees
Duration/frequency of use: 2-4 weeks per season.

Since designation, the ONMS staff have surveyed approximately 600 square miles of the sanctuary and discovered and identified five intact shipwreck sites at depths between 160 and 300 feet, as well as hundreds of targets in shallow water representing the scattered remains of an undetermined number of shipwrecks and other historic features such as pound net stakes, pilings and cribs. TBNMS and its research partners have now obtained good quality sonar images of 49 of the 92 known wrecks in the sanctuary.

Support Diving

The sanctuary regularly supports multidisciplinary on-water research projects. In 2014, for example, the sanctuary research team continued to support two multidisciplinary projects with SCUBA diving activities, sample collection and vessel operations: the Michigan Department of Environmental Quality and University of Vermont experimental reef restoration project, and the Grand Valley State University and University of Michigan microbial research project at the Middle Island sinkhole. Remote sensing equipment is also employed during some of these operations.

Education

Resource protection is a shared responsibility between the sanctuary and a wide range of stakeholders. At the front lines of this effort are divers who visit sanctuary sites directly as part of the TBNMS vessel operations. Fostering appreciation for sanctuary resources among divers is fundamental to reducing human impacts on these unique, irreplaceable sites. Divers, and other stakeholders, will protect what they value. Through focused education and outreach the sanctuary strives to articulate the message that the shipwrecks of Thunder Bay are historical, archaeological

and recreational sites worth protecting. The sanctuary conducts substantial education and outreach activities designed to reach multiple audiences including educators, students, tourists and the local community, among others. These include snorkeling with students, glass-bottom boat tours, AUV/ROV workshops, and educational programs within the Great Lakes Maritime Heritage Center. Many education and outreach products derive from data that is collected during the sanctuary's research and diving programs.

Involving recreational divers directly in the documentation of shipwreck sites helps foster a preservation ethic, while also expanding the sanctuary's research abilities. Using the Nautical Archaeology Society's curriculum and certification, the sanctuary has trained 69 divers in archaeological field methods. During this hands-on archaeological training experience, students learn about historic preservation, maritime archaeological law and sanctuary-specific resource protection efforts. These "citizen scientists" include local residents, as well as members of the Michigan Underwater Preserve Council, Michigan State Police, U.S. Naval Sea Cadets and National Association of Black SCUBA Divers.

2.2.2 Stellwagen Bank National Marine Sanctuary Projects and Field Operations

The site's primary operations platform is the 50-foot R/V *Auk* (see Appendix B), a catamaran used for a variety of research projects, as well as for emergency response, enforcement, and education/outreach missions. The *Auk* is docked at the Stellwagen Bank National Marine Sanctuary facility in Scituate, Massachusetts and transit approximately 20 miles to conduct operations in the sanctuary. As an example of a typical year of field operations in SBNMS, in 2018 the sanctuary research team operated 95 days at sea; conducted 12 whale and seabird tagging operations, 10 SCUBA or snorkel operations, 10 North Atlantic Right Whale surveys, deployed 4 buoys and 16 remote sensors; and performed 211 other sampling activities in the sanctuary. Table 3 below summarizes the various projects undertaken at SBNMS on an ongoing basis. A detailed description of each project follows.

Table 3. SBNMS Projects under Alternative 1

Project Title	Summary Description of Project	Categories of Field Operations
Whale Tagging	Tagging whales with digital, pop-off tags to understand their behavior (year 6 of study as of 2014).	Vessel Operations Other Sampling Activities
Diving Investigations	Documentation of habitat and shipwrecks.	Vessel Operations SCUBA or Snorkel Operations Deployment of AUVs/ROVs Deployment of Remote Sensing Equipment

Seabird Surveys	Characterization of seabird abundance and richness.	Vessel Operations Other Sampling Activities
Wildlife Investigations	Ecological studies, population assessments, behavioral observations.	Vessel Operations SCUBA or Snorkel Operations Deployment of AUVs/ROVs Deployment of Remote Sensing Equipment Other Sampling Activities
Oceanographic Investigations	Characterization of internal waves and their impact on foraging by wildlife.	Vessel Operations SCUBA or Snorkel Operations Deployment of AUVs/ROVs Deployment of Remote Sensing Equipment
Water Quality Investigations	Characterization of water quality conditions.	Vessel Operations Deployment of Remote Sensing Equipment
Archaeological Investigations	Characterization of historic and prehistoric resources.	Vessel Operations SCUBA or Snorkel Operations Deployment of AUVs/ROVs Deployment of Remote Sensing Equipment
Educational Partnerships	Conducting student investigations	Vessel Operations
Vessel Transit	Transiting of research vessel to and from SBNMS and between research stations	Vessel Operations
Acoustic Investigations	Characterization of sound from animals, vessels and ambient sources	Vessel Operations Deployment of AUVs/ROVs Deployment of Remote Sensing Equipment Deployment of Equipment on the Seafloor Other Sampling Activities
Vessel Maintenance and Crew Training	Includes general maintenance, transit to and from boat yard repair facilities, vessel crew training and safety drills	Vessel Maintenance

General Vessel Operations

General vessel operations support many of the sanctuary's field projects. The small boats are operated according to the NOAA Small Boat Program guidelines[5]. In addition, sanctuary vessels follow additional standing orders imposed by ONMS management to minimize impacts on sanctuary resources, particularly whales and other marine mammals. These self-imposed standing orders are followed anytime large whales are known to be present or believed to be present in an area of operation, regardless of time of year.

The process for determining when large whales are present is to check the right whale listening buoys for the presence of right whales and to check with commercial whale watch boats for recent sighting locations. The cruise plan for the day is updated with information on whale sightings. The Cornell University Right Whale Listening Network's Bioacoustics Research Program (see www.listenforwhales.org) discusses how smart buoys in and around SBNMS help ships avoid collisions with endangered right whales. The right whale listening network employs 13 "auto-detection buoys" that listen for calling whales day and night. The buoys record underwater sounds and analyze them as the sounds come in. When the onboard software detects a right whale call, the buoy makes a cell or satellite phone call to an analyst at the Cornell Lab of Ornithology, who verifies the information so it can be included in warnings sent to ships in the area through channels such as the Northeast U.S. Right Whale Sighting Advisory System. The buoys have an estimated listening radius of five nautical miles. The line of 10 buoys provides full coverage for a 55-mile stretch of the commercial shipping lanes into and out of Boston Harbor. Time from detection at the buoy to posting on this site can be as short as 20 minutes.

The self-imposed measures taken by SBNMS to mitigate potential impacts from field operations are:

- **Standing Order for Speed** – Operating speeds shall not exceed 16 knots, except when responding to an emergency or when the safety of passengers or vessel is at risk.
- **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 knots 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.
- **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.

[5] https://www.omao.noaa.gov/find/media/documents/small-boat-standards-and-procedures-manual-41-edition Accessed on 7/12/2018

- **Posting a Dedicated Marine Mammal Observer** – In addition to the precautions required in the S.O. for operations around marine mammals, our internal policy is to post one dedicated marine mammal observer on every mission when practicable.

- **Annual *Whale Sense* Training for Vessel Operators** – Whale Sense is a training program developed by NMFS/GARFO and Whale and Dolphin Conservation in conjunction with SBNMS that is designed to increase the awareness of vessel operators about operating safely around whales. SBNMS vessel crew members are required by internal policy to take the training every year.

- **Abide by Voluntary Northeast Region Whale Watching Guidelines** – The guidelines developed by NMFS/GARFO in collaboration with the whale watching industry recommend progressively slower speeds as the vessel approaches whales and a limit to the number of vessels viewing whales at close approach (100-300 feet).

- **Comply with Seasonal and Dynamic Management Areas** – There are two Seasonal Management Areas overlapping SBNMS that require commercial vessels to transit at 10 knots or less. Even though federal vessels and vessels 65 feet or less are exempt the R/V *Auk* is required via the standing order to transit at 10 knots or less. If a Dynamic Management Area is created by NMFS the R/V *Auk* will transit at 10 knots or less through it.

- **Reduced Speed When Right Whale Listening Buoys Are Activated** – There are four listening buoys in the segment of the Boston Traffic Separation Scheme that overlaps SBNMS. If right whales are detected a 5 nm diameter area around the buoy is activated for 24 hours or as long as whales are detected and LNG carriers are required by NOAA to slow to 10 knots while transiting through these activated areas. Internal policy is that the R/V *Auk* transit through these activated areas at 10 knots or less.

- **All Cruise Plans Incorporate Current Whale Sighting Data from Real-time Listening Buoys and other Sources** – Every cruise conducted by the R/V *Auk* has a cruise plan that describes the purpose and itinerary, lists the crew and passengers, and provides a risk assessment for the mission. Among the factors included in the risk assessment are whether right whales and other whales are present in the sanctuary. For right whales this presence is determined by consulting the right whale listening buoy network and by communicating with the NEFSC Protected Resources Division. For other baleen whales this is determined by communicating with other researchers and whale watch companies.

In addition to abiding by the aforementioned self-imposed precautionary measures, all research on marine mammals operates in accordance with permits issued by NMFS.

Regarding historic resources, for a proposed activity that has the potential to impact a shipwreck the sanctuary archaeologist consults the shipwreck database to determine if there are any known

wrecks in the vicinity. If there are then the proposed activity site is moved a safe distance away. If there are no known wrecks, the proposed site is surveyed either with side scan sonar or with the vessel's Simrad ES60 echosounder to determine if there are any anomalies. If an anomaly is detected the proposed activity site is moved a safe distance away.

The NOAA R/V *Auk* is equipped with a Simrad ES60 narrowbeam echo sounder that is in operation during most if not all use of the vessel. The echo sounder is interfaced to the Scientific Computing System for recording the seafloor depth during operations. The *Auk* operates year-round.

Active sonar remote sensing equipment:

Product name and model: Simrad ES60 single beam sonar
Operating frequencies (kHz): 120 and 50/200 kHz
Maximum source level (dB re 1 µPa at 1 m): 224
Single ping duration or repetition rate (if applicable): 1 milisecond
Nominal beam width (degrees): H: 7°
Duration/frequency of use: constant use while vessel is operating

Vessel Transit

All of the above mentioned vessel operations and cruises as well as moving the *Auk* from one location to another require round trip transits of varying lengths and duration. Standing Orders dictate the speed and manner in which the *Auk* is operated around whales, as described above under “general vessel operations”. Currently the *Auk*’s top speed is 16 knots, and it abides by all federal speed restrictions, as described above, including some restrictions for which federal vessels are normally exempt. Additionally, if any of the right whale listening buoys that bisect SBNMS are activated due to a recent right whale call, the *Auk* will reduce its speed to 10 knots while transiting through the zone. In terms of operations around whales, the *Auk* always has dedicated trained observers watching for whales, and it abides by the Northeast Whale Watching Voluntary Guidelines as well as the 500 yard “no approach” rule for right whales.

Vessel Maintenance and Crew Training

Vessel maintenance is generally done while the vessel is docked at its homeport in Scituate, MA. However, once a year the vessel is hauled out at a boatyard and is refurbished, and repairs are made. Every spring the crew takes the Whale Sense training on how to operate safely around whales. Whale SENSE is a voluntary education and recognition program offered to commercial whale watching companies in the U.S. Atlantic and Alaska Regions. The program is sponsored by NOAA Fisheries, SBNMS, and Whale and Dolphin Conservation (WDC). Developed in collaboration with the whale watching industry, Whale SENSE recognizes whale watching companies committed to responsible practices.

Participating companies agree to:

- Stick to the regional whale watching guidelines.
- Educate naturalists, captains, and passengers to have SENSE while watching whales.
- Notify appropriate networks of whales in distress.
- Set an example for other boaters.
- Encourage ocean stewardship.

Whale Tagging

Dr. David Wiley (SBNMS staff) has permission to tag whales to record behavior under MMPA permits issued by the National Marine Fisheries Service (NMFS) (currently permit No. 14245 and 14809), using acoustic recording tags (D-TAGs) which are affixed to a whale's back with suction cups. These remain on the animal for about 24 hours. Since 2004, ONMS has tagged 120 whales resulting in >500 hours of data and 14 scientific journal publications. The tags are deployed from a small inflatable boat which is driven by a NOAA certified driver. The inflatable is deployed off of a larger NOAA vessel, either the R/V *Auk* or the R/V *Nancy Foster*, during sanctuary vessel operations. Once the tags are deployed the whale is tracked throughout the duration of the deployment. When the tag pops off automatically, it is retrieved by the inflatable boat. Detailed operations are described in the NMFS permit application. Permits and authorizations for whale tagging are required under the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA). Current species tagged by SBNMS staff are humpback and fin whales. A new permit that is under review would expand to include sei and minke whales. The permit is specific to the Gulf of Maine and nearby waters (i.e., the Great South Channel area). This sampling project is in its 6th year of study.

Diving Investigations

With support from sanctuary vessel operations, NOAA certified sanctuary divers conduct sporadic SCUBA dives between May and October to investigate shipwrecks and survey and document habitats and marine life. These missions focus on portions of the sanctuary that are less than 40m depth. Divers are deployed off the R/V *Auk* and use cameras and video to document the dive and acquire data. A Simrad ES60 narrow single beam beam echo sounder (operating at 120 kHz) is used to locate dive sites. The echo sounder is interfaced to the Scientific Computing System for recording the seafloor depth during diving operations.

Active sonar remote sensing equipment:

Product name and model: Simrad ES60 single beam sonar
Operating frequencies (kHz): 120 and 50/200 kHz
Maximum source level (dB re 1 µPa at 1 m): 224
Single ping duration or repetition rate (if applicable): 1 milisecond
Nominal beam width (degrees): H: 7°

Duration/frequency of use: Diving operations occur approximately 10 days a year from May through October. The sonar is active for 2 hours during each day of diving operations.

Seabird Surveys

Massachusetts Audubon certified birdwatchers led by sanctuary staff conduct seabird surveys during sanctuary vessel operations from the R/V *Auk* five times per year to count seabirds as a means of sampling populations. A standardized protocol is followed which entails following a transect along which the observations are made.

Wildlife Investigations

Investigations of wildlife are conducted throughout the year during sanctuary vessel operations using the R/V *Auk*. For example, two ongoing multi-year investigations are (1) SCUBA diving to place passive acoustic remote sensing receivers on the seafloor, and on AUVs to understand the spawning behavior of cod, and (2) tagging great shearwater seabirds with micro-satellite tracking tags and sampling seabird tissue to understand their foraging behavior. In addition, a collaborative project with the USGS uses the R/V *Auk* to sample the seafloor with a Van Veen grab for the purpose of mapping sand lance habitat and catching sand lance.

Oceanographic Investigations

SBNMS supports researchers who use the *Auk* during sanctuary vessel operations to conduct oceanographic investigations. For example, two ongoing multi-year projects are (1) SCUBA diving to deploy instruments to measure internal waves in order to understand their effects on the foraging behavior of marine mammals, and (2) towing remote sensing instruments to measure oceanographic and water quality conditions. In addition, AUVs/ROVs are deployed to investigate oceanographic conditions, as well as shipwrecks and prey aggregation areas.

Water Quality Investigations

SBNMS supports researchers who use the R/V *Auk* during sanctuary vessel operations to conduct water quality sampling using remote sensing equipment. For example, in 2014 contractors for the Massachusetts Water Resources Authority used the *Auk* for a day to take samples and CTD casts at 14 stations in Massachusetts Bay.

Archaeological Investigations

The ONMS is directed by the National Historic Preservation Act of 1966 to inventory the historic properties under its jurisdiction. Historic properties in SBNMS consist of historic shipwrecks and other archaeological sites on the sanctuary's seafloor. The sanctuary archaeologist uses the *Auk* during SBNMS vessel operations sporadically to conduct side scan sonar, SCUBA, remote sensing equipment and ROV investigations of known or presumed shipwreck sites to inventory and document wrecks. The sanctuary utilizes side scan sonar to map the seafloor to locate sonar targets for further investigation. Historic properties located thus far are scattered through the sanctuary at all depths between 20 and 180m. Thus far 15 percent of the sanctuary has been

mapped to the resolution to locate historic properties. Remote sensing survey requires flat seas; survey operations are generally constrained to the months between June and October.

Active sonar remote sensing equipment:

Product name and model: Klein 3000
Operating frequencies (kHz): 100 kHz (125 ±1%); 500 kHz (445 ±1%); 132 kHz (modeled)
Maximum source level (dB re 1 µPa at 1 m): 220 (estimated; p-p); 234 (rms; modeled)
Single ping duration or repetition rate (if applicable): 25–400 µsec; 0.4 msec (modeled)
Nominal beam width (degrees): H: 1° (100 kHz); H: 0.2° (500 kHz); V: 40°
Duration/frequency of use: 10 days of use per year between June and October, 10 hours of continual operation each day of use.

SBNMS occasionally utilizes NOAA research vessels, such as the R/V *Hassler*, to conduct side scan surveys to document wrecks. The R/V *Hassler* employs a Towed Klein 5500 side scan sonar.

Acoustic Investigations

Reducing mortality caused by entanglement in commercial fishing gear and ship strike requires an understanding of how whales use the water column relative to human activities. The *Auk* is used to deploy passive acoustic receivers on AUVs, on buoys, and on the seafloor, which remain deployed from 3-12 months. At the end of the deployment the receivers automatically float to the surface where they are retrieved using the *Auk*. Researchers from the sanctuary and their partners use acoustic information to study and characterize sound from animals, vessels and ambient sources to better understand the impact of noise on marine mammal behavior. Remote sensing equipment records both marine mammal sounds and those originating from human uses of the ocean. Other sampling activities include the use of state-of-the-art multi-sensor, synchronous motion, acoustic recording tags (D-TAGs) and newly designed data visualization software (GeoZUI4D and TrackPlot) to provide fine scaled data on the underwater behavior of whales to aid in the mitigation of these adverse impacts. The results from these investigations allow virtual visualization of the underwater activities of a tagged animal, concurrent with the sounds the animal makes and is exposed to, shipping tracks or other measured aspects of the environment.

2.2.3 Monitor National Marine Sanctuary Projects and Field Operations

The primary platform used for field operations at MNMS is the 57 ft. *Peter Gladding* (see Appendix B). The *Peter Gladding* is docked and maintained in Newport News, Virginia and transits approximately 150 miles to the sanctuary, in addition to being used extensively for yearly summer expeditions to the Battle of the Atlantic maritime heritage research area off of North Carolina's Outer Banks. This vessel provides archaeologists and researchers the ability to stay on the water for extended time periods. As an example of a typical year, in 2014 MNMS sanctuary staff operated 30 days at sea, conducted approximately 250 dive operations, and deployed 15

AUVs and 60 remote sensors. Table 2 below summarizes the various projects undertaken at MNMS on an ongoing basis. A detailed description of each project follows.

Table 4. MNMS Projects under Alternative 1

Project Title	Summary Description of Project	Categories of Field Operations
Battle of the Atlantic	Battle of the Atlantic is an ongoing survey project by MNMS in collaboration with other federal agencies, university partners, and the state of North Carolina, to characterize WWII shipwreck sites along the coast of North Carolina. This project seeks to raise awareness of an important war fought along the American coastline and preserve our nation's maritime history. The expedition studied several sites using AUVs and divers.	Vessel Operations SCUBA or Snorkel Operations Deployment of AUVs/ROVs Deployment of Remote Sensing Equipment Deployment of Equipment on the Seafloor
Nautical Archaeology Society (NAS) Training	NAS is program which provides recreational divers practical training in the methodology used by underwater archaeologists to record shipwrecks. The course is a 3-day long event held quarterly by MNMS. The course provides an opportunity for community engagement and participation. This enhances public understanding of how to interact with heritage resources.	Vessel Operations SCUBA or Snorkel Operations Deployment of AUVs/ROVs
Volunteer Diver Archaeological Survey	This is an annual 10-day project using volunteers or working alongside private citizens with the goal of a complete baseline archaeological survey of a WWII shipwreck in North Carolina. This program collects data that will be used for nominations to the National Register, as well as provides education and engagement opportunities for the public.	Vessel Operations SCUBA or Snorkel Operations Other Sampling Activities
Regional Middle School Field Experience and Curriculum Development	As part of an ongoing program that teaches middle school students about Maritime Heritage and Ocean Sciences, students have the opportunity to engage in on-the-water activities. This focuses on deployment and recovery of a seawater chemistry buoy and the use of small scale ROVs. The goal is focused exclusively on education and awareness of maritime heritage resources.	Vessel Operations Deployment of Equipment on the Seafloor Other Sampling Activities
Vessel Maintenance and Crew Training	Includes general maintenance, transit to and from boat yard repair facilities, vessel crew training and safety drills.	Vessel Maintenance

Enforcement	NOAA small vessels are used to augment enforcement activities generally conducted by USCG and NOAA Office of Law Enforcement.	Vessel Operations

None of these MNMS operations require a permit, although if diving/SCUBA operations on the *Monitor* site itself occur (a rare event) then a superintendent's permit would be required

General Vessel Operations

General vessel operations support many of the sanctuary's field projects. The small boats are operated according to the NOAA Small Boat Program guidelines. In addition, sanctuary vessels, such as the *Peter Gladding*, follow additional standing orders imposed by ONMS management to minimize impacts on sanctuary resources. These self-imposed standing orders are modeled after USCG regulations that apply to the safe operation on USCG vessels. The standing orders include:

- **Look Out** -- Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.

- **Safe Speed** - Every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions. Consistent with Rule 6 (Safe Speed) of the U.S. Coast Guard's International/Inland Navigation Rules (COMDTINST M 166672.2c), in determining a safe speed the following factors shall be among those taken into account:
    - By all vessels:
        - state of visibility;
        - traffic density including concentrations of fishing vessels or any other vessels;
        - maneuverability of the vessel with special reference to stopping distance and turning ability in the prevailing conditions;
        - at night, the presence of background light such as from shore lights or from back scatter of her own lights;
        - state of wind, sea and current, and the proximity of navigational hazards; and
        - draft in relation to the available depth of water.
    - Additionally, by vessels with operational radar:
        - characteristics, efficiency and limitations of the radar equipment;
        - constraints imposed by the radar range scale in use;
        - effect on radar detection of the sea state, weather and other sources of interference;
        - possibility that small vessels, ice and other floating objects may not be detected by radar at an adequate range;

- number, location and movement of vessels detected by radar;
- more exact assessment of the visibility that may be possible; and
- when radar is used to determine the range of vessels or other objects in the vicinity.

Finally, MNMS operators are advised that additional reductions in speed should be considered when a whale is sighted or known to be within 5 nm of the vessel. In these situations, vessels would navigate prudently at the best "safe" speed at the Captain's discretion according to Coast Guard regulations to avoid a collision with a whale, clear the area and, if necessary, reduce speed to the minimum at which the vessel can be kept on course or come to all stop. Sanctuary vessel operators receive information on the location of whales by communicating with other marine users on the radio. There are no minimum distances other than those required by NMFS. If there is a sighting, the vessel must maintain maximum distance and make every attempt to avoid striking a large whale. If the vessel becomes too close to the whale the vessel must come to a complete stop.

The MNMS vessel, the *Peter Gladding*, is over 57 feet in length. It is equipped with a single beam sonar that operates at 50/200kHz. The *Peter Gladding* must follow NMFS regulations designating Dynamic Management Areas and Seasonal Management Areas to reduce ship strikes of marine mammals. However, the sanctuary vessel does not operate within Designated Management Areas (DMAs) or Special Management Areas (SMAs). It does operate in the area included in the SMA off Morehead City, N.C.; however, this SMA is in effect from November 1st to April 30th and the sanctuary field operations are typically conducted in late spring/summer.

Vessel Maintenance and Crew Training

Periodically as needed, the *Peter Gladding* operates for vessel testing or crew training purposes. In these instances, the vessel generally operates for less than 12 hours. Generally these cruises are for crew training, but may occasionally include proficiency dives at locally accessible sites. Dive operation would be conducted in the same manner as normal field operations using live-boating and lift bags. The vessel also undergoes 20-30 days of maintenance per year both in and out of the water on a regular basis.

Battle of the Atlantic Expedition

The annual Battle of the Atlantic Expedition, which occurs outside MNMS, consists of complex field and vessel operations typically over the course of 2-3 weeks. The vessel used is the *SRVx* with twin 4000 series MTU diesel engines. Operations usually consist of 24-hour operations during which the vessel is continually operating offshore. Diving operations and remote sensing comprise the bulk of research activities on this project. Technical SCUBA diving generally consists of up to 6 divers in the water accessing shipwreck sites at depths of between 50-250 feet. When the vessel is engaged in diving operations the standard protocol is to operate in live-boat mode, where no anchoring is conducted and the vessel deploys the divers on site while the vessel is still under power. A small weighted visual surface buoy marker is deployed on the dive site to guide divers to the bottom. This set-up consists on a 10-15 pound weight, usually 3/8'' line and

small surface float. Divers conduct non-invasive recording (photo-video documentation and measurements) and deploy self-contained lift bags (air fillable canvas float bags) as an ascent line.

Remote sensing operations used during this expedition typically include single and multibeam high frequency SONAR or passive magnetometry from either autonomous or towed vehicles. Specifically we use the Reson 7125 SV2 multibeam, dual frequency (200kHz or 400kHz) shallow water system with an optimal range of 5-250m. For deep water we use the Simrad EM1002 multibeam, 95kHz with an optimal range of 200- 1000m. For AUVs we use the Bluefin 12, 1000m depth rated AUV. The vehicle is capable of making dives in 8 hours of duration and is proven to operate effectively in this area of high currents, with operational speed of 3-5kts. The Bluefin vehicle will be equipped with a low frequency 260khz Delta-T Multibeam sonar for wide area survey and obstacle avoidance, and a high frequency BlueView MB1350 sonar for high resolution survey and data collection. For sidescan sonar, we use 100khz sidescan sonar survey at 100 m (328 ft) line spacing for as much as possible as conditions allow (other potential frequencies are 500khz or 455khz, based on prevailing conditions the frequency that provides the best data over the widest swath will be used). The Klein 5000 or 3000 sonar are used. Resolution of survey is based on kHz (100kHz low resolution, wider area/swath covered; 500 kHz higher resolution, smaller area/swath covered.

In addition, sidescan sonar is often used with a frequency of 100-900 kHz from a “towfish” system. The towfish consists of a pair of streamlined transducers that are tethered to the surface craft by means of a jacketed coaxial cable. The towfish is generally towed about 5-15 meters above the seafloor. Autonomous Underwater Vehicles (AUVs) are also used on this project. These are preprogrammed systems deployed from the surface craft to run a pre-programmed survey. These typically run 5-30 meters above the seafloor and use multibeam sonar for seafloor mapping.

Nautical Archaeology Society (NAS) Training

This is a vessel field operation that consists of in-water training for recreational SCUBA divers. The training focuses on teaching divers techniques used for mapping and recording shipwrecks. Generally the course focuses on using tapes and slates to measure and record features on the seabed, and may utilize AUVs as a means of demonstrating the gathering of data. This course is typically taught in confined water rock quarries and not in the sanctuary. The MNMS staff serve as the dive instructors. Anyone interested may apply for and be a student in the class. The instruction consists of two parts: a closed area (usually a swimming pool), and an open water area which may be a quarry or a beach/coastal area. The ONMS vessel would not be used in a quarry – usually another vessel contracted through a separate institution (*e.g.*, ECU) would be used in that case. The ONMS vessel could be used in the open water beach dive training.

Volunteer Diver Archaeological Survey

On an annual basis, MNMS hosts a volunteer based survey of a WWII shipwreck site off of North Carolina. These vessel operations typically run for a 10-day period and are supported by a single small 32' dive boat. In a given day a total of 12-24 SCUBA dives might be conducted (each diver doing 2 dives per day) with a goal of completing a baseline archaeological assessment of the site. The work being conducted focuses on sampling activities such as observation, basic measurements, and photo and video documentation. A fixed mooring and down-line are usually established on site. These operations are day-trips and are limited to less than 12 hours on the water. Ultimately, the data collected helps to create National Register nominations and provides education and engagement opportunities for the public.

Regional Middle School Field Experience and Curriculum Development

This is a bi-annual education event, which comprises a maximum of four days on the water annually in the Chesapeake Bay. A total of 15-20 students embark on a vessel operation education cruise. Seawater samples are collected and a small floating buoy is deployed and immediately recovered that records some basic water quality parameters. These are day operations, and time on the water is less than 12 hours. Light tackle is used for buoy operations within a dredged channel.

Enforcement

The primary sea enforcement presence in the sanctuary is the U.S. Coast Guard (USCG) District Five. However, NOAA is working to increase its presence on the water by using small NOAA vessels to provide additional opportunities to augment the USCG and NOAA Office of Law Enforcement (OLE) efforts in the sanctuary as part of normal vessel operations.

Table 5 below estimates the total field operations per year that will be conducted in the Northeast and Great Lakes (NEGL) Region in the next five years (2015-2020).

Table 5. Estimated Field Operations Days Per Year for the Northeast and Great Lakes Region

Categories of Field Operations	TBNMS Annual Activities	SBNMS Annual Activities	MNMS Annual Activities	Estimate Days/Year for NEGL Region for Next 5 Years
Vessel Operations (days/year)	50-60	122	30	220
Vessel Maintenance	20-30 days of cleaning, fluid replacement and repairs	25-35 days of cleaning, fluid replacement and repairs	20-30 days of cleaning, fluid replacement and repairs	95

Aircraft Operations	0	0	0	0
Non-Motorized Crafts	0	0	0	0
SCUBA or Snorkel Operations (dives/year)	280-325	32	20-30 (DAS) approx. 250 dives	600
Onshore Fieldwork	0	0	0	0
Deployment of AUVs/ROVs (deployments/year)	5-10	12	10 (DAS) up to 20 deployments annually	45
Deployment of Remote Sensing Equipment (deployments/year)	10-20	24	20-30 (DAS) 60 deployments	105
Deployment of Equipment on the Seafloor (buoys/year)	1-3 days of new installations/ approximately 30 seasonal buoy deployments/retrievals	7	0	40
Other Sampling Activities	5-10 operations divided among sediment sampling, bacterial mat studies, and Zebra mussel collecting	230 operations divided among measuring water quality and oceanographic conditions, whale and seabird tagging, seafloor habitat monitoring and catching sand lance for whale foraging studies	0	250

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

Alternative 2 is to continue conducting existing field operations with the exception of 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 1, except for the vessel operations described below.

2.3.1 Thunder Bay National Marine Sanctuary

Since there are no voluntary measures in TBNMS, there would be no change in how vessel operations are conducted for that site compared to Alternative 1.

2.3.2 Stellwagen Bank National Marine Sanctuary

The voluntary and precautionary measures described in Section 2.2 would not be followed under this alternative. There would be no vessel speed restrictions, no restrictions to operate only during the day, no requirement for an observer on board to keep a lookout for marine mammals and other species unless specified as required or recommended mitigation measures.

2.3.3 Monitor National Marine Sanctuary

The voluntary and precautionary measures described in Section 2.2 would not be followed under this alternative. There would be no self-imposed vessel speed restrictions, no restrictions to operate only during the day, no requirement for an observer on board to keep a lookout for marine mammals and other species unless specified as required or recommended mitigation measures.

3.0

AFFECTED ENVIRONMENT

This section includes a brief summary of the physical, biological, socioeconomic and maritime heritage and cultural environments relevant to 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:

- TBNMS management plan (2009) p. 3-5, p. 42-43 at https://thunderbay.noaa.gov/management/
- National Marine Sanctuary System Condition Report (2013) p. 7-20 at https://nmssanctuaries.blob.core.windows.net/sanctuaries-prod/media/archive/library/pdfs/ncr2013.pdf
- SBNMS management plan (2010) Section 3 p. 25-50 at https://stellwagen.noaa.gov/management/fmp/fmp2010.html
- SBNMS condition report (2007) p. 2-6 at https://sanctuaries.noaa.gov/science/condition/sbnms/
- MNMS management plan (2013) p. 24-28 at https://monitor.noaa.gov/management/2013-plan.html
- MNMS condition report (2008) p. 6-8 at https://sanctuaries.noaa.gov/science/condition/monitor/

3.1 Thunder Bay National Marine Sanctuary

3.1.1 Physical Environment

Geology and Oceanography

Located in northwestern Lake Huron, the second-largest of the Great Lakes, Thunder Bay is adjacent to one of the most treacherous stretches of water within the Great Lakes system.

Unpredictable weather, murky fog banks, sudden gales, and rocky shoals earned the area the name “Shipwreck Alley.”

Thunder Bay has a gradually sloping bottom with flats that extend from the nearshore area located off of the Thunder Bay River to the open waters of Lake Huron. Depths range from approximately 25–60 feet, although the sanctuary’s boundaries run offshore to over 330 feet. The sanctuary’s lake bottom is composed of undifferentiated glacial till, rocky shoals, limestone walls and various reefs. Submerged sinkholes that support a specialized local ecosystem are also present.

Lake Huron is heated significantly in the spring, and then heat losses begin to occur over the summer through evaporation. Generally, in December, ice forms first in the bays and other protected areas. Lake Huron’s cold, fresh water ensures that Thunder Bay’s shipwrecks are among the best-preserved in the world.

Water Quality in TBNMS

Invasive zebra and quagga mussels have altered water quality by decreasing the concentration of suspended matter and dissolved oxygen; and increasing the amounts of soluble phosphorus and ammonia nitrate. Further, ice coverage has declined and water levels have fluctuated. Algal blooms, nutrient eutrophication and non-point source pollution also occurs at various times of the year, and may adversely affect water quality. The sanctuary is working with university and NOAA scientists to develop long-term monitoring programs to better understand how the chemical, biological, and physical conditions found around Thunder Bay’s shipwrecks are affecting the corrosion and deterioration of these irreplaceable archaeological sites.

Air Quality in TBNMS

The air quality above the sanctuary is satisfactory and not significantly affected by any sanctuary field operations.

Acoustic Environment in TBNMS

Commercial shipping is considered the major contributor to low frequency noise within the sanctuary. However, the acoustic environment is only mildly affected by the use of boats and other vehicles, and is altered only slightly by Lake Huron’s seasonal variations.

3.1.2 Biological Environment

Biological Habitat in TBNMS

Lake Huron supports a high diversity of aquatic plants and other organisms in its natural environments and has retained significant remnants of historic fish and wildlife habitat. Although the sanctuary exclusively manages maritime archaeological resources, it supports and facilitates multidisciplinary research aimed at better understanding the natural resources of Thunder Bay

and Lake Huron. These efforts lead to a better understanding of habitat quality and living resources (particularly invasive mussels) in and around the sanctuary.

Thunder Bay's bedrock exposures of glacial till, rocky shoals, limestone walls and reefs often serve as important spawning habitats for whitefish, walleye and lake trout, and are typically heavily colonized by dreissenid mussels. The lake's sinkholes, analogous to marine vent ecosystems, are freshwater "hotspots" where nutrients recycle rapidly and where novel organisms and community processes are observed.

Shipwrecks may also function as marine habitats that attract a large diversity and abundance of ecologically and economically valuable species. Furthermore, these artificial reefs may enhance the production of reef-associated species (e.g., microalgae, invertebrates and fish) by serving as refuge and foraging grounds. Smallmouth bass and rock bass are the dominant species, with Walleye, log perch and round gobies are also common.

Invertebrates in TBNMS

At least 200 non-indigenous species have become established in the Great lakes, including zebra and quagga mussel, spiny water flea, and bloody-red shrimp. Aquatic animals that may be viewed near shipwrecks include benthic invertebrates such as sponges, hydras, aquatic worms, crayfish, freshwater shrimp, snails, clams, mussels and aquatic insects. Some of these aquatic invertebrate species could potentially harm maritime heritage resources.

Fishes in TBNMS

In general, the fish inhabiting the Thunder Bay region can be characterized as forage and predator species. Important fish stocks include whitefish, rainbow smelt, bloaters, deepwater sculpin, slimy sculpin, ninespine stickleback, lake herring, suckers, Channel Darter, Lake Sturgeon, Shortjaw Cisco, Sauger, and Kiwi and trout-perch. Predatory fish species include lake trout, brown trout, rainbow trout, Coho salmon, Chinook salmon, pink salmon, walleye, yellow perch and burbot. Many of these species can be observed around shipwrecks and other diving sites.

Birds in TBNMS

Approximately 160 breeding bird species have been recorded for the Alpena region, and include American coot, barn swallow, belted kingfisher, Canada goose, great blue heron, green-backed heron, mallard, wood duck, tree swallow, ring billed gulls, double crested cormorants, herring gulls, common merganser, Caspian Tern, Common Tern, Common Loon, Osprey ,Red Shouldered Hawk and red-breasted merganser. The federally endangered whooping crane (*Grus americana*) and piping plover (*Charadrius melodus*) have been observed in the area. Please see Appendix A for more information.

Protected Species in TBNMS

No listed/threatened species reside or are managed in the areas affected by the TBNMS operations. The federally endangered whooping crane (*Grus americana*) and piping plover (*Charadrius melodus*) have been observed in the area.

3.1.3 Socioeconomic Environment

Transportation in TBNMS

From the earliest days of European settlement the Great Lakes have been utilized as a means of transportation for both cargo and people heading west to settle. Great Lakes cities were founded as trading posts along a vast marine highway which facilitated commerce in an era pre-dating railroads and highways. This relationship to the water has enabled the region to thrive. Today, the Great Lakes region is one of the world's busiest waterways, primarily transporting dry bulk goods (*i.e*., iron ore, grain and potash; and some liquidized and containerized cargo) to and from Midwestern states with some final destinations being eastern cities for both use and export overseas. Due to the construction of locks and channel dredging, ships can now traverse the length of the Great Lakes to the Atlantic Ocean. Many large cargo vessels carrying coal, iron ore, limestone and other goods from Lake Superior pass through Lake Huron and the Alpena region to points east.

Commercial Fishing in TBNMS

The groups using the Lake Huron fisheries are state licensed commercial fishers, recreational anglers and Native American commercial fishers. The popularity of recreational fishing increased after the collapse of commercial fish stocks by the late 1940s. The decline in the economic impact of commercial fishing is illustrated by the decline in numbers of people employed in commercial fishing on the Great Lakes. Since 2001 only two state-licensed and two to four tribally licensed commercial fishing operations have been operating out of Alpena County.

Recreational Fishing in TBNMS

The popularity of recreational fishing has increased over the past century. Opportunities for recreational fishing expanded in the late 1960s with the introduction of salmon in the Great Lakes. Recreationally important native fish such as lake trout, whitefish, walleye, smallmouth bass, northern pike, and yellow perch are present. Both commercial and recreational fishing and boating are potential stressors to sanctuary maritime archaeological resources, with the biggest threat being damage resulting from deploying, dragging and recovering anchors and nets.

Climate Change in TBNMS

The possible impacts of climate change may be seen in altered lake conditions or the physical state of the maritime heritage resources, although this is not a primary focus of the sanctuary's management efforts.

Research and Education in TBNMS

The sanctuary continues a robust and significant program of research, education and public outreach focused on the maritime and cultural archaeological resources of the site.

3.1.4 Maritime Heritage and Cultural Environment

Maritime Heritage Resources in TBNMS

For over 12,000 years, people have traveled on the Great Lakes. From Native American dugout canoes to wooden sailing craft to steamboats to steel freighters, thousands of ships have voyaged across the Great Lakes. Inevitably, accidents have occurred: over 200 shipwrecks vessels of all types lie below the waters of Lake Huron, in and around Thunder Bay. Today, the recently expanded 4,300-square-mile Thunder Bay National Marine Sanctuary protects one of America's best-preserved and nationally-significant collections of shipwrecks.

Sanctuary regulations protect these maritime heritage resources from adverse human activities including anchoring, inadvertent and intentional diving practices, and looting. To enforce these regulations, the sanctuary partners with local, state, and federal authorities. Enforcement also relies on observations from recreational divers and other members of the community. To facilitate recreational access, the sanctuary invests in mooring buoys designed to improve safety and access to resources, while reducing visitor impacts. "Interpretive enforcement," seeks to enhance compliance primarily through education and support of sanctuary goals.

Cultural Resources in TBNMS

The Thunder Bay sanctuary staff not only manage, protect, study and interpret shipwrecks, they also focus their efforts on cultural and natural features related to maritime heritage, such as lifesaving stations, lighthouses, commercial fishing camps, docks, and working ports. Many features, however, are less visible and some remain unrecognized or unknown. Humans have used the waters of Thunder Bay and its shores for thousands of years. Geological and archaeological evidence also suggests a high probability of prehistoric archaeological sites awaiting discovery. In addition to helping to protect and interpret individual sites, managing the sanctuary as a maritime cultural landscape reveals a broad historical canvas that can encompass many different perspectives to foster an interconnected understanding of the maritime past. The maritime cultural landscape allows Thunder Bay's maritime heritage to continue to unfold as new discoveries are made and encourages an increasingly diverse public to find shared meaning in this nationally and internationally significant place.

Historic Properties (As Known) in TBNMS

Many historic shipwrecks that "tell the story" of Great Lakes shipping and commerce are protected within the sanctuary. The sheer number of shipwrecks is impressive, but it is their excellent state of preservation and what they represent – a century and a half of maritime commerce and travel on the Great Lakes – that elevate them to national and international

significance deserving of an extraordinary level of protection, study, and public interpretation. Several wrecks are already listed on the National Register of Historic Places, with more nominations pending.

3.2 Stellwagen Bank National Marine Sanctuary

3.2.1 Physical Environment

Geology and Oceanography in SBNMS

The Stellwagen Bank sanctuary is located in the southwestern Gulf of Maine and stretches between Cape Ann and Cape Cod at the mouth of Massachusetts Bay. It is about the size of the state of Rhode Island. The sanctuary encompasses 842 square miles in a topographically diverse area created some 14,000 years ago during the retreat of the Ice Age glaciers. Today, the dominant feature of the sanctuary is a shallow, glacially deposited, primarily sandy underwater bank, curving in a southeast to northwest direction for 19 miles. It is roughly 6 miles across at its widest point at the southern end. Water depths over and around the bank range from 65 feet to more than 600 feet. The sanctuary contains each of the following five major seafloor habitat types found in the Gulf of Maine: rocky outcrop, boulders (piled, scattered or mud-draped), gravel, sand and mud.

Because of its relative inshore location, water flow over Stellwagen Bank tends to be associated primarily with a coastal current, driven by fresh water input from rivers, and prevailing winds. However, water properties are also influenced by the larger counter-clockwise circulation pattern within the Gulf of Maine. Stellwagen's nutrient-rich waters are the result of its geology and water dynamics. The twice daily tidal fluctuations moving east and west buffet the bank's edges with currents, which drive the nutrient-rich bottom water to the surface. This upwelling process and other water movements around the bank bring nutrients up into the sunlit waters to support a rich mix of plankton, which in turn attracts and supports a wide diversity of marine life.

A fiber optic cable was laid across the northern part of the sanctuary under federal permit in 2000. This cable provides a direct link between North America and the Republic of Ireland. The cable is designed for a life expectancy of 25 years and is buried at an average depth of approximately 1.5 meters into the seafloor. Aside from the past habitat disturbance resulting from the cable laying and burial process, there could be future disturbance from potential cable repair or removal operations.

Water Quality in SBNMS

The Massachusetts Water Resources Authority (MWRA) outfall discharges on the order of 350 million gallons per day of treated secondary effluent 12 miles west of the sanctuary. Potential stressors from the outfall and other point and non-point sources of pollution include eutrophication, toxic chemicals, and agents that alter biological processes. Furthermore, the Massachusetts Bay Disposal Site for clean dredge material is located in Stellwagen Basin

adjacent to the sanctuary's western boundary. Materials deemed free of hazardous materials by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency may be dumped at this site. Known hazardous and radioactive materials were dumped in and around this site in the 1940s and 1950s. Given the proximity of the dumpsite to the sanctuary there is concern that these dumped materials have impacted sanctuary habitats, and that barrels with toxic materials are leaking.

Air Quality in SBNMS

The air quality above the sanctuary and in its vicinity is satisfactory.

Acoustic Environment in SBNMS

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. The level of noise pollution in the oceans and in Stellwagen Bank sanctuary has increased dramatically during the last 50 years. The primary source of low frequency ocean noise is commercial shipping. Many marine mammals respond to noise by altering their breathing rates, spending more time underwater before coming up for air, changing the depths or speeds of their dives, shielding their young, changing their song note durations, and swimming away from the affected area. Noise pollution may cause marine mammals and other organisms to acquire temporary or permanent hearing loss. The disorientation and hearing loss may account for cases in which ships collide with marine mammals that are apparently unaware of the approaching vessel.

3.2.2 Biological Environment

Biological Habitat in SBNMS

Stellwagen Bank and the surrounding waters provide one of the richest, most productive marine environments in the U.S. The area sustains marine mammals and fishery resources that constitute important regional ecological and economic resources. Due to its accessibility, the region is also used extensively for whale watching and commercial and recreational fishing.

The underwater landscape of the area, which includes Stellwagen Bank and surrounding environs, is a patchwork of habitat features that is composed of both geologic and biologic components. These features can provide shelter from predators and the flow of tidal and storm generated currents, serve as sites that enhance capture of prey such as drifting zooplankton or species associated with particular features, and serve as foci for spawning activities.

Primary production at Stellwagen Bank is three times greater than the Gulf of Maine in general. There are well over 575 known species in the sanctuary and the list is largely incomplete. Living landscapes (anemone forests, sponge gardens, hydroid meadows, worm tube beds) carpet the seafloor.

The sanctuary's water column and diverse seafloor habitats sustain over 80 species of fish and invertebrates including cod, haddock, silver hake, bluefin tuna, lobsters, scallops and various flatfish; and provide important feeding and nursery grounds for 31 marine mammal species including the humpback[6] (*Megaptera novaeangliae*) and fin (*Balaenoptera physalus*) whales and the critically endangered North Atlantic right whale. The area also supports foraging activity by 53 species of seabirds dominated by gulls, storm petrels, gannets, auks, sea ducks and shearwaters. Leatherback (*Dermochelys coriacea*), Green (*Chelonia mydas*), Loggerhead (*Caretta caretta*), and Kemp's Ridley (*Lepidochelys kempii*) sea turtles (all endangered species, except the green sea turtle, which is threatened) visit the area for feeding, as do harbor and grey seals. Please refer to Appendix A for the full list of protected species occurring in SBNMS.

A portion of the sanctuary is included within the Western Gulf of Maine Essential Fish Habitat Closure Area. No fishing vessel or person on a fishing vessel with bottom tending mobile gear on board the vessel may enter, fish in, or be in the Essential Fish Habitat Closure Areas unless otherwise specified. Other existing marine resource management zones that overlap SBNMS are the Inshore Restricted Roller Gear Area, and the Gulf of Maine Rolling Closure Areas. All of these areas restrict and manage fishing efforts within part of the sanctuary at certain times. For the latest version of the regulations including area coordinates refer to http://www.nero.noaa.gov/nero/regs/.

Invertebrates in SBNMS

Every major taxonomic group of invertebrates that occurs in the global marine environment is present in the sanctuary. This includes large cerianthid anemones, sand dollars and sea stars in shallower sand areas; and structure-forming epifauna such as sponges and anemones that provide refuge and nursery habitat for juvenile fish of many species.

Fishes in SBNMS

Fish are a vital component of the sanctuary's biological diversity and also one of its strongest links to the human population. The groundfish community in the sanctuary, made up of fish such as Atlantic cod, haddock, whiting (silver hake) and various flatfish, has been sought for food from pre-European settlement to the present. The fish species found in the sanctuary and in its vicinity are generally representative of fish assemblages in the Gulf of Maine region. Of the known 652 Gulf of Maine species, over 80 species of fish exist in and around the sanctuary. The diverse seafloor topography and nutrient-rich waters in the sanctuary result in increased primary productivity and large zooplankton populations, which support abundant populations of small schooling species such as sand lance, herring and mackerel. Many groundfish and larger pelagic

[6] 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. Under the terms of the proposal the Mexico DPS would not be listed under the ESA, and the Central America DPS would be listed as threatened. The population frequenting Stellwagen Bank National Marine Sanctuary is not listed (https://www.fisheries.noaa.gov/species/humpback-whale).

fish prey upon these schooling species, which also form part of the varied diet of marine mammals and seabirds. Fish found in the sanctuary range in size from small snake blennies to basking sharks. Some fish, such as giant bluefin tuna, are annual migrants to the area, while others, such as the Acadian redfish, are likely year-round residents.

Birds in SBNMS

The Gulf of Maine is locally and internationally recognized as an important area for seabirds, with seabird densities that are considerably higher than adjacent oceanic waters. The shallow banks and shelves, including Stellwagen Bank, have long been known to support large numbers of seabirds. The Massachusetts Audubon Society has designated Stellwagen Bank an Important Bird Area (IBA). An IBA is a site that provides essential habitat to one or more species of breeding, wintering or migrating birds, and which supports high-priority species, large concentrations of birds, exceptional bird habitat, and/or has substantial research or educational value. Approximately 53 species of seabirds inhabit the sanctuary intermittently throughout the year, including Great Black-Backed Gulls, Herring Gulls, Common Terns, Wilson's Storm-Petrels, Northern Gannets, Common Eiders, White-Winged Scoters, Greater Shearwaters, and Double-Crested Cormorants.

Protected Species in SBNMS

Marine mammals, particularly whales, are the most visible occupants of sanctuary waters. Seventeen species of cetaceans and five species of pinnipeds are known to frequent the Stellwagen Bank waters and in their vicinity, including five baleen whale species that are listed as endangered under the Endangered Species Act (ESA): blue, fin, humpback, sei and North Atlantic right whale (critically endangered). The sanctuary is also the seasonal home to four species of endangered or threatened sea turtles: the loggerhead (threatened), the Atlantic or Kemp's ridley, the leatherback and the green sea turtle. The Atlantic sturgeon (Gulf of Maine Distinct Population Segment) may also frequent sanctuary waters. See Appendix A of this document for a complete list of protected species in SBNMS and in its vicinity.

Please see Table 6 for a representative list of marine mammals around SBNMS and their estimated hearing ranges. See Appendix A for a full list of protected species known to occur within SBNMS.

Table 6. A list of marine mammals found around SBNMS, their ESA Status, and functional hearing ranges for three Cetacean functional groups. All marine mammals are protected by the Marine Mammal Protection Act.

Common Name	Scientific Name	Local Population Status	Functional Hearing Group	Functional Hearing Range
Blue Whale	*Balaenoptera musculus*	Endangered	Low-frequency (LF) cetaceans	

Fin Whale	*Balaenoptera physalus*	Endangered	(baleen whales) 7 Hz to 35 kHz
Humpback Whale	*Megaptera novaeangliae*	No ESA Listing*	
Sei Whale	*Balaenoptera borealis*	Endangered	
North Atlantic Right Whale	*Eubalaena glacialis*	Endangered	
Minke Whale	*Balaenoptera acutorostrata*	No ESA Listing	
Sperm Whale	*Physeter macrocephalus*	Endangered	Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales) 150 Hz to 160 kHz
Bottlenose Dolphin	*Tursiops truncates*	No ESA listing	
Harbor Porpoise	*Phoca vitulina*	No ESA listing	
Long-finned Pilot Whale	*Globicephala melas*	No ESA listing	
Killer Whale	*Orcinus orca*	No ESA listing for local population	
Beluga Whale	*Delphinapterus leucas*	No ESA listing	
Common Dolphin	*Delphinus delphis*	No ESA listing	
Striped Dolphin	*Stenella coeruleoalba*	No ESA listing	
Atlantic White-Sided Dolphin	*Lagenorhynchus acutus*	No ESA listing	
White-Beaked Dolphin	*Lagenorhynchus albirostris*	No ESA listing	
Grampus (Risso's) Dolphin	*Grampus griseus*	No ESA listing	

Harbor Seal	*Phoca vitulina*	No ESA listing	Mid-frequency (MF) pinnipeds	50 Hz to 86kHz[7]

***** Effective October 11, 2016, NOAA's National Marine Fisheries Service completed a comprehensive status review under the Endangered Species Act for the Humpback Whale (81 FR 62259) and revised the listing status of the species. Per the revised listing status, the Mexico DPS is listed as threatened under the ESA, and the Central America DPS is listed as endangered. The population frequenting Stellwagen Bank National Marine Sanctuary is not listed (https://www.fisheries.noaa.gov/species/humpback-whale).

3.2.3 Socioeconomic Environment

Transportation in SBNMS

Stellwagen Bank sits at the mouth of Massachusetts Bay and is open to vessel traffic traveling to and from the Port of Boston. The port handles more than 1.3 million tons of general cargo, 1.5 million tons of non-fuel bulk cargo and 12.8 million tons of bulk fuel cargo yearly. The designated traffic separation scheme for Boston passes in a roughly east-west direction through the sanctuary. These lanes are used for numerous types of domestic and foreign-flagged vessels, including container ships, liquefied natural gas and oil tankers and barges, and cruise liners. While many vessels remain in the designated travel lanes, use of these lanes is not mandatory and vessel traffic occurs throughout the sanctuary. Stressors from these vessels include noise disturbance of animals, strikes to whales, pollutant discharges, and the introduction of invasive species.

There are 65 small boat harbors and over 80 boating and yacht clubs sited along the Massachusetts coast with easy access to the sanctuary. Recreational boaters typically transit the sanctuary going to and from Boston, the Cape Cod Canal or Cape Cod Bay, and are most numerous within the sanctuary during the whale watching season from April to October.

Currently, there are 15 commercial whale watch companies visiting Stellwagen Bank sanctuary operating a total of 24 boats that make single and sometimes multiple trips daily from April through October. More than one million people visit the sanctuary yearly aboard these platforms. There is increasing concern regarding the short and long-term impacts of whale watching on the targeted large whale populations. Impact studies worldwide have shown changes in respiration rate, avoidance behavior, and changes in habitat use. Vessel strikes with whales, the leading cause of human-induced mortality of the endangered North Atlantic right whale, and entanglement in fixed fishing gear, can cause injury or death.

A deepwater port for the off-loading of liquid natural gas was installed approximately two miles west of the western boundary of the sanctuary. This port, along with the existing MWRA deep-water sewage outfall and the Massachusetts Bay Disposal Site, creates a de facto industrial zone

[7] NMFS 2016 and http://www.nmfs.noaa.gov/pr/species/mammals/seals/harbor-seal.html accessed on June 15, 2018.

adjacent to the sanctuary. Concerns in this area include contamination from discharges, and in the case of proposed liquid natural gas ports, increased vessel traffic and noise, displaced commercial fishing and whale watching activities, and impacts to the sanctuary's scenic views.

Commercial Fishing in SBNMS

Commercial fishing with mobile gear such as trawls, scallop and clam dredges, together with fixed gear such as bottom-tending gill nets and lobster pots, occurs extensively throughout the sanctuary. Approximately 440 commercial fishing vessels, primarily from ports in Massachusetts, use the sanctuary each year. Atlantic herring, cod, lobster, spiny dogfish, flounder, scallop and monkfish are the predominant species caught. Stressors resulting from commercial fishing include alteration of habitat, removal of biomass, discharge of pollutants, entanglement of marine mammals, and destruction of historic resources.

A portion of the sanctuary is included within the Western Gulf of Maine Essential Fish Habitat Closure Area. No fishing vessel or person on a fishing vessel with bottom tending mobile gear on board the vessel may enter, fish in, or be in the Essential Fish Habitat Closure Areas unless otherwise specified. Other existing marine resource management zones that overlap SBNMS are the Inshore Restricted Roller Gear Area, and the Gulf of Maine Rolling Closure Areas. All of these areas restrict and manage fishing efforts within part of the sanctuary at certain times. For the latest version of the regulations including area coordinates refer to http://www.nero.noaa.gov/nero/regs/.

Recreational Fishing and Boating in SBNMS

The sanctuary is a popular destination for recreational fishing boats, sailboats and powerboats. Recreational fishing is divided into two categories: party/charter boat and private. In the party/charter boat category, commercial operators take customers fishing for a fee. In the private category, individuals own or rent boats that they use to go fishing or transit through the sanctuary. Recreational fishers primarily target groundfish and pelagic species such as tuna, shark, and bluefish. It is estimated that the recreational fishing fleet takes 25% of the cod in the Gulf of Maine. Potential stressors from recreational boating and fishing activities include targeted removal of large spawning and breeding fish, disturbance of whale feeding, strikes to whales, and discharge of pollutants.

Climate Change in SBNMS

Over the next century, climate change is projected to profoundly impact coastal and marine ecosystems. Climate change can have significant effects on sea level, temperature, and currents. These changes could result in more intense storms and more extreme floods and droughts. Rising seawater temperatures may give rise to increased algal blooms, major shifts in species distributions, local species extirpations, and increases in pathogens within the sanctuary and its surrounding waters.

Research and Education in SBNMS

The sanctuary continues a robust and significant program of research, education and public outreach focused on the scientific, ecological and archaeological resources of the site. The myriad research efforts are designed to enhance species, habitat and biodiversity protection; management of both living and maritime heritage resources; recreational opportunities for sanctuary users; and to create strategies to allow more compatible uses while limiting deleterious impacts to sanctuary resources.

The goals of the education and outreach program are to bring information about the sanctuary's research and resource protection programs before the public, to encourage stewardship of sanctuary resources, and to advance ocean literacy among students, teachers and the general public. The education and outreach program for the sanctuary consists of multiple elements including print publications and audio-visual productions, general public outreach, user group outreach, formal education, informal education, media relations and exhibits. Many of the sanctuary's education and outreach projects have developed as cooperative ventures with partners including non-governmental organizations, educational institutions, museums and aquariums. In recent years, a variety of projects have been initiated that meet site needs and incorporate ONMS priorities, including several education mini-grant projects.

3.2.4 Maritime Heritage and Cultural Environment

Maritime Heritage Resources in SBNMS

The sanctuary's maritime archaeological resources include many shipwrecks and other submerged archaeological sites that may include other cultural themes, such as traditions, histories, and values. Hundreds of years of fishing, whaling, and maritime transportation have made the sanctuary a repository for valuable historic maritime archaeological resources. To date 35 historic and five modern shipwreck sites been located in the sanctuary, with six shipwrecks listed on the National Register of Historic Places. These shipwrecks are tangible connections to the past that allow sanctuary staff and visitors to study and better understand the area's history.

Cultural Resources in SBNMS

Sitting astride historic fishing grounds and shipping routes, Stellwagen Bank sanctuary has been a locus for a variety of human maritime activities for centuries. As Gloucester is America's oldest seaport, Stellwagen Bank is among the most historic fishing grounds in the Gulf of Maine harkening back to colonial times. The major shipping corridors established in the past are still prominent today where they cross the sanctuary. Shipwrecks on the sanctuary's seafloor represent the development of commercial fishing and maritime transportation during the nearly 400 years that maritime commerce passed through the area.

Historic Properties (As Known) in SBNMS

The steamer *Portland*, listed on the National Register of Historic Places, is considered to be the sanctuary's most historically significant wreck as it represents the most intact 19th-century New England steamship located to date. Also listed on the National Register are the shipwrecks of two coal collies that collided in 1902, the Frank A Palmer and the Louise B. Crary; the Eastern Rig Dragger *Edna G*; the Eastern Rig Dragger *Joffre*; and the Schooner *Paul Palmer*.

3.3 Monitor National Marine Sanctuary

3.3.1 Physical Environment

Geology and Oceanography

The *Monitor's* remains lie 230 feet down on the continental shelf 16.1 nautical miles south-southeast of the Cape Hatteras Lighthouse at the western margin of the Gulf Stream, and are influenced both by the Stream itself, the Labrador Current, and by eddies created by that current. Changes in current direction and velocity occur frequently. Water temperatures in the area are related to current patterns, and demonstrate an annual variation between 52 degrees and 78 degrees Fahrenheit. In the vicinity of the *Monitor*, the ocean bottom is composed of sand, shell hash, and clay below the surface. Bathymetric profiles of the area indicate that the bottom surface slopes gently away to the southeast at less than seven feet per 1000 feet.

Water Quality

The *Monitor* is located in water that is deep and well-mixed. Although there is not a water quality monitoring program at the sanctuary, an abundance of apparently healthy marine life near the wreck indicates that the water quality is good and that there are few, if any, risks to human health. The velocity of the Gulf Stream is high enough to transport fine to medium sand to and from the site. Visibility in the 230-foot-deep water varies from 10 to 150 feet according to turbidity, the presence of microorganisms, and the intensity and angle of sunlight. Eutrophication is not a management concern, and no discharge of waste material within sanctuary boundaries is allowed. However, the strong currents, high water temperatures and high salinity water found off the coast of Cape Hatteras, NC has the potential to accelerate the deterioration rate of the *Monitor*. The discharge of untreated sewage from vessels is not allowed within or into the sanctuary.

Air Quality

The air quality above the sanctuary and its vicinity is satisfactory and not significantly affected by any sanctuary field operations.

Acoustic Environment in MNMS

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. The acoustic environment in MNMS is marginally affected by the use of boats and other vehicles in the area, and is altered only slightly by seasonal and other oceanographic variations. Marine mammals that migrate through the area may be impacted by noise from boats or other vehicles.

3.3.2 Biological Environment

Habitat in MNMS

The wreck attracts various biological assemblages as a productive artificial reef that supports both transitory organisms and local communities including sponges, corals and many species of fish. Some non-indigenous species exist, precluding full community development and function, but are unlikely to cause substantial or persistent degradation of ecosystem integrity. The prohibition of commercial fishing and trawling in the sanctuary helps to eliminate the pressure and deleterious impacts of fishing gear on living resources.

Overall, some changes in the numbers and types of fish, corals and sponges have been noted since the establishment of the sanctuary. Variations in the environment and even changes in the condition of the ship's hull have been suggested as possible explanations. For example, although the sanctuary has become a productive reef habitat, cold-water intrusions by the Labrador Current may limit its productivity (*e.g*., this intrusion may have contributed to the decline of red snapper and vermilion snapper).

Invertebrates in MNMS

Encrusting organisms and motile invertebrates are found on the wreck of the *Monitor*, using the shipwreck's structure for feeding grounds or shelter. The encrusting organisms include coral, sponges (at least 40 species), sea squirts, sea anemones, hydroids, barnacles, tubeworms, mussels and oysters. Although many invertebrates are cryptic and difficult to detect, those that have been identified include crabs, brittlestars, sea urchins, snapping shrimp and spiny lobsters.

Fishes in MNMS

The *Monitor's* remains are located near the northern boundary of tropical reef fish habitat, and therefore support a mixture of temperate and tropical species. Thousands of fish form schools throughout the center of the vessel, with twenty-five species, most abundantly red barbier, greater amberjack, scad, and black sea bass, documented. The sanctuary and its surrounding waters also host sharks, manta rays, scup and grouper. Commercial fishing and trawling within the sanctuary is prohibited.

Birds in MNMS

Although there are no detailed studies or counts that focus on the seabirds that inhabit the area of the sanctuary, the waters off of Cape Hatteras, NC and the Outer Banks support great numbers of

seabirds, both migratory and year-round residents. Many different types of fish and other sea life serve as food sources for these birds that include many species of gulls, shearwaters, and petrels.

Protected Species in MNMS

The presence of the Gulf Stream and the wreck's location near the northern boundary of tropical reef fish habitat makes Monitor National Marine Sanctuary very attractive for a variety of marine life. Federally listed fish species include the endangered scalloped hammerhead shark (*Sphyrna lewini*), Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), and the shortnose sturgeon (*Acipenser brevirostrum*). There are 11 dolphin species, 20 whale species, as well as the harbor porpoise (*Phocoena phocoena*), habor seal (*Phoca vitulina*), and the endangered West Indian manatee (*Trichechus manatus*). Five species of sea turtles occur in the area, including the endangered hawksbill and Kemp's Ridley and the threatened green and loggerhead. Please see Appendix A for more information.

3.3.3 Socioeconomic Environment

Maritime Transportation in MNMS

Vessels enter the sanctuary for diving, recreational fishing, research and transit. Although the number of vessels is not exceptional, pollution concerns from these vessels include exhaust, oil spills, fuel spills, human waste and bilge discharge.

Commercial Fishing in MNMS

Commercial fishing activities including anchoring, bottom trawling, dredging, stopping or drifting without power at any time are prohibited due to the potential threat to the fragile *Monitor* shipwreck. The *Monitor* sanctuary lies within the jurisdiction of the South Atlantic Fishery Management Council, which manages fishery species of interest at the *Monitor* site. The Council is responsible for the conservation and management of fish stocks within the federal 200-mile limit off the coasts of North Carolina, South Carolina, Georgia and east Florida to Key West.

There have been incidents involving commercial fishing activity within the sanctuary that have caused serious damage to the sanctuary's living and archaeological resources. A 1991 anchoring incident, the discovery of commercial fishing gear found tangled on the *Monitor* in 1997, and the observed remains of a trawling net and long lines on the *Monitor*'s hull in 2004 illustrate the potential dangers to the wreck from careless fishing operations.

Recreational Fishing in MNMS

The waters within and surrounding MNMS are used for sport and charter fishing. Fishing is permitted within the boundaries of the sanctuary, and many of the charter captains operate both fishing and SCUBA charter businesses, although drifting without the boat motor running is prohibited. Recreational fishing is a significant economic factor in the local economy, supporting hotel and restaurant business, tackle shops, and charter operators. This activity is responsible for

hundreds of millions of dollars of revenue to the local economy. Although the sanctuary has no data on what portion of the local economy is driven directly by the presence of MNMS, it is clear that sanctuary regulations permitting fishing serve to support the economy rather than hinder it. Recreational fishing may be a potential stressor to marine species and artifacts at the site of the *Monitor*. The structure of the wreck is very fragile and any physical interaction, including anchoring and use of bottom fishing gear, could cause considerable damage.

Climate Change in MNMS

Any changes in oceanographic conditions may affect both biological organisms and the condition of the wreck itself. For example, as the high-salinity waters that are found off the coast of Cape Hatteras, N.C. have the potential to accelerate the deterioration rate of the *Monitor,* any increase in salinity due to climate change may hasten this process even more. Although the sanctuary does not currently have long-term data comparing many oceanographic parameters, a data buoy within the MNMS borders provides critical information on many possible environmental changes that may impact the site.

This Diamond Shoal Data Buoy (NDBC-41025) collects oceanographic and meteorological information including temperature, wind conditions, sea states, and current data. This real-time data aides seafarers in determining sea conditions off the coast of Cape Hatteras and assists ONMS staff in monitoring conditions at the sanctuary. The public can access data online from the buoy 24-hours a day.

Research and Education in MNMS

Archaeological research at MNMS serves to better protect the sanctuary's resources and maritime landscape by inventorying, locating, documenting, assessing, managing, and interpreting the site's archaeological, historical, and environmental resources. Much of this work is collaborative as the sanctuary partners with many other local, state and federal government agencies; and with academic and research institutions. The sanctuary's ongoing monitoring program has resulted in much important data, including the detection of a significant increase in the rate of deterioration of the *Monitor*. The rapid degradation of the hull may have been precipitated by an incident in 1991, when a private fishing boat was cited by the U.S. Coast Guard for anchoring illegally on the wreck. It is also possible, however, that the structural integrity of the *Monitor* has also decreased through natural deterioration to the point that the rate of collapse has begun to accelerate. As a result of this new information, current research goals for the sanctuary are to ensure the scientific recovery and dissemination of historical and cultural information from the site and to preserve and manage the remains of the *Monitor* in a manner that appropriately enhances the significance and interpretive potential of the warship. Additionally, resource-monitoring programs will help NOAA better understand the living and natural resources within the sanctuary and in the surrounding waters.

Education and outreach is an effective tool to protect and promote the sanctuary. Jointly, education and outreach directly support resource protection by creating a better-informed public

not only on issues affecting the sanctuary, but larger ocean conservation issues as well. The sanctuary uses education to promote awareness and protection of the site's natural and cultural resources, and to enhance local, regional, and national knowledge of the surrounding ocean's climatological and ecological significance.

3.3.4 Maritime Heritage and Cultural Environment

Maritime Heritage Resources in MNMS

On January 30, 1975, NOAA designated the wreck of the USS *Monitor*, lying off the coast of Cape Hatteras, N.C., as the nation's first national marine sanctuary. The *Monitor* was the prototype for a class of U.S. Civil War ironclad, turreted warships that significantly altered both naval technology and marine architecture in the nineteenth century. Designed by the Swedish-American engineer John Ericsson, the vessel contained many emerging innovations that revolutionized warfare at sea.

The *Monitor's* career as a warship was significant, though short-lived. On March 9, 1862, she battled the CSS *Virginia* (former USS *Merrimak*) in one of the most celebrated naval battles in history. On December 25, 1862, the ironclad received orders to proceed, under tow, to Beaufort, N.C. En route, the *Monitor* encountered a severe gale and began to take on water. On December 31, 1862, less than a year after her commissioning, the *Monitor* sank with a loss of sixteen men.

For over a century the *Monitor* lay undiscovered. In August, 1973, scientists aboard Duke University's research vessel *Eastward* located the Monitor in 230 feet of water, 16 miles off Cape Hatteras, N.C. The wreck was in relatively good condition, although some structural damage and deterioration was apparent. Over the years, numerous research expeditions have visited the sanctuary. Between the years of 1998-2002, NOAA and the United States Navy mounted several major archaeological expeditions to the wreck site, recovering the ship's propeller, revolving gun turret, cannons, engine and over 1,500 other artifacts. Many of these artifacts are on display at The Mariners' Museum (TMM) in Newport News, Va., the principal repository for the conservation, storage and exhibition of Monitor artifacts and at the Graveyard of the Atlantic Museum in Hatteras, N.C. Other traveling and temporary exhibits have also been displayed at various museums, conferences and special events across the country.

Today the *Monitor* represents a unique legacy from our nation's past. The shipwreck and its contents comprise an irreplaceable historical record and represent a monument to the American naval tradition that the vessel itself helped to create. Archaeological investigations of the *Monitor* have provided an opportunity to examine aspects of our past that are not recorded in surviving manuscript sources. Artifacts from the ship's stores and personal property of the crew have greatly enhanced our understanding of life aboard the United States Navy's first prototype ironclad warship.

Cultural Resources in MNMS

Due to its historic significance, the *Monitor* is considered a national treasure. As such, it is an important driver for heritage tourism in North Carolina and Virginia. The Mariners' Museum in Newport News, VA., and the Graveyard of the Atlantic Museum in Hatteras, NC, serve as primary repositories of Monitor historic artifacts and are important to the economic health of those associated coastal communities. The Mariners' Museum in Newport News, Va., saw an almost 200% increase in attendance in 2007, following the opening of the USS Monitor Center. Today the museum continues to benefit immensely from the display of artifacts recovered from the *Monitor* in the form of increased attendance and new positions created to support the facility, and the museum remains a major draw for regional tourism. Similarly, the Graveyard of the Atlantic Museum in Hatteras, N.C., has benefited from the relationship with the sanctuary. The museum employs about a dozen people and has received almost 2.6 million dollars in direct support from the sanctuary. In 2011, the museum had an attendance of almost 80,000 visitors. In both cases, the impact of the sanctuary to local communities has been clear and positive. SCUBA diving also has had a positive impact on the local economy and plays a significant part in driving heritage tourism. Thousands of divers come to the Outer Banks of North Carolina each year to dive the shipwrecks of the Graveyard of the Atlantic. This region is characterized by popular wreck diving magazines as one of the top wreck diving destinations in the world year after year. The *Monitor* attracts divers each year and is considered by many to be one of the "Holy Grails" of shipwrecks in U.S. waters. Divers who dive the *Monitor* typically spend thousands of dollars in equipment, food, and lodging within the local communities as part of these dive trips.

Conservators at The Mariners' Museum have been documenting, stabilizing, treating, and exhibiting artifacts recovered from the *Monitor* since the first large-scale excavations in the 1990s. Over 200 tons of artifacts have been recovered from the wreck. Archaeologists and U.S. Navy divers recovered the revolving gun turret, vibrating side-lever steam engine, steam condenser, auxiliary steam equipment, propeller and shaft assembly, Dahlgren guns and gun carriages, and other structural and personal items. These artifacts are composed primarily of wrought iron, cast iron, and copper alloys. Additional materials included lead, tin, steel, rubber, canvas, wood, wool, glass, and ceramic.

To date, fully one-quarter of the approximately 2,000 artifacts and components have been stabilized, treated, and displayed or stored. Fifty-percent of all organic materials were documented, stabilized, and treated during the past five years. Additionally, conservation staff discovered and accessioned over 200 new artifacts during initial conservation of the gun turret between 2005 and 2010. Owing to significant facility upgrades between 2006 and 2008, including the construction of the USS *Monitor* Center and Batten Conservation Complex and acquisition of specific capital equipment, conservators are now making significant progress with *Monitor's* auxiliary steam equipment, steam condenser, Dahlgren guns, composite gun carriages, and other structural components.

In late 2010 and early 2011, conservators focused on the deconcretion and disassembly of *Monitor's* 30-ton main steam engine in support of complete treatment. Composite artifacts composed of differing material types and tightly sealed components require disassembly to promote thorough desalination and cleaning. This fact considerably increases the amount of hands-on work and overall treatment time for all composite artifacts recovered from the *Monitor*. Conservation of the revolving gun turret is ongoing and conservators have reduced the corrosion rate by an order of magnitude. The turret is currently stable and is undergoing a lengthy desalination process. It is anticipated that the entire conservation project will take at least another fifteen to twenty years to complete. This timeframe is based upon the volume of material recovered by NOAA archaeologists, the stability and fragility of these materials, as well as specific conservation treatment parameters.

In order to facilitate public access to this historic and iconic material during this time period (aside from an award-winning exhibit), TMM provides large viewing platforms and windows into the conservation lab. The lab is also outfitted with three live web cameras that can be directed at every portion of the lab to show activities as they occur. Additionally, The Mariners' Museum conservators maintain a blog in which they post new and interesting information, images, and discoveries on a weekly basis.

Major recovery work began with the propeller and a segment of the propeller shaft, which were recovered with assistance from the U.S. Navy in 1998. In 2001, the steam machinery and associated components were removed from the wreck, and in 2002, the vessel's rotating gun turret and its contents were successfully brought to the surface. Since then, NOAA has continued to study the site. Areas of wood that were exposed during the large item recovery expeditions (1998-2002) have led to degradation of the wood components that were exposed during those expeditions. In more recent years, surveys on the site have revealed the additional loss of deck plating at the stern. During a 2011 NOAA expedition to the site, researchers observed a build-up of modern marine debris; however, earlier accelerated deterioration of the site from recovery activities appears to have slowed. Finally, in March 2013, the remains of two sailors that were discovered in the turret were laid to rest with full military honors at Arlington Cemetery in Washington, D.C.

Historic Properties (As Known) in MNMS

During the years since *Monitor* sank on December 31, 1862, its hull and contents have been slowly transforming from a ship of war to an archaeological site. The *Monitor's* present condition is the result of a number of factors, including damage that occurred at the time of sinking, natural degradation of material that has resulted from more than a century and a half of immersion in seawater, and damage from human activities, including recovery activities.

It is clear that while natural and man-made processes will continue to affect the site, the site remains a valuable repository of significant archaeological information and historical material for the foreseeable future. Furthermore, the site is considered a gravesite and is listed as a National Historic Landmark.

4.0

ENVIRONMENTAL CONSEQUENCES

This section evaluates the environmental consequences of the No Action (or status quo alternative) and the other two alternatives as described in Chapter 2. The environmental effects of these alternatives are summarized in Table 7 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). For each alternative, the field operations are analyzed by resource. For each resource within these settings, the analysis is organized by the type and level of impact anticipated to that resource from the ONMS field operations activity. Where an activity is expected to result in an effect to the resource, that activity is analyzed under the heading which corresponds to its anticipated type and level of impact. Based on the nature of ONMS field operation activities, and the similarity of resources within a particular region, our analysis finds that the impacts on individual national marine sanctuaries are comparable within a region. Therefore, the documented analysis applies to all sanctuaries within this region, unless stated otherwise.

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.

- **Indirect effects** – effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects 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 adverse environmental impacts of field operations would be reduced through these mitigations. NOAA will complete consultation with NMFS and FWS prior to publishing the final version of this programmatic EA (PEA). The final PEA 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 and less than significant adverse impacts

Deployment of Equipment on the Seafloor

There are about 40 wreck and acoustic buoys deployed annually in the NEGL region, with the majority in TBNMS, all of which are shipwreck mooring. The shipwreck moorings in TBNMS consist of permanent mooring blocks on the lake floor, with surface buoys that are deployed seasonally. The scientific data generated through the seafloor deployment of observation equipment helps 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 use by fish), marine mammal behavior, and aiding the development of education and outreach materials. This aids protection

and management of these resources, and the sanctuary as a whole. Vessel moorings prevent anchor damage to the seafloor.

The use of weighted marker buoys are necessary to ensure the safety of dive operations that support science and education projects. These projects help managers take action to protect sanctuary physical resources. Also, incident response operations that benefit physical resources through the removal of hazardous material and pollution threats may occasionally require deployment of marker buoys. Thus, deployment of equipment on the seafloor in sanctuaries is expected to provide less than significant, indirect, short-term and long-term beneficial effects to the affected geologic environment.

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 direct contact with the bottom. Usually, their limited local effects and the narrow scope of each study with regards to the size of the area keep these adverse effects minor. For example, the deployment of autonomous recording unit (ARU) 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. 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 buoy anchors into coral and other sensitive areas. However, the short-term nature of anchored buoys are expected to result collectively in impacts to geologic resources that are less than significant.

Additionally, to facilitate research diving at sites that do not have permanent moorings, a temporary weighted marker buoy is deployed to the seafloor, typically in sandy areas. The system consists of a small weight (approximately 10 lbs.), a line to the surface, and a marker buoy. The entire system is retrieved at the termination of dive operations. The direct adverse effects on the physical environment are expected to be less than significant, because the effects are localized and short-term. Additionally, the weight is light (10 pounds or less), and is designed to quick release to prevent damage to ledge habitat if the current carries the line attached to the weight.

Deployment of Remote Sensing Equipment

It is estimated that about 105 deployments of remote sensing equipment occur annually in the NEGL region, equally spread over the three national marine sanctuaries. 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 use by fish), and aiding the development of education and outreach materials. This helps the protection and management of these resources and the sanctuary as a whole. For example, the development of bathymetric maps is beneficial in developing better strategies for managing both living and cultural resources found on the seabed. As such, the deployment of this sensing

equipment is expected to result in a less than significant, indirect, long-term benefit to the affected geologic environment.

The deployment of some remote sensing arrays poses 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 transitory 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 relative to the size of the region are expected to result in less than significant adverse effects on the affected geologic environment.

Other Sampling Activities

About 250 other sampling operations are expected to take place per year in all three NEGL region sanctuaries, with the great majority occurring at SBNMS. The scientific and monitoring data generated through other sampling activities help better characterize the geologic and oceanographic processes within a sanctuary, thus increasing our understanding of sanctuary resources and their associated relationship to the physical environment. The other sampling activities also raise public awareness of the nature and importance of the physical environment and the need to protect it; help researchers deduce potential impacts from human and natural sources; and aid in the 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 buoys from the physical environment. The collective benefits from these activities are expected to be indirect, long-term and less than significant.

The deployment of some other sampling activities pose 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 temporarily 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 the direct adverse effects are expect to be less than significant, because they are localized and short-term.

Activities with only less than significant adverse impacts

Vessel Operations

The NEGL region will spend about 220 days each year on vessel operations, with approximately one-half of those at SBNMS. The anchoring and unintentional striking or groundings that may occur as the result of operating vessels has the potential to have adverse, but less than significant direct impacts to geological resources. Fixed moorings are used whenever possible to avoid impacts from anchoring. Vessel operations are episodic and low intensity. Vessel operators are highly trained and adhere to the NOAA Small Boat Program policies, as well as sanctuary standing orders and procedures designed to minimize 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 U.S. Coast Guard (USCG) license or equivalent NOAA Corps experience for the vessel size. In general, operators of sanctuary vessels employ ONMS best management practices, and, because they are operating assets that are very visible to the public they are trained to serve as models of best practices to avoid harm to geological resources. Therefore, these activities are expected to have only less than significant adverse impacts.

Activities with negligible impacts

Deployment of AUV/ROV/Gliders/Drifters

There are about 45 deployments of AUVs/ROVs conducted annually in the NEGL region, equally spread over the three national marine sanctuaries. In the NEGL region, ONMS deploys AUVs/ROVs/gliders/drifters only within sanctuary waters. 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. The deployment of AUVs/ROVs/gliders/drifters are expected to result in negligible effects on geological resources due to the unlikely disturbance of the submerged lands in each sanctuary. While intentional or accidental improper operation is possible, ONMS only uses skilled operators who are trained in best practices designed to prevent such improper techniques. In addition, these operators recognize that they serve as models of responsible practices within the sanctuary, and conduct themselves accordingly. Collectively, these attributes serve to mitigate any disturbance to the geologic resources in the NEGL sanctuaries, and as such, the deployment of AUVs/ROVs/gliders/drifters is expected to result in negligible effects.

SCUBA/Snorkel Operations

About 600 dives per year are expected to take place in all three sanctuaries in the NEGL region, with the majority occurring in TBNMS and MNMS. Those SCUBA/snorkel operations are expected to result in negligible effects on geological/oceanographic resources due to very limited disturbance of sediments and other submerged lands of affected areas. 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 the ONMS best management practices to avoid improper actions that can cause harm to geologic resources. Thus, these operations are expected to result in negligible effects.

Vessel Maintenance

It is estimated that approximately 95 days of vessel maintenance will be required each year to support the ONMS vessels which operate in the NEGL sanctuaries. 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. 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'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 geological resources are expected to be negligible.

Water Quality

Activities with only less than significant adverse impacts

Vessel Operations

The NEGL region will spend about 220 days each year on vessel operations, approximately one-half of those at SBNMS. 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, garbage spills and bilge water discharges from sanctuary vessels. Because there are existing state and federal regulations, and in many cases, sanctuary regulations prohibiting most discharges, significant impacts to water quality are highly unlikely. As stated above, sanctuary vessel operators are highly trained and will apply the NOAA Small Boat Program mandates and self-imposed standing orders in effect during all ONMS vessel operations, in addition to withholding most discharges to avoid impacts to water quality as required by sanctuary regulations and other statutes that apply to waters outside of the sanctuaries. Therefore, these activities are expected to have only less than significant adverse impacts.

Activities with negligible impacts

Deployment of AUV/ROV/Gliders/Drifters

There are about 45 deployments of AUVs/ROVs conducted annually in sanctuary waters in the NEGL region, equally spread over the three NEGL national marine sanctuaries. 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 is expected to result in negligible effects on water quality due to the lack of discharge involved in operations of these tools.

Deployment of Equipment on the Seafloor

There are about 40 buoys deployed annually in the NEGL region, with the majority being wreck buoys in TBNMS. The normal deployment and use of equipment on the seafloor causes no discharge of harmful waste material into the water column and is expected to have a negligible impact on any affected water quality.

Deployment of Remote Sensing Equipment

It is estimated that about 105 deployments of remote sensing equipment occur annually in sanctuary waters in the NEGL region, equally spread over the three national marine sanctuaries. Normal remote sensing operations cause no discharge of harmful waste material into the water column and thus are expected to have negligible impact on any affected water quality.

Other Sampling Activities

About 250 other sampling operations are expected to take place per year in all three NEGL region sanctuaries, with the great majority occurring at SBNMS. The use of sampling technologies and operations, such as deploying instruments to measure oceanographic and water quality conditions, or tagging marine mammals to better understand their behavior, generally has no, or at most a negligible effect, on the physical environment (including geology and oceanography, water quality, air quality and acoustics). Normal operations cause no discharge of harmful substances into the water column, atmosphere or onto the seafloor. Therefore, these activities are expected to have only negligible impacts.

SCUBA/Snorkel Operations

About 600 dives per year are expected to take place in all three sanctuaries in the NEGL region, with the majority occurring in TBNMS and MNMS. SCUBA/snorkel operations are expected to result in negligible effects on water quality due to the lack of discharge involved in SCUBA diving or snorkeling activities.

Vessel Maintenance

It is estimated that approximately 95 days of vessel maintenance will be required each year to support the ONMS vessels which operate in the NEGL sanctuaries. 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

Vessel Operations

The NEGL region will spend about 220 days each year on vessel operations, approximately one-half of those at SBNMS. 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 and episodic. Compared against existing vessel and shipping traffic, the addition of sanctuary vessel operations are expected to have a less than significant impact on air quality. In addition, all three sanctuary vessels operating in the region are larger sanctuary vessels constructed since the mid-2000's, which have Tier 3, EPA-compliant diesel engines.

Activities with negligible impacts

Deployment of AUV/ROV/Gliders/Drifters

There are about 45 deployments of AUVs/ROVs conducted annually in the NEGL region, equally spread over the three national marine sanctuaries. Deployment of AUV/ROV/gliders/drifters are considered as discharge at all national marine sanctuaries. However, their use is expected to result in negligible effects on air quality due to the lack of emissions involved in operations of these tools. Thus, these operations are expected to result in negligible impacts to affected air quality.

Deployment of Equipment on the Seafloor

There are about 40 buoys deployed annually in the NEGL region, with the majority being wreck buoys in TBNMS. The normal deployment and use of equipment on the seafloor causes no discharge of harmful emissions into the atmosphere, and thus, these operations are expected to have a negligible impact on affected air quality.

Deployment of Remote Sensing Equipment

It is estimated that about 105 deployments of remote sensing equipment occur annually in the NEGL region, equally spread over the three national marine sanctuaries. Normal remote sensing operations cause no discharge of harmful emissions into the atmosphere, and thus, these operations are expected to have negligible impact on affected air quality.

Other Sampling Activities

About 250 other sampling operations are expected to take place per year in all three NEGL region sanctuaries, with the great majority occurring at SBNMS. The use of sampling technologies and operations, such as deploying instruments to measure oceanographic and water quality conditions, or tagging marine mammals to better understand their behavior, generally has no, or at most a negligible effect, on the physical environment (including geology and oceanography, water quality, air quality and acoustics). Normal operations cause no discharge of harmful substances into the water column, atmosphere or onto the seafloor. Therefore, these activities are expected to have only negligible impacts.

SCUBA/Snorkel Operations

About 600 dives per year are expected to take place in all three sanctuaries in the NEGL region, with the majority occurring in TBNMS and MNMS. SCUBA/snorkel operations are expected to result in negligible effects on air quality due to the lack of harmful emissions involved in SCUBA diving or snorkeling activities.

Vessel Maintenance

It is estimated that approximately 95 days of vessel maintenance will be required each year to support the ONMS vessels which operate in the NEGL sanctuaries. 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.

Acoustics

Activities with only less than significant adverse impacts

Deployment of AUV/ROV/Gliders/Drifters

There are about 45 deployments of AUVs/ROVs conducted annually in the NEGL region, equally spread over the three national marine sanctuaries. Deployment of this equipment is 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 they are short-term and localized.

Deployment of Equipment on the Seafloor

There are about 40 buoys deployed annually in the NEGL region, with the majority being wreck buoys in TBNMS. Some equipment attached to the seafloor may result in increased noise levels from its normal operations. For example, pop-up buoys may emit sound for several seconds when they are interrogated to ascertain communication with the surface vessel, which may result in minor impacts to certain organisms, particularly marine mammals. However, given the relative low intensity of the sound emitted by these devices, and their infrequent deployment throughout the large area of the three sanctuaries, the overall impact to the affected acoustic environment is expected to be less than significant, if not negligible.

Deployment of Remote Sensing Equipment

It is estimated that about 105 deployments of remote sensing equipment occur annually in the NEGL region, equally spread over the three national marine sanctuaries. The normal use of towed arrays, such as magnetometers, side scan sonar systems, and ES-60 fish finders, may result in increased noise levels from towing the sensing equipment.

Vessels are estimated be used, up to 220 days each year, to deploy passive acoustic equipment including recording hydrophones either attached to moorings which are anchored to the seafloor, or towed or tethered from a vessel 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 using snorkel, SCUBA, or by vessel.

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

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 also 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, side scan sonar systems, and ES-60 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 of pings per minute.

The underwater “soundscapes” (acoustic environments) of the east coast sanctuaries are composed of anthropogenic (sounds produced by a variety of human activities), biological (sounds produced by animals) and geophysical (wind, waves and other physical forces that produce sound) components. These contributions vary significantly over time and space. Overall, the dominant contributions to east coast sanctuary 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 the side-scan and multi-beam, 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 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

About 250 other sampling operations are expected to take place per year in all three NEGL region sanctuaries, with the great majority occurring at SBNMS. 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 NEGL region will spend about 220 days each year on vessel operations, approximately one-half at SBNMS. The general operation of vessels has the potential to have adverse, but less than significant impacts on the acoustic environment due to the movement of vessels through water and the operation of propulsion machinery and other vessel-related equipment including depth sounders. The overall intensity of the vessel operations is limited and episodic. Compared against the ocean and great lakes ambient acoustic environment and existing shipping traffic background noise, the addition of sanctuary vessel operations is expected to have limited and direct less than significant adverse impacts.

Activities with negligible impacts

SCUBA/Snorkel Operations

About 600 dives per year are expected to take place in all three sanctuaries in the NEGL region, with the majority occurring in TBNMS and MNMS. SCUBA/snorkel operations are expected to result in negligible effects on the acoustic environment due to the lack of significant noise emitted in SCUBA diving or snorkeling activities.

Vessel Maintenance

It is estimated that approximately 95 days of vessel maintenance will be required each year to support the ONMS vessels which operate in the NEGL sanctuaries. 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, 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 the acoustic environment are expected to be negligible.

Summary of Effects on Physical Resources

The effects on physical resources from Alternative 1 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; and prevented 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 both less than significant beneficial and less than significant adverse impacts

Deployment of AUV/ROV/Gliders/Drifters

It is anticipated that there will be approximately 45 deployments of AUVs/ROVs conducted annually in the NEGL region, equally spread over the three national marine sanctuaries. 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, which are used predominantly for scientific or educational purposes, increases the understanding and appreciation of the biological environment thereby enhancing management strategies to protect biological 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 long-term, indirect, less than significant beneficial effects to affected areas.

Deployment of AUV/ROV/gliders/drifters is expected to result in short term, less than significant adverse effects on biological habitat including sessile invertebrates 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, operators are trained to serve as models of best practices, and as such, through the use of these best practices, potential adverse effects to habitat from these operations are mitigated. In addition, the high mobility of these tools prevents overuse of any specific location.

Deployment of Equipment on the Seafloor

There are about 40 buoys deployed annually in the NEGL region, with the majority of wreck buoys in TBNMS (the NEGL Region installs 1-3 new installations, and deploys and retrieves approximately 37 buoys per year). The use of seafloor deployed equipment has several beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity and habitats; monitoring; boating and transit safety; and support for the development of education and outreach materials for the public. 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 biological resources in the long-term. These benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

Furthermore, seafloor deployed equipment, such as instrumentation placed on data buoys designed for biological data collection and monitoring, 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. Further, mooring buoys deployed to the seafloor by ONMS staff, are frequently used by visiting boaters prevent anchor damage to the seafloor. As a result, these deployments are expected to result in indirect, short-term and long-term effects that are less than significant beneficial, because these effects are localized to the affected habitat.

Because virtually all seafloor substrates in sanctuaries host some organisms, disturbing the seafloor with deployments of buoys or other equipment 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 disturbance. 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 short-term and direct adverse effects of these buoy deployments on the physical environment are expected to be less than significant, because these effects are localized and the buoys are light weight and designed for quick release to prevent damage to bottom habitats and organisms. Further, deploying moored instruments on the seafloor is expected to have, at most, short-term, temporary effects including localized mortality of organisms residing on the benthos directly impacted by the instrument or mooring.

Deployment of Remote Sensing Equipment

It is estimated that about 105 deployments of remote sensing equipment occur annually in the NEGL region, equally spread over the three national marine sanctuaries. Remote sensing has several beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity and habitats; the indirect benefits of developing education and outreach materials for public education; 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 benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

Furthermore, deployment of remote sensing equipment, such as instrumentation on data buoys, has indirect beneficial impacts on habitat resources by allowing 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 research and management plans that address environmental changes (*i.e.*, ocean acidification). As another example, the development of

hydrographic 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. Hydrographic surveying also enables the generation of more accurate navigational charts, thus reducing the likelihood of habitat destruction due to vessel groundings. As a result, these deployments are expected to result in less than significant, long-term, indirect benefits.

Possible adverse effects on habitat from remote sensing operations may occur if the equipment impacts or causes changes to habitat. Normal operations preclude this possibility, and as such, any adverse effects on habitat associated with these deployments are expected to be short-term, direct and less than significant.

Other Sampling Activities

About 250 other sampling operations are expected to take place per year in all three NEGL region sanctuaries, with the great majority occurring at SBNMS. These other sampling activities have several beneficial impacts on biological resources including data collection for future study; increased understanding of individual species, biodiversity and habitats; improved conservation and management of resources; increased public awareness and enabling the development of public education and outreach materials 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 benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

Furthermore, 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 improve the monitoring of habitat conditions and changes. This gives managers better information to use when developing future research and management plans. As a result, these activities are expected to result in less than significant, long-term, indirect benefits.

The use of other sampling technology and operations, particularly those involving collecting, capturing and tagging individual animals, may have some adverse impacts to marine habitats. For example, because virtually all seafloor substrates serve as habitat for some form of organism, disturbing the seafloor with equipment and/or collecting samples can adversely affect such habitat. Similar disturbances to habitat may also occur in projects that involve injury assessment and restoration activities. While there may be some adverse impacts, the effects are expected to be less than significant because most sampling devices deployed on the seafloor are relatively small in size and few in number and thus only a very small portion of the sanctuaries' habitats are affected. In addition, the deployment of these devices is generally either temporary, or for long durations such that they stay in place for a long-time and remain undisturbed. 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

possible. The overall habitat impacts are expected to be short-term, direct, and localized. Therefore, they are less than significant.

SCUBA/Snorkel Operations

About 600 dives per year are expected to take place in all three sanctuaries in the NEGL region, with the majority occurring in TBNMS and MNMS. The results of ONMS SCUBA/snorkel operations, which are conducted predominantly for scientific or educational purposes, increase the understanding and appreciation of biological resources thereby 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 long-term, indirect, less than significant beneficial effects on the biological environment.

SCUBA/snorkel operations are expected to result in less than significant adverse effects, because effects on the biological habitat are short term and localized. Sessile invertebrates will be affected due to the minor and limited disturbance of the water column and bottom habitats (*e.g.*, live bottom benthic communities, coral) 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 the ONMS best management practices to avoid improper actions that can cause harm to affected habitats.

Vessel Operations

The NEGL region is expected to spend about 220 days each year on vessel operations, approximately one-half at SBNMS. In general, conducting vessel operations allows sanctuary personnel to be on the water enforcing compliance and 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. These operations are expected to result in direct and indirect, less than significant beneficial impacts to habitat, invertebrates, fish, birds and protected species in affected areas.

The operation of vessels has the potential to have adverse, but less than significant, direct impacts on habitat resources from anchoring and from unintentional striking or groundings. Fixed moorings are used whenever possible to minimize impacts from anchoring, and vessel operations are relatively episodic and low intensity. In addition, vessel operators are highly trained and will apply the NOAA Small Boat Program and sanctuary standing orders and procedures to avoid direct impacts to habitat resources. The NOAA Small Boat program also 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, and they are

trained to serve as models of best practices, and thus, through the use of these best practices, mitigate the potential to harm habitat in the course of vessel operations.

Activities with negligible impacts

Vessel Maintenance

It is estimated that approximately 95 days of vessel maintenance will be required each year to support the ONMS vessels, which operate in the NEGL sanctuaries. 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 habitat resources 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) 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 habitat resources are expected to be negligible.

Invertebrates

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

Deployment of AUV/ROV/Gliders/Drifters

It is anticipated that there will be approximately 45 deployments of AUVs/ROVs conducted annually in the NEGL region, equally spread over the three national marine sanctuaries. Deployment of AUV/ROV/gliders/drifters, which are used predominantly for scientific or educational purposes, increases the understanding and appreciation of the biological environment thereby enhancing management strategies to protect biological 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 long-term, indirect, less than significant beneficial effects to affected areas.

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 minor and limited, short-term impact caused by these tools. While intentional or accidental improper operator techniques are possible, operators utilizing these assets are trained to serve as models of best practices, and thus, through the use of these best practices, mitigate the potential for adverse impacts. In addition, the high mobility of these tools helps to prevent overuse of any specific location. Thus, these operations may result in less than significant, short term, adverse effects to the biological environment.

Deployment of Equipment on the Seafloor

There are about 40 buoys deployed annually in the NEGL region, with the majority being wreck buoys in TBNMS (the NEGL Region installs 1-3 new installations, and deploys and retrieves approximately 37 buoys per year). The use of seafloor deployed equipment has several beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity and habitats; monitoring; boating and transit safety; and support for the development of education and outreach materials for the public. 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 biological resources in the long-term. These benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

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. Due to the transitory nature of most of these devices, as well as the limited scope of each study relative to the size of the region, these adverse effects from these deployments are expected to result in an overall less than significant impact to invertebrates.

Deployment of Remote Sensing Equipment

It is estimated that about 105 deployments of remote sensing equipment occur annually in the NEGL region, equally spread over the three national marine sanctuaries. Remote sensing has several beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity and habitats; the indirect benefits of developing education and outreach materials for public education; 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 benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

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 is 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 benthic organisms by the gear itself. The transitory nature of these devices, as well as the limited scope of each study relative to the size of the region is, however, expected to result in effects that are less than significant. In addition, 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 single and multi-beam sonar use profiled here for SBNMS and MNMS suggests that implications for the use of acoustics in 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

About 250 other sampling operations are expected to take place per year in all three NEGL region sanctuaries, with the great majority occurring at SBNMS. These other sampling activities have several beneficial impacts on biological resources including data collection for future study; increased understanding of individual species, biodiversity and habitats; improved conservation and management of resources; increased public awareness and enabling the development of public education and outreach materials 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 benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

It is possible that other sampling activities may result in indirect, adverse effects on 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 relative to the size of the region, however, is expected to result in effects that are less than significant. The sampling of sand lance, soft sediments and invertebrate fauna 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 biological resources.

SCUBA/Snorkel Operations

About 600 dives per year are expected to take place in all three sanctuaries in the NEGL region, with the majority occurring in TBNMS and MNMS. The results of ONMS SCUBA/snorkel operations, which are conducted predominantly for scientific or educational purposes, increase the understanding and appreciation of biological resources thereby 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 long-term, indirect, less than significant beneficial effects on the biological environment.

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 prolonged disturbance of animals in any one location. In addition, sanctuary divers and snorkelers are highly trained and will employ the 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 effects, because these effects are short-term and localized.

Vessel Operations

The NEGL region is expected to spend about 220 days each year on vessel operations, approximately one-half at SBNMS. In general, conducting vessel operations allows sanctuary personnel to be on the water enforcing compliance and 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. These operations are expected to result in direct and indirect, less than significant beneficial impacts to habitat, invertebrates, fish, birds and protected species in affected areas.

The operation of vessels has the potential to have adverse, but less than significant direct and indirect, short-term impacts on invertebrates. Generally, these impacts are from anchoring and from temporary displacement due to vessel movement. Whenever possible, ONMS staff make efforts to conduct vessel anchoring operations in locations where concentrations of invertebrates are low (*i.e.*, sand).

Activities with negligible impacts

Vessel Maintenance

It is estimated that approximately 95 days of vessel maintenance will be required each year in the NEGL sanctuaries. 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 habitat resources 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) 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 invertebrates, birds and protected species are expected to be negligible.

Fish

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

Deployment of AUV/ROV/Gliders/Drifters

It is anticipated that there will be approximately 45 deployments of AUVs/ROVs conducted annually in the NEGL region, equally spread over the three national marine sanctuaries. Deployment of AUV/ROV/gliders/drifters, which are used predominantly for scientific or educational purposes, increases the understanding and appreciation of the biological environment

thereby enhancing management strategies to protect biological 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 long-term, indirect, less than significant beneficial effects to affected areas.

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 minor and limited, short-term impact caused by these tools. While intentional or accidental improper operator techniques are possible, operators utilizing these assets are trained to serve as models of best practices, and thus, through the use of these best practices, mitigate the potential for adverse impacts. In addition, the high mobility of these tools helps to prevent overuse of any specific location. Thus, these operations may result in less than significant, short term, adverse effects to the biological environment.

Deployment of Equipment on the Seafloor

There are about 40 buoys deployed annually in the NEGL region, with the majority being wreck buoys in TBNMS (the NEGL Region installs 1-3 new installations, and deploys and retrieves approximately 37 buoys per year). The use of seafloor deployed equipment has several beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity and habitats; monitoring; boating and transit safety; and support for the development of education and outreach materials for the public. 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 biological resources in the long-term. These benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

Some seafloor deployed instrumentation is expected to result in negligible impacts to sanctuary biological resources. As discussed further below, it is also possible, however unlikely, that the equipment could unintentionally come into contact with an organism that is harmed by the deployment, and thus result in a less than significant, direct impact to the biological environment.

Deployment of Remote Sensing Equipment

It is estimated that about 105 deployments of remote sensing equipment occur annually in the NEGL region, equally spread over the three national marine sanctuaries. Remote sensing has several beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity and habitats; the indirect benefits of developing education and outreach materials for public education; 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 benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

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. As a result, these deployments are expected to result in less than significant, long-term, indirect benefits.

The possible adverse or beneficial effects of remote sensing operations on fish 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 fish through behavioral disturbances caused by the instruments themselves; or more directly through direct contact of fish by the gear itself. Some remote sensing equipment (*i.e.*, side scan sonar) emits sound that may have a short-term, temporary impact on the biological environment. Side scan imagery can pick up the signature of biological organisms, including sharks and marine mammals, which has the slight potential of altering their behavior. Thus, it is possible that remote sensing equipment may indirectly adversely affect fish through behavioral disturbances caused by the instruments themselves; or more directly through direct contact of fish by the gear itself. The transitory nature of these devices, as well as the limited scope of each study relative to the size of the region, is expected to result in effects that are less than significant.

Other Sampling Activities

About 250 other sampling operations are expected to take place per year in all three NEGL region sanctuaries, with the great majority occurring at SBNMS. These other sampling activities have several beneficial impacts on biological resources including data collection for future study; increased understanding of individual species, biodiversity and habitats; improved conservation and management of resources; increased public awareness and enabling the development of public education and outreach materials 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 benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

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). As a result, these activities are expected to result in less than significant, long-term, indirect benefits.

These activities include tagging of whales, seabirds, or fish; catching sand lance for wildlife investigations; and sampling soft sediments and representative invertebrate fauna on boulders and gravel. The sampling of sand lance, soft sediments and invertebrate fauna 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 biological resources.

Furthermore, 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 relative to the size of the region, is expected to result in effects that are less than significant.

Activities with only less than significant beneficial impacts

SCUBA/Snorkel Operations

About 600 dives per year are expected to take place in all three sanctuaries in the NEGL region, with the majority occurring in TBNMS and MNMS. The results of ONMS SCUBA/snorkel operations, which are conducted predominantly for scientific or educational purposes, increase the understanding and appreciation of biological resources thereby 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 indirect beneficial impacts that are less than significant because they are long-term.

Vessel Operations

The NEGL region is expected to spend about 220 days each year on vessel operations, approximately one-half at SBNMS. In general, conducting vessel operations allows sanctuary personnel to be on the water enforcing compliance and 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. These operations are expected to result in direct and indirect beneficial impacts to habitat, invertebrates, fish, birds and protected species in affected areas that are less than significant because they are limited in scope.

Birds

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

Deployment of AUV/ROV/Gliders/Drifters

It is anticipated that there will be approximately 45 deployments of AUVs/ROVs conducted annually in the NEGL region, equally spread over the three national marine sanctuaries. Deployment of AUV/ROV/gliders/drifters, which are used predominantly for scientific or educational purposes, increases the understanding and appreciation of the biological environment thereby enhancing management strategies to protect biological 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 long-term, indirect, less than significant beneficial effects to affected areas.

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 minor and limited, short-term impact caused by these tools. While intentional or accidental improper operator techniques are possible, operators utilizing these assets are trained to serve as models of best practices, and thus, through the use of these best practices, mitigate the potential for adverse impacts. In addition, the high mobility of these tools helps to prevent overuse of any specific

location. Thus, these operations may result in adverse effects to the biological environment that are less than significant, because they are short-term.

Deployment of Equipment on the Seafloor

There are about 40 buoys deployed annually in the NEGL region, with the majority being wreck buoys in TBNMS (the NEGL Region installs 1-3 new installations, and deploys and retrieves approximately 37 buoys per year). The use of seafloor deployed equipment has several beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity and habitats; monitoring; boating and transit safety; and support for the development of education and outreach materials for the public. 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 biological resources in the long-term. These benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

Some seafloor deployed instrumentation is expected to result in negligible impacts to sanctuary biological resources. As discussed further below, it is also possible, however unlikely, that the equipment could unintentionally come into contact with an organism that is harmed by the deployment, and thus result in less than significant, direct impact to the biological environment.

Deployment of Remote Sensing Equipment

It is estimated that about 105 deployments of remote sensing equipment occur annually in the NEGL region, equally spread over the three national marine sanctuaries. Remote sensing has several beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity and habitats; the indirect benefits of developing education and outreach materials for public education; 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 benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

Other Sampling Activities

About 250 other sampling operations are expected to take place per year in all three NEGL region sanctuaries, with the great majority occurring at SBNMS. These activities include tagging of whales, seabirds, or fish; catching sand lance for wildlife investigations; and sampling soft sediments and representative invertebrate fauna on boulders and gravel. These other sampling activities have several beneficial impacts on biological resources including data collection for future study; increased understanding of individual species, biodiversity and habitats; improved conservation and management of resources; increased public awareness and enabling the development of public education and outreach materials 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 benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

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 in the management and protection of these animals. These beneficial effects are expected to be long-term and less than significant.

Conducting standardized transects with a research vessel to count seabirds, which may temporarily affect their behavior. They also include applying micro-satellite tracking tags and obtaining tissue samples from seabirds, which could result in short-term, temporary injury; however, the injuries are generally minor and the seabirds are expected to recover from these manipulations. These sampling operations may adversely impact a small number of birds but their effects are expected to be short-term and less than significant.

Vessel Operations

The NEGL region is expected to spend about 220 days each year on vessel operations, approximately one-half at SBNMS. In general, conducting vessel operations allows sanctuary personnel to be on the water enforcing compliance and 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. These operations are expected to result in direct and indirect, less than significant beneficial impacts to habitat, invertebrates, fish, birds and protected species in affected areas.

Such impacts are generally due to temporary displacement or changes in behavior due to presence of vessels or from vessel movements. While highly unlikely, there is also the potential for floating and diving birds have the potential to be struck by a moving vessel. The operation of vessels has the potential to have adverse, but less than significant short term direct and indirect impacts on birds.

Activities with only less than significant beneficial impacts

SCUBA/Snorkel Operations

About 600 dives per year are expected to take place in all three sanctuaries in the NEGL region, with the majority occurring in TBNMS and MNMS. The results of ONMS SCUBA/snorkel operations, which are conducted predominantly for scientific or educational purposes, increase the understanding and appreciation of biological resources thereby 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 long-term, indirect, less than significant beneficial effects on the biological environment.

Protected Species

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

Deployment of AUV/ROV/Gliders/Drifters

It is anticipated that there will be approximately 45 deployments of AUVs/ROVs conducted annually in the NEGL region, equally spread over the three national marine sanctuaries. Deployment of AUV/ROV/gliders/drifters, which are used predominantly for scientific or educational purposes, increases the understanding and appreciation of the biological environment thereby enhancing management strategies to protect biological 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 long-term, indirect, less than significant beneficial effects to affected areas.

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 minor and limited, short-term impact caused by these tools. While intentional or accidental improper operator techniques are possible, operators utilizing these assets are trained to serve as models of best practices, and thus, through the use of these best practices, mitigate the potential for adverse impacts. In addition, the high mobility of these tools helps to prevent overuse of any specific location. Thus, these operations may result in less than significant, short term, adverse effects to the biological environment.

Entanglement in ROV cables or collision with the ROV itself of protected resources – primarily marine mammals – is possible, but unlikely because the duration of operations is very limited and the operation is attended. 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, short-term adverse effects on protected species.

Deployment of Equipment on the Seafloor

There are about 40 buoys deployed annually in the NEGL region, with the majority being wreck buoys in TBNMS (the NEGL Region installs 1-3 new installations, and deploys and retrieves approximately 37 buoys per year). The use of seafloor deployed equipment has several beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity and habitats; monitoring; boating and transit safety; and support for the development of education and outreach materials for the public. The use of seafloor deployed equipment can be used for monitoring marine mammal behavior and providing information for sanctuary users to avoid interfering with the animals, thus reducing the possible deleterious impacts of human interactions with these animals. As a result, these deployments are expected to result in less than significant, long-term, indirect benefits. These benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

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 as a result. Such equipment may result in protected species 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 short-term and localized, and therefore considered to be less than significant on protected species.

Deployment of Remote Sensing Equipment

Remote sensing operations include the use of active or side-scan sonar that may adversely impact species, particularly marine mammals (some endangered) through increased noise in the environment. For example, hydrographic survey data collection uses active 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. The use of this equipment, however, is short-term and localized to the immediate vicinity of equipment, and therefore, the adverse effects of these deployments are expected to be less than significant on protected species.

Remote sensing activities include the use of both active (sound producing) and passive (listening only) technologies for a variety of uses (e.g., monitoring humpback whales and their habitat, and inventorying resources 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; better education and outreach materials for public education, which can lead to indirect benefits to living marine resources through informed management actions; and the use of hydrographic mapping as a means to improve habitat characterization and protection of seabed living and maritime heritage 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 benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

As discussed above, active acoustic sources (single beam and multi-beam sonars) may be used in NEGL sanctuaries. Single beam is anticipated to be used in MNMS and SBNMS. In SBNMS, the R/V *Auk* will employ the Simrad ES60 single beam sonar, with operating frequencies (kHz) 120/120 and 50/200 kHz, a maximum source level (dB re 1 µPa at 1 m) of 224, a ping duration of 1 milisecond, and nominal beam width (degrees) of 7°. In MNMS, sidescan sonar is often used with a frequency of 100-900 kHz from a “towfish” system, generally towed about 5-15 meters above the seafloor. Autonomous Underwater Vehicles (AUVs) are also used, and typically run 5-75 meters above the seafloor and use multibeam sonar for seafloor mapping.The multibeam echo sounder systems used on the NOAA ship *Nancy Foster* is the Furuno FE-700 (200 kHz shallow,

50 kHz deep) and Knudsen 3200 (200 kHz/12 kHz) echosounders for navigation. It is also equipped with a Reson 7125 SV2 multibeam, dual frequency (200kHz or 400kHz) shallow water system with optimal range at 5-250m. It is also equipped with the Simrad EM1002, 95kHz optimal range is 200- 1000m.

TBNMS seafloor data are collected using single and multibeam sonars. The sounder has 150˚ maximum swath width (75˚ each side) and a 500 m depth range capability. The Extended Range 8101 has a maximum transmit power of 200 dB µPa (micropascals) at 1 m. The transit pulse width is 21-225 µS (micro-seconds) at 240 kHz. The ping rate range is 1-40 pings/second, governed by the "round-trip" transit and receive time" of the selected range. However, because there are no fresh water mammals found in TBNMS, there is no impacts anticipated and no further analysis is provided in this subsection.

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[8] which provides acoustic thresholds for onset of permanent threshold shift (PTS) and temporary threshold shifts (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

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

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 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). The spreading for a single beam sonar will be much smaller spread than a multibeam. Single beam sonar used in NE sanctuaries have a beam width of 7 degrees, compared with 140 degrees for a multibeam. Figure 2 shows the modeled sound spreading of a single beam echosounder similar to the sonar used in the NEGL. (NEFSC LOA 2015). Figures 3a and 3b 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. However, note that the multibeam systems used for MNMS will be operated at fairly short distances (5 – 75 m) from the seafloor, so the ensonified volume is likely far less.

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 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). Single beam sonars are highly directional with very narrow beam widths (in this case, 7 degrees), and very short

pulses at limited ping rates. These two characteristics of this type of sonar decrease the probability of the animals being subjected to TTS threshold intensity levels (see Figures 2 and 3).

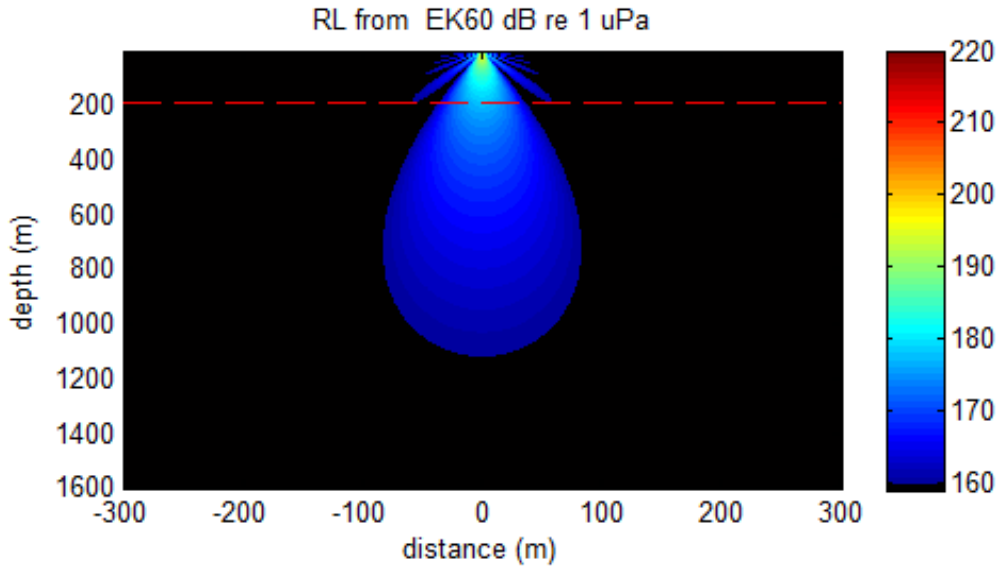
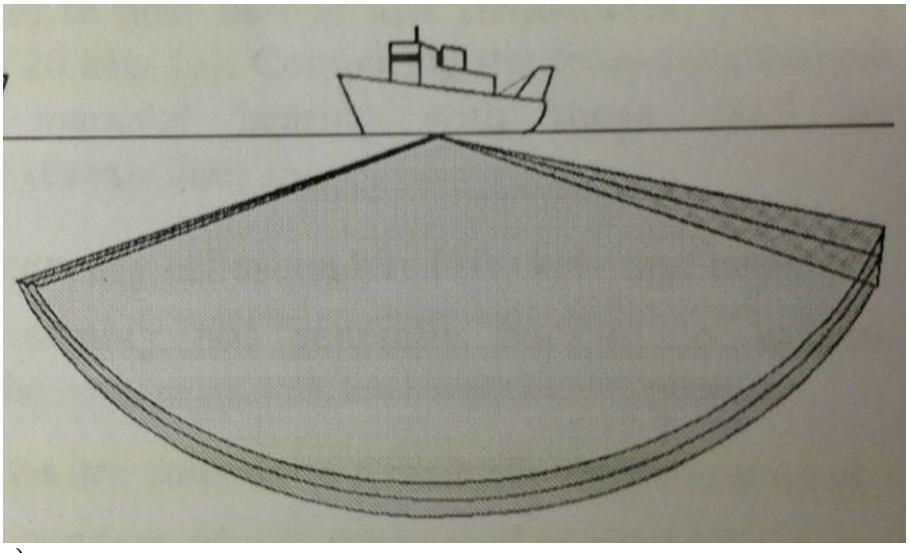
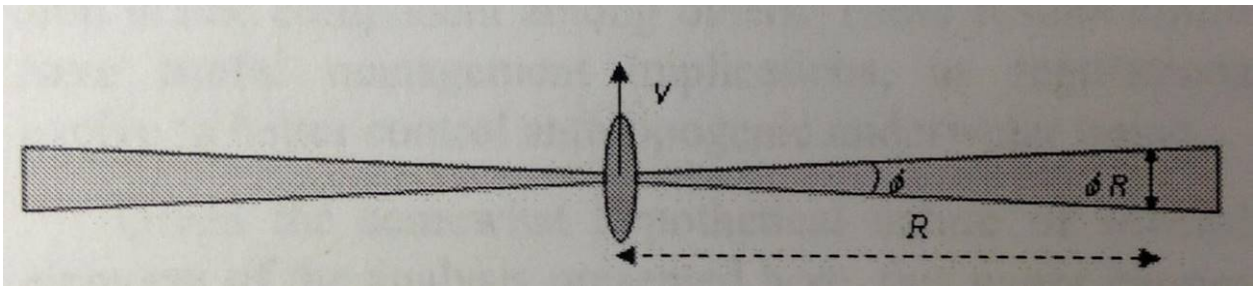


Figure 2. Visualization of a 2-dimensional slice of modeled sound propagation to illustrate the predicted area ensonified to the 160 dB level by an EK-60 operated at 18 kHz. Note that the *R/V Auk* uses the ES-60, which is single beam width of 7 degrees, while the EK-60 is a has a beam width of 11 degrees at 18 kHz. However, the beam width is a surrogate for illustrative purposes. (NMFS 2014)

The dashed red line marks the transition between the two depth strata (0-200m and >200m)



a)



b)

Figure 3(a) and (b) Diagrams showing a typical multibeam ensonification volume from a) the horizontal and b) the overhead prospective (From Lurton & DeRuiter 2011). Note that the beam width of a multibeam system is

In the unlikely event submerged animals are caught in the narrow ensonification beam as the ship passes, those animals will be only briefly subjected to the elevated sound levels occurring inside the transmitter beam pattern. Furthermore, the narrow beam widthprovides 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 single and 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. As mentioned previously, mid-frequency cetaceans is the group that may be affected by the use of multibeam sonar systems. See Appendix B for a representative list of cetacean hearing ranges.

Finally, to further address the unlikely impacts to marine mammals, observers on the bridge or the marine mammal observation deck will carefully monitor for the presence of marine protected species[9], and permitted personnel would follow the BMPs listed above, thereby minimizing disturbance. Shallow water mapping would be conducted during daylight hours as much as possible and only with cetacean observers present. If cetaceans are present within 200 meters of the ship, the vessel would stop until the animals depart the area. 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

[9] The Bluefin vehicle will be equipped with a low frequency 260khz Delta-T Multibeam sonar for wide area survey and obstacle avoidance.

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 non existent (humpbacks) to negligible (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.

Marine Mammals

As noted in source descriptions above, the majority of the active acoustic work conducted within SBNMS and at MNMS uses mid to higher frequencies. Thus, although SBNMS includes key habitat used by several species of low frequency active cetaceans, the hearing sensitivities of these species are presumed not to optimize detection of these sources (see Appendix A). Mid-frequency cetaceans are thus the focus of impact consideration for this work. However, the sources assessed here are downward facing, do not propagate over large distances (due to high attenuation of higher frequencies) and are strongly directional (constrained within narrow beams). This means that individual animals would need to be in very close range of the source, and located below it to be exposed to higher intensities capable of inducing physical injury to ears or causing behavioral responses. Such risk is minimized through the application of mitigations discussed below, therefore, any adverse impacts to marine mammals are expected to be less than significant.

Other Listed Species

There are a number of other ESA species in SBNMS and MNMS including four species of sea turtle: Kemp's Ridley, Green, Leatherback, and Loggerhead as well as the Atlantic sturgeon. The mid to higher frequencies emitted by the sources assessed here have not been documented to disturb these species. Turtles are believed to be mostly low frequency sensitive. In their PEA, NOAA's Office of Coast Survey found that their similar acoustic work "may affect, but not likely to adversely affect" any Endangered Species as part of ESA Section 7 Consultation with NMFS. Therefore, any adverse impacts to protected species are expected to be less than significant.

Mitigation and Monitoring

SBNMS incorporates operational mitigation measures into its survey activities to reduce or avoid impacts wherever practicable. Vessels operate at slow speed (4-12 knots) during survey effort. SBNMS uses downward-facing, mid to high frequency sources outside of the highest hearing sensitivity ranges for most offshore-centric local cetacean species. SBNMS requires that a designated lookout stand watch on the vessel's bridge during transit and survey operations, scanning the water for humans, animals, vessels, and other objects.

Other Sampling Activities

About 250 other sampling operations are expected to take place per year in all three NEGL region sanctuaries, with the great majority occurring at SBNMS. These activities include tagging of whales, seabirds, or fish; catching sand lance for wildlife investigations; and sampling soft sediments and representative invertebrate fauna on boulders and gravel. These other sampling activities have several beneficial impacts on biological resources including data collection for future study; increased understanding of individual species, biodiversity and habitats; improved conservation and management of resources; increased public awareness and enabling the development of public education and outreach materials 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 benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

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 how such waves affect whale foraging. These operations support long-term scientific studies that are intended to aid sanctuary management decisions. Further, large whale disentanglements – considered a form of other sampling activity - 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. These indirect benefits are expected to be less than significant and short-term given that such disentanglement events are very rare and usually involve a single animal, and that the publicity from any single event may fade quickly unless education and outreach programs continue to inform the public of the dangers of entanglements. Collectively, the beneficial results from the other sampling activities in the NEGL region sanctuaries are expected to be, direct and indirect, long and short term, and less than significant.

Tagging whales with temporary digital tags that adhere to the skin with suction cups is non-invasive but has the slight potential to alter their behavior on a short-term, temporary basis, similarly to disentanglement efforts. We use passive acoustic moorings and pop-up buoys. In order to retrieve these moorings or buoys we need to establish communication between the buoy and the research vessel and then send a high frequency (above 100kHz) short duration (several seconds) and relatively low intensity (~ 150 dB re 1 uPa) signal to the buoy to release it from its mooring and float to the surface. Ensonification from this signal is minimal, both in time and space. There are not predicted to be any long term effects from these sounds on protected species. Additionally, operating a research vessel in close proximity to whales specifically to adhere tags (which is much closer than a vessel otherwise would approach a whale) can have short-term temporary effects on their behavior, and carries the very remote risk of the vessel striking the animal. As a result, these activities are expected to have adverse impacts that are short-term, direct and less than significant.

Vessel Operations

The NEGL region is expected to spend about 220 days each year on vessel operations, approximately one-half at SBNMS. In general, conducting vessel operations allows sanctuary personnel to be on the water enforcing compliance and 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. These operations are expected to result in direct and indirect, less than significant beneficial impacts to habitat, invertebrates, fish, birds and protected species in affected areas.

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 the presence or movements of vessels. While unlikely, there is also the potential for protected species to be struck by a moving vessel. Smaller vessels are typically faster, but have higher maneuverability and shallower draft compared to larger vessels; therefore, they are less likely to collide with and injure protected species. Except for law enforcement purposes, larger vessels tend to move slower but have less maneuverability and deeper draft, which means they require more time and distance to avoid a collision with a surface hazard such as a marine mammal or other protected species. For that reason, larger vessels (but still within the NOAA small boat class) have increased crew requirements per the NOAA Small Boat Program and sanctuary program standing orders in order to better detect the presence of protected species in the path or vicinity of the vessel.

Best practices were being followed at the time of the 2009 whale strike in SBNMS. However, at the time best practices were a maximum speed of 20 knots, having a dedicated observer, and checking available data for reports of whales in operational area prior to departing. Best practices were revised after the whale strike and codified in two standing orders for vessel operations: vessel speed and operations around marine mammals. The vessel speed standing orders lowered the maximum vessel speed from 20 knots to 16 knots or 10 knots when a SMA/DMA is in effect. The operations around marine mammals standing orders requires a dedicated whale observer, following whale watching guidelines, and including in the daily cruise plan any reports on whale sightings. In addition to these requirements, the vessel crew is required to receive the Whale Sense training every year.

Regardless of boat size, operators of sanctuary vessels employ ONMS best management practices of sanctuary, ESA and marine mammal regulations. In addition, because they are highly trained and will employ the 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. These practices serve to mitigate the potential adverse impacts vessel operations on protect species. The combination of a limited number of days at sea,

large operational areas, and the small number of vessels operated by ONMS further decreases the likelihood of impacts to protected species residing in the sanctuaries or in waters through which ONMS vessels transit. 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

About 600 dives per year are expected to take place in all three sanctuaries in the NEGL region, with the majority occurring in TBNMS and MNMS. The results of ONMS SCUBA/snorkel operations, which are conducted predominantly for scientific or educational purposes, increase the understanding and appreciation of biological resources thereby 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 long-term, indirect, less than significant beneficial effects on the biological environment.

Summary of Effects on Biological Resources

The effects on biological resources from Alternative 1 are expected to be negligible or less than significant (beneficial and adverse, depending on the type of operations). These operations are expected to result in improved compliance with sanctuary regulations, increased characterization of biological resources enhancing conservation and management of living resources; data collection for future study; 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 a biological resource such as tagging a seabird. Digital tagging of whales or attempts to tag constitutes a taking under the MMPA and ESA, and consultation with NMFS is required for that activity. Tagging is non-invasive but has the potential to alter behavior on a short-term, temporary basis. Collecting samples of species are expected to have a less than significant adverse impact because the amount of biomass collected is not expected to result in species or population-level effect.

In addition, ONMS has determined that active acoustics equipment activities will result in very little risk of injury to marine mammals and other endangered species in SBNMS, as well as very little risk of injury to other sanctuary resources such as fish and marine invertebrates. Risk is minimized due to source characteristics (higher frequency and highly directional sources) and additional mitigations applied (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

About 250 other sampling operations are expected to take place per year in all three NEGL region sanctuaries, with the great majority occurring at SBNMS. The information gleaned from 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 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 considered 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 due to their short-term nature and localized scope, these effects will be short-term, localized and less than significant if not negligible.

Activities with less than significant beneficial and negligible impacts

Deployment of Equipment on the Seafloor

There are about 40 buoys deployed annually in the NEGL region, with the majority of wreck buoys in TBNMS. 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 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 considered less than significant.

The use of buoys to aid navigation is beneficial to marine transport as they assist in preventing groundings in shallow areas. As a result, these deployments are expected to have benefits that are long-term, indirect and 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

It is estimated that about 105 deployments of remote sensing equipment occur annually in the NEGL region, equally spread over the three national marine sanctuaries. 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. Thus, the socioeconomic environment stands to 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 considered less than significant.

The use of remote sensing to develop bathymetric maps is beneficial to marine navigation as they assist in preventing groundings. As a result, these deployments are expected to have benefits that are long-term, indirect and 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 will be short-term and negligible.

Activities with negligible impacts

Vessel Maintenance

It is estimated that approximately 95 days of vessel maintenance will be required each year to support the ONMS vessels which operate in the NEGL sanctuaries. Vessel maintenance activities are highly unlikely to have any effect on marine transport because they are low intensity, episodic and typically conducted pier-side or on land, and therefore, would not be expected to interfere with marine or Great Lakes shipping activities. Therefore, the effects of vessel maintenance on maritime transportation would be negligible.

Research and Education

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

Other Sampling Activities

About 250 other sampling operations are expected to take place per year in all three NEGL region sanctuaries, with the great majority occurring at SBNMS. Sanctuary research and education that derive 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, all designed to both better protect and manages sanctuary resources and offer improved socioeconomic opportunities to users and constituents. These activities are expected to result in short or long-term, direct or indirect, and less than significant impacts to the affected research and education resources.

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

Activities with less than significant beneficial and negligible impacts

Deployment of Equipment on the Seafloor

There are about 40 buoys deployed annually in the NEGL region, with the majority of wreck buoys in TBNMS. 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). Given the long-term nature of scientific study these beneficial effects are considered 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

It is estimated that about 105 deployments of remote sensing equipment occur annually in the NEGL region, equally spread over the three national marine sanctuaries. 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. Thus, the socioeconomic environment stands to 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 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 will be short-term and negligible.

Activities with only less than significant beneficial impacts

Deployment of AUV/ROV/Gliders/Drifters

There are about 45 deployments of AUVs/ROVs conducted annually in the NEGL region, equally spread over the three national marine sanctuaries. Deployment of AUV/ROV/gliders/drifters in sanctuaries is 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 learn more 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 in each sanctuary stands to gain a benefit since many trade, tourism, recreation, research, and commercial ventures depend on the vitality of the sanctuaries.

SCUBA/Snorkel Operations

About 600 dives per year are expected to take place in all three sanctuaries in the NEGL region, with the majority occurring in TBNMS and MNMS. 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 learn more 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 in each sanctuary stands to gain a benefit since many trade, tourism, recreation, research, and commercial ventures depend on the vitality of the sanctuaries.

Vessel Operations

The NEGL region will spend about 220 days each year on vessel operations, approximately one-half at SBNMS. Conducting vessel operations allows sanctuary personnel to be on the water providing direct and indirect less than significant beneficial impact to the socioeconomic environment through enforcing compliance with sanctuary and other regulations and thereby providing a suitable environment for research and education. In addition, the enforcement of compliance serves to heighten general awareness to other users so that they may avoid impacts to sanctuary resources. Vessels serve as platforms for research activities which are analyzed elsewhere in this document.

Activities with negligible impacts

Vessel Maintenance

It is estimated that approximately 95 days of vessel maintenance will be required each year to support the ONMS vessels which operate in the NEGL sanctuaries. Vessel maintenance activities are highly unlikely to have any effect on research and education because they are low intensity, episodic and typically conducted pier-side or on land, and therefore, would be expected to be negligible and to not interfere with research and education activities.

Human Use (Fishing, Recreation, Tourism)

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

Deployment of Equipment on the Seafloor

There are about 40 buoys deployed annually in the NEGL region, with the majority of wreck buoys in TBNMS. 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 is expected to result in 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 by vessels. This impact is expected to be very localized and short-term, and therefore, less than significant.

Deployment of Remote Sensing Equipment

It is estimated that about 105 deployments of remote sensing equipment occur annually in the NEGL region, equally spread over the three national marine sanctuaries. Sanctuary operations foster a greater awareness and appreciation for sanctuary resources, which in turn promotes public use of a 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 exhibit less than significant beneficial, short-term and direct impacts to the socioeconomic environment. 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 is expected to result in a less than significant benefit to fishermen and those associated with the fishing industry.

The only possible adverse socioeconomic impacts from normal remote sensing operations would occur if the equipment somehow interfered with other uses and users of sanctuary resources. This is a remote scenario, and any effects would likely be short-term and less than significant.

Other Sampling Activities

About 250 other sampling operations are expected to take place per year in all three NEGL region sanctuaries, with the great majority occurring at SBNMS. Sanctuary operations and other sampling activities can foster a greater awareness and appreciation for sanctuary resources, which in turn promotes public use of a sanctuary (e.g., through diving, kayaking, snorkeling, glass bottom boat excursions). Local businesses are expected to benefit from this heightened awareness. For example, applying digital tags to whales benefits whale watching activities by providing additional information for the on-board naturalists to discuss thus enhancing passengers' experience and appreciation for whales, and benefiting the whale-watching industry. 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 is expected to result in 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 due to their short-term nature and localized scope, these effects will be short-term, localized and less than significant if not negligible.

Activities with only less than significant beneficial impacts

Vessel Operations

The NEGL region will spend about 220 days each year on vessel operations, approximately one-half at SBNMS. 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

About 600 dives per year are expected to take place in all three sanctuaries in the NEGL region, with the majority occurring in TBNMS and MNMS. SCUBA/snorkel operations are expected to have a less than significant, short-term, localized adverse effect on sanctuary users due to the potential for temporary displacement of fishing activity when divers or snorkelers are present conducting sanctuary operations.

Activities with negligible impacts

Vessel Maintenance

It is estimated that approximately 95 days of vessel maintenance will be required each year to support the ONMS vessels which operate in the NEGL sanctuaries. Vessel maintenance activities are highly unlikely to have any effect on other human uses because they are low intensity, episodic and typically conducted pier-side or on land, and therefore, would be expected to be negligible and to not interfere with fishing, recreation, and overall tourism activities.

Summary of Effects on the Socioeconomic Environment

The effects on socioeconomic resources are expected to 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 are expected to outweigh the possible short-term negative 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

There are about 45 deployments of AUVs/ROVs conducted annually in NEGL region, equally spread over the three national marine sanctuaries in the NEGL region. 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, it is expected that the historical environment

will be better protected, restored, or preserved. Thus, these resources stand to 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

There are about 40 buoys deployed annually in the NEGL region, with the majority of wreck buoys in TBNMS. 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 mangers locate and document new archaeological sites; lead to enhanced resource characterization, protection and management; raise public awareness; prevent 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 long-term, localized, and therefore, less than significant.

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 impacts 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 training in NHPA protocols designed to mitigate any harm to maritime resources. Consequently, the expected possibility of any serious harm to historic artifacts is quite small. Accordingly, the effects of these operations on such resources are expected to be long-term, localized, and therefore, less than significant.

Some other benthic sampling activities could potentially occur in the vicinity of historic and cultural resources and may 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 removing important historic resources, but again the possibility of this is expected to be 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. As a result, only less than significant adverse impacts are expected.

Deployment of Remote Sensing Equipment

It is estimated that about 105 deployments of remote sensing equipment occur annually in the NEGL region, equally spread over the three national marine sanctuaries. The use of remote sensing equipment has a 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. 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. Benefits are less than significant as they are limited in scope.

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, albeit highly improbable, adverse impact to maritime heritage resources from remote sensing operations is the physical impact of the sensing 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 removing important historic resources. As a result, the adverse impact of these deployments are expected to be direct and indirect, short- and long-term and less than significant.

Other Sampling Activities

About 250 other sampling operations are expected to take place per year in all three NEGL region sanctuaries, with the great majority occurring at SBNMS. Such operations include intertidal monitoring, whale disentanglement, reef assessments, disease reversal research, and whale surveys. The use of other sampling activities in a sanctuary has many positive and beneficial effects on maritime heritage resources because such activities may help sanctuary mangers 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 increase knowledge of these sanctuary resources so that managers and partners can work together to better protect and preserve our

maritime heritage. Given the nature of maritime archaeological operations the beneficial impacts from these activities are expected to be long-term, localized, and therefore, less than significant.

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, and destruction of historic resources by damaging extraction techniques such as using grabs or corers on the seafloor in close proximity to an artifact. These operations, however, are evaluated in advance for proximity to historic resources on the seafloor, and are conducted by personnel with experience and knowledge of NHPA protocols designed to mitigate the possibility of any serious harm to maritime resources. As a result, the adverse impact of these activities is expected to be direct, short-term and less than significant.

SCUBA/Snorkel Operations

About 600 dives per year are expected to take place in all three sanctuaries in the NEGL region, with the majority occurring in TBNMS and MNMS. SCUBA/snorkel operations are 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 all these resources. By undertaking these projects, historical and cultural resources are expected to 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 the ONMS best management practices to avoid improper actions that can cause harm to historical resources. Thus, these operations are expected to result less than significant adverse effects.

Activities with negligible impacts

Vessel Maintenance

It is estimated that approximately 95 days of vessel maintenance will be required each year to support the ONMS vessels which operate in the NEGL sanctuaries. Vessel maintenance activities are highly unlikely to have detectable effect on historical or cultural resources because they are low intensity, episodic and typically conducted pier-side or on land away from such resources. Therefore, the effects of vessel maintenance on historical or cultural resources are expected to be negligible.

Vessel Operations

The NEGL region will spend about 220 days each year on vessel operations, approximately one-half at SBNMS. Vessel operations are highly unlikely to have a detectable effect on maritime heritage resources, cultural resources or historical properties as they rarely impact any of the resources. There is, however, the remote possibility that operator error or other factors could

result in inadvertent anchoring damage to cultural resources. Therefore, the effects of vessel operations on historical or cultural resources are expected to be negligible.

Maritime Heritage and Cultural Environment

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

Deployment of AUV/ROV/Gliders/Drifters

There are about 45 deployments of AUVs/ROVs conducted annually in the NEGL region, equally spread over the three national marine sanctuaries in the NEGL region. 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, it is expected that the historical environment will be better protected, restored, or preserved. Thus, these resources stand to 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.

SCUBA/Snorkel Operations

About 600 dives per year are expected to take place in all three sanctuaries in the NEGL region, with the majority occurring in TBNMS and MNMS. SCUBA/snorkel operations are 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 all these resources. By undertaking these projects, historical and cultural resources are expected to be better protected, restored, or preserved; thus gaining benefit from these activities.

SCUBA/snorkel operations are expected to have a less than significant adverse effect on maritime heritage resources, cultural resources and historic properties. 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 the ONMS best management practices to avoid improper actions that can cause harm to historical resources. Thus, these operations are expected to result less than significant adverse effects.

Activities with only less than significant beneficial impacts

Deployment of Remote Sensing Equipment

It is estimated that about 105 deployments of remote sensing equipment occur annually in the NEGL region, equally spread over the three national marine sanctuaries. 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 activities are expected to result only in less than significant beneficial impacts due to their indirect effects.

Activities with negligible impacts

Deployment of Remote Sensing Equipment

It is estimated that about 105 deployments of remote sensing equipment occur annually in the NEGL region, equally spread over the three national marine sanctuaries. Remote sensing operations are expected to 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 Operations

The NEGL region will spend about 220 days each year on vessel operations, approximately one-half at SBNMS. Vessel operations are highly unlikely to have a detectable effect on maritime heritage resources, cultural resources or historical properties as they rarely impact any of the resources; therefore, the impacts are expected to be negligible. There is, however, the remote possibility that operator error or other factors could result in inadvertent anchoring damage to cultural resources.

Vessel Maintenance

It is estimated that approximately 95 days of vessel maintenance will be required each year to support the ONMS vessels which operate in the NEGL sanctuaries. Vessel maintenance activities are highly unlikely to have detectable effect on historical or cultural resources because they are low intensity, episodic and typically conducted pier-side or on land away from such resources. Therefore, the impacts are expected to be negligible.

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. Where the potential for adverse impacts exists, precautionary measures are taken to avoid disturbance of known maritime heritage and cultural resources.

4.2 Alternative 2: Conduct Field Operations without Voluntary or Precautionary Procedures for Vessels

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 SBNMS would be slightly different in Alternative 2. Current ONMS vessel operations best management practices would be discontinued. Since there are no voluntary measures in TBNMS, there would be no change in environmental consequences for those sites compared to Alternative 1. The only change would be in the vessel operations for SBNMS.

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. Therefore, discontinuing these best management practices could have an adverse effect on birds and protected species which are the most likely to be affected since they dwell on the surface, where vessel operations take place.

Birds

In the waters of SBNMS, operating without following the best management practices could result in vessel strikes or behavioral disturbance of seabirds, as the vessels would be able to operate at higher speeds and would not be required to 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 waters of SBNMS, operating without following the best management practices could result in vessel strikes or behavioral disturbance of marine mammals and turtles, as the vessels would be able to operate at higher speeds and would not be required to have a dedicated observer on board to reduce the risk of collision. Owing to the fact that the sanctuary has few vessels that are not on the water every day, and the fact that the vessel operator would still be on the lookout for protected species , the overall likelihood of a vessel strike with marine mammals or turtles is still low. Therefore, this could have a direct but less than significant adverse impact on protected species.

4.3 Cumulative Impacts

The cumulative effect of the proposed actions is the incremental environmental effect that the proposed actions have when added to other past, present, and foreseeable future actions in the affected environment. ONMS reviewed the projects identified under the proposed alternative 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.

4.3.1 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
- Deployment of AUVs/ROVs
- 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 activities that disturb the seafloor are commercial fishing (e.g. trawling, dredging, gillnetting, lobster trapping) and the laying of cables and pipelines, the latter of which would require a permit within the sanctuaries. With the exception of Thunder Bay National Marine Sanctuary, anchoring is not a prevalent activity on potentially affected seafloor areas either by external activities or by sanctuary activities in the NEGL region due to the depth and roughness of the water. 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.

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 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 (e.g. tankers, freighters, liquefied natural gas (LNG) carriers, tug and barge,

cruise ships), maintenance of deepwater ports for LNG, commercial fishing and Department of Defense operations. 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 do not contribute significantly to overall cumulative effects of noise pollution.

4.3.2 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
- Deployment of AUVs/ROVs
- Deployment of Remote Sensing Equipment

The following sanctuary-directed scientific activities could contribute adversely to the cumulative effects of water quality or living marine resource disturbance: operating research vessels and SCUBA dives to conduct surveys and transects; transiting of a research vessel; deploying AUVs/ROVs and towed arrays to survey habitats and biological activity, and locate archaeological artifacts; and conducting diving operations. 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 biological environment are commercial shipping (e.g. tankers, freighters, LNG carriers, tug and barge, cruise ships), vessel operations related to maintenance of deepwater ports for LNG, commercial and recreational fishing, whale watching, recreational boating, and U.S. Navy and U.S. Coast Guard operations. The effect of deep-water sewage outfalls in waters near SBNMS has been thoroughly studied for more than fifteen years and been determined to be negligible. Compared to the considerable level of external (i.e., non-sanctuary related) vessel operations and the fact that sanctuary-directed vessel operations are following self-imposed standing orders, conducted by highly trained personnel, and prohibited from 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. Neither alternative would contribute to any substantial adverse impacts on air quality or climate change. Other external activities that contribute to potential impacts on the biological environment are activities focused on marine resource protection, such as: other NOAA research, research conducted by local non-profit organizations, 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 according to ONMS best management practices by highly trained professionals, it is highly unlikely that the cumulative effect of these activities would be adverse.

4.3.3 Cumulative Effects on Socioeconomic Environment

None of the field operations analyzed in this environmental assessment are expected to result in significant disturbance to the socioeconomic environment unless some equipment malfunctioned during normal operations and adversely affected the conduct of a commercial or recreational activity. This is highly unlikely. All of the effects to the socioeconomic environment from ONMS field operations are thus expected to be either negligible, less than significantly adverse or less than significantly beneficial to the protection and management of sanctuary resources. The principal external activities that contribute to the socioeconomic environment are commercial shipping (e.g. tankers, freighters, LNG carriers, tug and barge, cruise ships), vessel operations related to maintenance of deepwater ports for LNG, commercial and recreational fishing, whale watching and recreational boating. Each of these activities likely has an order of magnitude greater impact on the socioeconomic environment of the affected areas than ONMS field operations. Therefore, the potential for adverse cumulative impacts to the socioeconomic environment in combination with other uses of the affected area is expected to be very low.

4.3.4 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 unless accidental or improper physical contact with an historic artifact occurs. 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. There is a small possibility that identifying historic sites may lead to looters or memento-seekers carrying off important historical resources, which would result in an adverse impact to these resources. All of the effects to the maritime heritage and cultural environment from ONMS field operations are thus expected to be either negligible, less than significantly beneficial or less than significantly adverse to the protection and management of sanctuary resources. The principal external activities that contribute to the maritime heritage and cultural environment are commercial shipping (e.g. tankers, freighters, LNG carriers, tug and barge, cruise ships), vessel operations related to maintenance of deepwater ports for LNG, commercial and recreational fishing, whale watching and recreational boating. Therefore, the potential for adverse cumulative impacts to the maritime heritage and cultural environment in combination with other uses of the affected area is expected to be very low.

4.4 Conclusions

Alternative 1 (Status Quo field operations with additional required mitigations resulting from consultations and permits) is expected to have overall beneficial effects to the environment as manager 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 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 expected 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 7. Summary of Anticipated Effects of Field Operations: Northeast and Great Lakes Regions based on Alternative 1

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	~/-	+/-	+	+/-

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**
Deployment of Remote Sensing Equipment	~/+/-	~/+/-	~/+/-	~/+/-
Deployment of Equipment on the Seafloor	~/+/-	~/+/-	~/+/-	~/+/-
Other Sampling Activities	~/+/-	~/+/-	~/+/-	~/+/-

Table 8. Summary of Effects by Resource Element and Alternative for Northeast and Great Lakes Sanctuaries

	Alternative 1	**Alternative 2**
RESOURCE ELEMENTS		
Physical Environment		
Geology	Activities have both less than significant adverse and less than significant beneficial impacts (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 seafloor disturbance from deployment activities, anchoring, unintentional groundings, and other sampling activities are expected to be short-term, of low intensity, and localized. ARU buoys attached to the seafloor may have localized impacts that are small in scope and marker buoys are removed at the end of each diving day. Anchor damage would be minimized by BMPs, requiring users to avoid sensitive areas, & would be small scale. 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.	Similar to Alternative 1

Water Quality	Activities have less than significant adverse impacts (vessel operations). Justification: Impacts caused by emissions from vessel operations 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.	Similar to Alternative 1
Air Quality	Activities have less than significant adverse impacts (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. 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 (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 (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: Adverse impacts from anchoring, other sampling activities, unintentionally grounding vessels, deployment of equipment, diving, and other sampling activities 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. RU buoys attached to the seafloor may have localized impacts that are small in scope and marker buoys are removed at the end of each diving day. Vessel operations increase enforcement. Characterization of habitat leads to the formation of management plans to address environmental changes. SCUBA/snorkel operations, deployment of equipment and other sampling activities can help increase public understanding and appreciation of sanctuary resources. However, benefits are localized and 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 habitat will be the same as Alternative 1 or worse. However, harm will be limited in scope.
Invertebrates	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, other	Same as Alternative 1, but there will be an additional indirect, less than significant adverse impact due to the

	sampling activities, SCUBA/snorkel operations, vessel operations). Justification: Indirect adverse impacts (e.g., temporary behavior modification or displacement), 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. Users are trained to avoid harm to resources, avoid over collection and avoid overuse of any specific location. Vessel operations increase compliance. SCUBA/snorkel operations, deployment of equipment and other sampling activities can help increase public understanding and appreciation of sanctuary resources. Characterizing species movements will improve species management and habitat protection. Benefits are limited in scope.	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.
Fish	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, other sampling activities). Some activities only 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. Vessel operations increase compliance. SCUBA/snorkel operations, deployment of equipment and other sampling activities can help increase public understanding and appreciation of sanctuary resources. Benefits are 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 and less than significant beneficial impacts (deployment of AUV/ROV/gliders/drifters, deployment of equipment on the seafloor, deployment of remote sensing equipment, other sampling activities, vessel operations). One activity has only less than significant beneficial impacts (SCUBA/snorkel operations). Justification: Adverse impacts, like temporary behavior modification or displacement from the presence of vessels, are expected to be short-term and localized. Direct collisions with vessels is highly unlikely and are expected to be small in scope. Vessel operations increase enforcement. Research will aid in management and protection of species. SCUBA/snorkel operations, deployment of equipment and other sampling activities can help increase public understanding and appreciation of sanctuary resources. Benefits will be 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. 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 (deployment of AUV/ROV/gliders/drifters, deployment of equipment on the seafloor, deployment of remote sensing equipment, other sampling activities, vessel operations). One activity has only less than significant beneficial impacts (SCUBA/snorkel operations). 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. Mid-frequency cetaceans may be affected; however, the sources assessed in SBNMS are downward facing, do not propagate over large distances (due to high attenuation of higher frequencies) and are strongly directional (constrained within narrow beams). Thus, individual animals would need to be in very close range of the source, and located below it to be exposed to higher intensities capable of inducing physical injury to ears or causing behavioral responses. Vessel impacts 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. 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. SCUBA/snorkel operations, deployment of equipment and other sampling activities can help increase public understanding and appreciation of sanctuary resources. 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 both less than significant adverse and less than significant beneficial impacts (other sampling activities). Some activities have only less than significant beneficial impacts (deployment of equipment on the seafloor, deployment of remote sensing equipment). Justification: Temporary interfere with the conduct of commercial or recreational activities, but the effect will be short-term and negligible. Benefits are limited scope; 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 (deployment of AUV/ROV/gliders/drifters, SCUBA/snorkel operations, vessel operations). Some activities have less than significant beneficial and negligible impacts (deployment of equipment on the seafloor, deployment of remote sensing equipment). One activity has both less than significant adverse and less than significant beneficial impacts (other sampling activities). 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, research and monitoring of sanctuary resources. 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 both less than significant adverse and less than significant beneficial impacts (deployment of equipment on the seafloor, deployment of remote sensing equipment, other sampling activities). One activity has less than significant beneficial impacts (vessel operations). 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 increasing enforcement, 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, other sampling activities, SCUBA/snorkel operations). 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. Beneficial impacts 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
Cultural Resources	Activities have both less than significant adverse and less than significant beneficial impacts (deployment of AUV/ROV/gliders/drifters, SCUBA/snorkel operations). One	Similar to Alternative 1

	activity has only less than significant beneficial impacts (deployment of remote sensing equipment). 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. Beneficial impacts 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.	

5.0

CONSULTATIONS

The purpose of this Chapter is to summarize the environmental statutes related to the ONMS proposed action and to present the actions ONMS has taken to comply with the requirements of these statutes. This chapter includes: ONMS responsibilities related to each statute, with whom we will consult; and a summary of the regulatory agency's requirements and recommendations, based on the proposed action. Requirements and recommendations received in response to ONMS consultation will also be reflected in the Alternatives considered (Chapter 2) and in the analysis of effects (Chapter 4) in the final PEA. Formal correspondence related to these consultations will also be included in the final PEA.

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 used this draft PEA to consult with the Northeast Region EFH Coordinator (and Southeast Region EFH Coordinator for Monitor NMS) 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 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 NEGL Marine Sanctuaries developed by NOAA's ONMS describes current and ongoing activities for research and management in three sites: Thunder Bay National Marine Sanctuary, Stellwagen Bank National Marine Sanctuary and Monitor 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

Based on the New England Fishery Management Council (NEFMC) and Mid-Atlantic Fishery Management Council (MAFMC) EFH descriptions for these areas, Stellwagen Bank and Monitor national marine sanctuaries overlap with multispecies (bottomfish), scallop, spiny lobster, coastal migratory pelagics, highly migratory species and other fish species EFH. Thunder Bay National Marine Sanctuary and the activities conducted there have no impact on EFH, as there is no EFH designated in the Great Lakes. A complete description of EFH designations and the criteria used

to determine them is available in the New England Fishery Management Council's and Mid-Atlantic Fishery Management Council's *Essential Fish Habitat Amendments*.

Multispecies (Bottomfish)

A portion of SBNMS is included within the Western Gulf of Maine Essential Fish Habitat Closure Area. No fishing vessel or person on a fishing vessel with bottom tending mobile gear on board the vessel may enter, fish in, or be in the Essential Fish Habitat Closure Areas unless otherwise specified.

In addition, SBNMS overlaps EFH for American Plaice, Haddock, Ocean Pout, Yellowtail Flounder, Redfish, Atlantic Cod, Winter Flounder, Red Hake, Atlantic Halibut and Atlantic Wolffish.

Monitor National Marine Sanctuary overlaps EFH for Dusky Rockfish, Summer Flounder and Black Sea Bass.

Other Fish Species

SBNMS overlaps EFH for Winter Skate, Thorny Skate, Monkfish, Spiny Dogfish, Northern Shortfin Squid, Atlantic Mackerel and Atlantic Herring.

Monitor National Marine Sanctuary overlaps EFH for Snapper Grouper, Bluefish, Northern Shortfin Squid and Longfin Inshore Squid.

Scallop

SBNMS overlaps EFH for Atlantic Sea Scallop. In addition, no vessel fishing for scallops, or person on a vessel fishing for scallops, may enter, fish in, or be in the Western Gulf of Maine EFH Closure Area.

Highly Migratory Species

SBNMS overlaps EFH for Basking Shark, Bluefin Tuna and White Shark.

Monitor National Marine Sanctuary overlaps EFH for Sandbar Shark, Sand Tiger Shark, Angel Shark, Tiger Shark, Bignose Shark, Sailfish, Night Shark, Skipjack Tuna, Atlantic Sharpnose Shark, Bluefin Tuna, Dusky Shark, Smooth Dogfish, Bigeye Thresher Shark, Common Thresher Shark, Great Hammerhead Shark, Shortfin Mako Shark, Longbill Spearfish, Scalloped Hammerhead Shark, White Marlin, Roundscale Spearfish, Yellowfin Tuna, Silky Shark, Blue Shark, Blue Marlin, Swordfish and Oceanic Whitetip Shark.

Coastal Migratory Pelagics

Monitor National Marine Sanctuary overlaps EFH for Coastal Migratory Pelagics.

Spiny Lobster

Monitor National Marine Sanctuary overlaps EFH for Spiny Lobster.

Assessment of Effects on Essential Fish Habitat

NOAA Fisheries' Office of Habitat Conservation has identified the following ONMS activities which may adversely affect Essential Fish Habitat (all activities are described in detail in Section 2 of this document):

General ONMS Field Operations Across the Northeast and Great Lakes Region

SCUBA/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 the 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 the bottom during installation of such equipment or in the event that such equipment breaks free from its moorings.

Other Sampling Activities

Specific Projects in Stellwagen Bank National Marine Sanctuary

Seafloor Habitat Recovery Program

Potential impacts may include unintentional contact with bottom habitat.

Wildlife Investigations

Potential impacts may include unintentional contact with bottom habitat.

Specific Projects in Monitor National Marine Sanctuary

Vessel Maintenance and Crew Training

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.

Specific Projects in Thunder Bay National Marine Sanctuary

None

There is no EFH in Thunder Bay National Marine Sanctuary.

Proposed Mitigation Measures

Great care is taken with survey vehicles to avoid bottom contact, 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: 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. Lastly, ONMS typically does not allow night operations.

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.

Revision, Tracking, and Review

If any changes are made to the ONMS Northeast and Great Lakes field operations such that there may be different adverse effects on EFH, ONMS must 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.[10, 11]

[10] "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

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.[12]

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., 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

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mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering
[11] Source: http://www.nmfs.noaa.gov/pr/dontfeedorharass.htm
[12] http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/mmpa_esa.html

determination. If, based on technical assistance, NMFS recommends that ONMS seek a LOA, then ONMS 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 C.F.R. 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 a) 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 C.F.R. 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 C.F.R. § 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

REFERENCES

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Office of Coast Survey. 2013. Final Programmatic Environmental Assessment for the Office of Coast Survey Hydrographic Survey Projects. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, Silver Spring, MD.

Office of Coast Survey. 2013. Finding of No Significant Impact. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, Silver Spring, MD.

APPENDIX A

PROTECTED SPECIES LISTS

TBNMS

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)
Fish:		
Marine/Adromous Species		
Salmon, Atlantic	*Salmo salar*	Not listed DPS
Salmon, Chinook (king)	*Oncorhynchus tshawytscha*	Not listed DPS
Salmon, Coho	*Oncorhynchus (=Salmo) kisutch*	Not listed DPS
Steelhead/Rainbow Trout	*Oncorhynchus (=Salmo) mykiss*	Not listed DPS
Seabirds/Shorebirds:		
Crane, whooping	*Grus americana*	E, 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
Invertebrates (Land Species)		
Hine's emerald dragonfly	*Somatochlora hineana*	E

SBNMS

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)
Fish:		
Marine/Adromous Species		
Salmon, Atlantic	*Salmo salar*	Not listed DPS
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 white-sided dolphin	*Lagenorhynchus acutus*	MMPA
Bottlenose dolphin	*Tursiops truncates*	MMPA
Risso's (Grampus) dolphin	*Grampus griseus*	MMPA
Short-beaked common dolphin/Common dolphin	*Delphinus delphis*	MMPA
Spotted dolphin	*Stenella plagiodon*	MMPA
Striped dolphin	*Stenella coeruleoalba*	MMPA
White-beaked dolphin	*Lagenorhynchus albirostris*	MMPA
Porpoises		
Harbor porpoise	*Phocoena phocoena*	MMPA
Whales		
Beluga whale	*Delphinapterus leucas*	E, MMPA
Blainsville beaked whale	*Mesoplodon densirostris*	MMPA
Blue Whale	*Balaenoptera musculus*	E, MMPA
Cuvier's beaked whale	*Ziphius cavirostris*	MMPA
Dwarf sperm whale	*Kogia simus*	MMPA
Fin Whale	*Balaenoptera physalus*	E, MMPA
Humpback Whale*	*Megaptera novaeangliae*	MMPA
Killer whale	*Orcinus orca*	E, MMPA

Long-finned pilot whale	*Globicephala melas*	MMPA
Minke whale	*Balaenoptera acutorostrata*	MMPA
North Atlantic/Northern right whale	*Eubalaena glacialis*	E, MMPA
Northern bottlenose whale	*Hyperoodon ampullatus*	MMPA
Pygmy sperm whale	*Kogia breviceps*	MMPA
Sei Whale	*Balaenoptera borealis*	E, MMPA
Short-finned pilot whale	*Globicephala macrorhynchus*	MMPA
Sowerby's beaked whale	*Mesoplodon bidens*	MMPA
Sperm Whale	*Physeter macrocephalus*	E, MMPA
True's beaked whale	*Mesoplodon mirus*	MMPA
Phocid Pinnipeds (Seals)		
Gray seal	*Halichoerus grypus*	MMPA
Harbor seal	*Phoca vitulina*	MMPA
Harp seal	*Pagophilus groenlandicus*	MMPA
Hooded seal	*Cystophora cristata*	MMPA
Ringed seal	*Phoca hispida*	MMPA; Rare in SBNMS
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:		
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
Tern, roseate	*Sterna dougallii dougallii*	E, MBTA

***** Effective October 11, 2016, NOAA's National Marine Fisheries Service completed a comprehensive status review under the Endangered Species Act for the Humpback Whale (81 FR 62259) and revised the listing status of the species. Per the revised listing status, the Mexico DPS is listed as threatened under the ESA, and the Central America DPS is listed as endangered. The population frequenting Stellwagen Bank National Marine Sanctuary is not listed (https://www.fisheries.noaa.gov/species/humpback-whale).

MNMS

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)
Fish:		
Marine/Adromous 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
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	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, MMPA
Long-finned pilot whale	*Globicephala melas*	MMPA
Melon-headed whale	*Peponocephala electra*	MMPA
Minke whale	*Balaenoptera acutorostrata*	MMPA
North Atlantic/Northern 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:		
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
Tern, roseate	*Sterna dougallii dougallii*	E, MBTA
***** Effective October 11, 2016, NOAA's National Marine Fisheries Service completed a comprehensive status review under the Endangered Species Act for the Humpback Whale (81 FR 62259) and revised the listing status of the species. Per the revised listing status, the Mexico DPS is listed as threatened under the ESA, and the Central America DPS is listed as endangered. The population frequenting Stellwagen Bank National Marine Sanctuary is not listed (https://www.fisheries.noaa.gov/species/humpback-whale).		

Marine Mammal Protection Act (MMPA) and Hearing Ranges

Common Name	Scientific Name	Federal Status	Functional Hearing Group	Functional Hearing Range
Harbor seal	*Phoca vitulina*	MMPA	MF pinnipeds	75 Hz to 75 kHz
Gray seal	*Halichoerus grypes*	MMPA	MF pinnipeds	75 Hz to 75 kHz

Harp seal	*Pagophilus groenlandica*	MMPA	MF pinnipeds	75 Hz to 75 kHz
Hooded seal	*Cystophora cristata*	MMPA	MF pinnipeds	75 Hz to 75 kHz
Ringed seal	*Pusa hispida*	MMPA	MF pinnipeds	75 Hz to 75 kHz
North Atlantic Right whale	*Eubalaena glacialis*	MMPA, ESA	LF cetaceans	7 Hz to 25 kHz
Minke whale	*Balaenoptera acutorostrata*	MMPA	LF cetaceans	7 Hz to 25 kHz
Fin whale	*Balaenoptera physalus*	MMPA, ESA	LF cetaceans	7 Hz to 25 kHz
Sei whale	*Balaenoptera borealis*	MMPA, ESA	LF cetaceans	7 Hz to 25 kHz
Blue whale	*Balaenoptera musculus*	MMPA, ESA	LF cetaceans	7 Hz to 25 kHz
Humpback whale	*Megaptera novaeangliae*	MMPA, ESA	LF cetaceans	7 Hz to 25 kHz
Sperm whale	*Physeter macrocephalus*	MMPA, ESA	MF cetaceans	150 Hz to 160 kHz
Long-finned pilot whale	*Globicephala malaena*	MMPA	MF cetaceans	150 Hz to 160 kHz
Grampus dolphin	*Grampus griseus*	MMPA	MF cetaceans	150 Hz to 160 kHz
Killer whale	*Orcinus orca*	MMPA, ESA	MF cetaceans	150 Hz to 160 kHz
Common dolphin	*Delphinus delphis*	MMPA	MF cetaceans	150 Hz to 160 kHz
Beluga	*Delphinus leucas*	MMPA	MF cetaceans	150 Hz to 160 kHz
Atlantic white-sided dolphin	*Lagenorhyncus acutus*	MMPA	MF cetaceans	150 Hz to 160 kHz

White-beaked dolphin	*Lagenorhynchus albirostris*	MMPA	MF cetaceans	150 Hz to 160 kHz
Bottlenose dolphin	*Tursiops truncates*	MMPA	MF cetaceans	150 Hz to 160 kHz
Striped Dolphin	*Stenella coeruleoalba*	MMPA	MF cetaceans	150 Hz to 160 kHz
Harbor porpoise	*Phocoena phocoena*	MMPA	MF cetaceans	150 Hz to 160 kHz

APPENDIX B

LIST OF ALL ONMS VESSELS IN NORTHEAST AND GREAT LAKES REGION

Name	Sanctuary	Homeport	Length	Range	Cruising Speed
R/V Storm	Thunder Bay	Muskegon, MI	50 ft	300 nm	22 kts
R/V Auk	Stellwagen Bank	Scituate, MA	50 ft	400 nm	20 kts
Peter Gladding	Monitor	Newport News, VA	57 ft	350 nm	34 kts

APPENDIX C

CONSULTATION LETTERS FOR THE NORTHEAST AND GREAT LAKES 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 D

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

[13] 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 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