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Proposed Geophysical and Geological Activities in the Atlantic OCS to Identify Sand Resources and Borrow Areas

North Atlantic, Mid-Atlantic, and South Atlantic-Straits of Florida Planning Areas

FINAL ENVIRONMENTAL ASSESSMENT

U.S. Department of the Interior
Bureau of Ocean Energy Management
Division of Environmental Assessment
Herndon, VA

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Prepared by

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Acronyms and Abbreviations

°C	degree Celsius
µPa	micropascal
AEP	auditory-evoked potential
AIS	Automatic Identification System
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
cm	centimeter
CZMA	Coastal Zone Management Act
dB	decibels
DMA	Dynamic Management Area
DPS	Distinct Population Segment
EA	Environmental Assessment
EEZ	U.S. Economic Exclusive Zone
EFH	Essential Fish Habitat
ESA	Endangered Species Act
FMC	fisheries management council
FMP	Fishery Management Plan
FWS	U.S. Fish and Wildlife Service
G&G	geophysical and geological
HAPC	Habitat Areas of Particular Concern
Hz	Hertz
IPF	Impact-Producing Factors
kg	kilogram
kHz	kilohertz
km	kilometer
km/hr	kilometer per hour
lb	pound
m	meter
MAB	Mid-Atlantic Bight
MMP	Marine Minerals Program
MMPA	Marine Mammals Protection Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
nmi	nautical miles
NRU	Northern Recovery Unit
NWR	National Wildlife Refuge
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
PAM	passive acoustic monitoring
PFRU	Peninsular Florida Recovery Unit
PSO	protected species observer
PTS	permanent threshold shift
rms	root mean squared
SAB	South Atlantic Bight
SAFMC	South Atlantic Fisheries Management Council
SHPO	State Historic Preservation Office
SPL	sound pressure level
SMA	Seasonal Management Area
TTS	Temporary threshold shift
UME	Unusual Mortality Event
U.S.C.	United States Code
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
WNS	white nose syndrome

1. Introduction

The Bureau of Ocean Energy Management (BOEM) is preparing an Environmental Assessment (EA) to describe and evaluate the potential environmental impacts related to reasonably foreseeable geophysical and geological (G&G) survey activities to support identification and mapping of sand resources in the North, Mid-, and South Atlantic-Straits of Florida Outer Continental Shelf (OCS) Planning Areas (see Figure 1-1). This EA provides an analysis to determine whether significant impacts on Atlantic resources could occur as a result of the proposed G&G activities and specifies mitigation and monitoring measures that would be implemented to avoid, reduce, or minimize impacts.

BOEM has prepared this EA in compliance with the National Environmental Policy Act (NEPA) of 1969 (42 United States Code [U.S.C.] 4321 et seq.); the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (Title 40 Code of Federal Regulations (CFR) 1500–1508); and the U.S. Department of the Interior regulations implementing NEPA (43 CFR 46). The NEPA process is designed to ensure environmental impacts of proposed major Federal actions are considered in the decision-making process. Federal agencies are encouraged to integrate the NEPA process with other planning at the earliest stage to ensure planning and decisions reflect environmental values, avoid delays, and address potential conflicts or challenges.

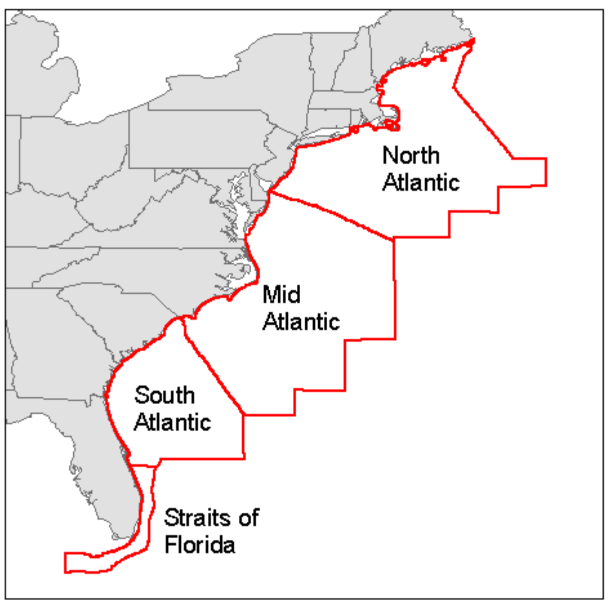


Figure 1-1. Outer Continental Shelf Planning Areas

1.1. Background

BOEM is responsible for managing energy and mineral resources on the OCS. BOEM's mission seeks to balance economic development, energy security, and environmental protection. BOEM's Marine Minerals Program (MMP) is responsible for managing non-energy minerals (primarily sand and gravel) for use in coastal resiliency and storm damage reduction projects, including beach nourishment and coastal restoration. BOEM must carefully manage sand and gravel resources while enhancing resiliency to the coastline by replenishing eroded beaches, conserving sensitive wildlife areas, and restoring barrier islands and wetlands that provide natural protection from storms, including protection for inland areas. Without adequate sand resources, this restorative and adaptive approach cannot be accomplished.

Coastal restoration benefits important habitats and ecosystems, shore protection, community rebuilding efforts (residential and commercial), and the state and Federal economies through tourism and tax revenues. Identifying sand resources is the first step in providing these mineral resources to other agencies that require them for rebuilding projects, which can promote the long-term sustainability of communities and ecosystems. Coastal restoration projects have historically increased the resiliency and capacity of coastal habitat and infrastructure to withstand future storms and reduce the amount of damage caused by storms such as Hurricane Sandy. By identifying OCS sand resources, BOEM is in the unique position to provide resources to multiple Federal and state agencies and localities to help in emergency responses and in rebuilding parkland, wildlife refuges and habitat, and other areas requiring additional material to stabilize and restore land.

To determine which OCS areas contain compatible sand resources (e.g., sediment grain size, shape, sorting, color, mineralogy, sediment deposit volume and geometry, and proximity to project sites), the MMP is proposing to conduct reconnaissance-level and site-specific studies to map OCS sand resources and to delineate potential sand resources for future projects. These resources could be used to add resiliency to the coastline to protect infrastructure and ecosystems from coastal storms and to create coastal habitat. This project is in response to the critical coastal and dune erosion that occurred due to effects from Hurricane Sandy.

On January 29, 2013, the Disaster Relief Appropriations Act of 2013 was enacted and provided $50.7 billion for disaster assistance, which largely focused on recovery from Hurricane Sandy and resiliency for future storms. BOEM received millions in funding to conduct the proposed research to identify and delineate additional OCS sand resources. A stipulation to receiving these funds was that 40 percent of the funding would be spent on recovery/resiliency efforts offshore New Jersey and New York, and funding must be spent within 24 months of obligation.

BOEM proposes to procure a contractor to help frame the full scope of necessary work, a scope that is dependent on information needs, potential benefits that may result from addressing those needs, and other relevant factors, such as cost. Once there is a BOEM-approved scope of work and detailed tactical plan and design for G&G surveys, the contractor would undertake the work. Until a contractor is selected and a plan for implementation approved, the specific locations and survey design parameters are not known. NEPA and other environmental requirements, however, require the funding agency to consider the environmental effects of its proposed effort prior to making any commitment of funds. Within this framework, BOEM has adopted a conservative approach, including systematic environmental mitigation, to address a range of different project designs, implementation schedules, and equipment use.

1.2. Purpose of and Need for the Proposed Action

The purpose of the proposed action is to facilitate future access to OCS sand resources that may be needed in beach nourishment, coastal restoration, and resiliency projects. By collecting and analyzing these G&G data in advance, BOEM can help proactively identify sand resources for enhancing coastal resiliency, better manage resources within its jurisdiction, and develop a more comprehensive understanding of available resources. Following additional environmental review, those sand resources could be made available to local, state, and Federal agencies to recover from severe storms like Hurricane Sandy, provide storm damage reduction, enhance coastal habitat, and stem chronic erosion.

The proposed action is needed to identify additional OCS sand resources for beach nourishment and coastal restoration projects because sand resources in state waters are either diminishing or are of poor quality, or otherwise unavailable. Dredging sand closer to shore can also lead to more severe environmental effects. Using nearshore sand often occurs within the active coastal system, compromising long-term effectiveness of projects and failing to address the need to supplement a deficit in the coastal sand budget. Using OCS sand resources introduces new sand from outside of the active coastal system to decrease the coastal sand deficit, improving project sustainability and geomorphic function (Hilton and Hesp 1996).

1.3. Regulatory Framework

The Outer Continental Shelf Lands Act (OCSLA), as amended, provides the authority to manage the use of minerals on the OCS (subsoil and seabed of all submerged lands seaward of state-owned waters to the limits of the OCS) and applies out to 200 nautical miles (nmi) and only offshore of the 50 states. Section 11 of the OCSLA, as amended, mandates the Secretary of the Interior (Secretary), through BOEM, to manage the exploration of marine minerals (e.g., sand, gravel, and shell resources). The OCSLA defines the term "exploration" as the process of searching for minerals, including geophysical surveys and geological sampling. Section 8(k) of the OCSLA allows BOEM to negotiate, on a noncompetitive basis, the rights to OCS sand, gravel, or shell resources for shore protection, beach or wetlands restoration projects, or for use in construction projects funded in whole or in part by, or authorized by, the Federal Government.

The OCSLA directs BOEM to ensure all Federal actions are undertaken in a technically safe and environmentally sound manner. Other environmental laws, including the Endangered Species Act (ESA), Marine Mammals Protection Act (MMPA), Magnuson-Stevens Fishery Conservation and Management Act, Coastal Zone Management Act (CZMA), and the National Historic Preservation Act (NHPA) have been considered in this EA and consultations with appropriate agencies have been undertaken.

1.4. Objectives and Scope of this Environmental Assessment

The objectives of this EA are to complete the following:

- Characterize proposed G&G activities that support sand resource identification on the Atlantic OCS in conjunction with Hurricane Sandy recovery and resiliency efforts;
- Describe alternatives to the proposed action;
- Identify and analyze direct, indirect, and cumulative impacts that could result from implementing the proposed action and alternatives; and,
- Evaluate mitigation measures that are practical and feasible to ensure impacts on the human and natural environments are avoided or minimized to the extent possible.

1.5. Study Area

The potential Study Area is in the North Atlantic Planning Area, Mid-Atlantic Planning Area, and the South Atlantic-Straits of Florida Planning Areas of the OCS (see Figures 1-1 and 1-2). The potential Study Area extends from approximately 3 to 8 nmi (4.8 to 12.9 kilometers (km)) from the shore and to depths of about 90 feet (27.5 meters (m)). Actual G&G activities will not occur across the entire Study Area, but will be concentrated in very limited subareas, comprising a small fraction of the overall contiguous inner shelf area. BOEM anticipates that G&G activities would occur in a small fraction of that overall footprint, approximately 50,000 to 450,000 acres (200–1,800 square kilometers) or less than 5 percent of the overall Study Area identified. The Study Area includes adjacent transit corridors used for mobilization and demobilization and access to support bases.

Forty percent of funding received will be spent for G&G activities to support recovery efforts in New Jersey and New York. Therefore, it is anticipated that almost half of the G&G activities within the Study Area would be concentrated offshore New Jersey and New York. Areas within Nantucket Sound and Cape Cod Bay are specifically excluded; marine protected areas, such as Stellwagen Bank National Marine Sanctuary and Biscayne Bay National Marine Sanctuary, are outside the footprint of the Study Area or are otherwise excluded.

Prior to G&G activities commencing, BOEM plans to coordinate with Atlantic coastal states, Federal stakeholders, and relevant regional planning bodies to determine areas of greatest need, defined in terms of potential need to use OCS sand resources and the need for data to identify additional borrow areas. A more detailed survey and sampling plan would be developed prior to undertaking any G&G activities; this plan would define the geographic scope and relative timing of the proposed activities.

Similar resource area identification and delineation activities could occur in state waters, but are not part of this proposed action and are not analyzed in this EA. G&G activities associated with connected actions, such as borrow area final design and pre-dredge clearance surveys, monitoring of nearshore environmental resources, or assessment of beach fill performance, are not included in the proposed action or alternatives. Construction-related activities, including beach nourishment and wetlands reconstruction, are not considered connected actions and are not included in this analysis. Any such proposals will be considered individually and will be subject to a separate environmental review process.

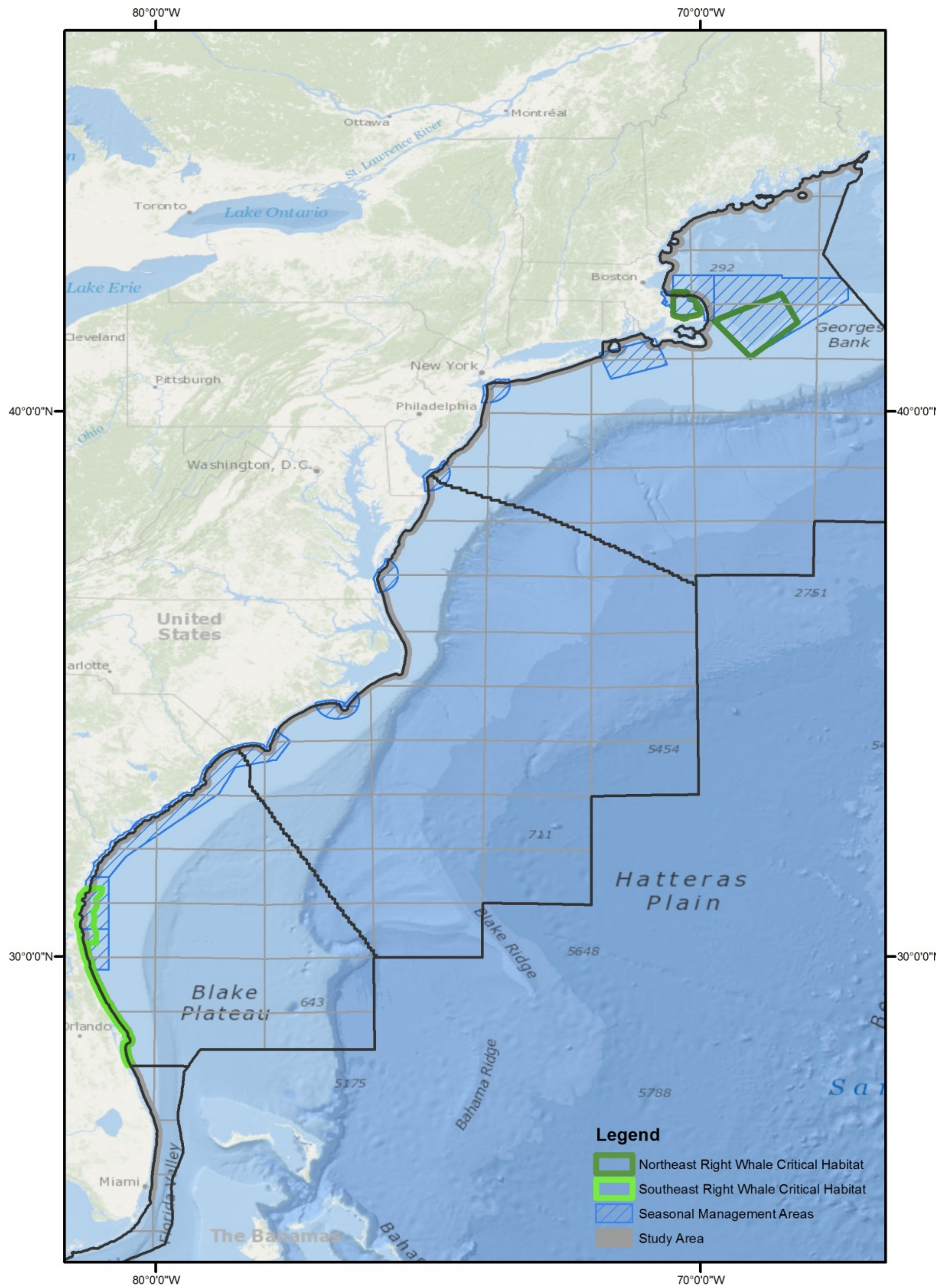


Figure 1-2. Map Showing Study Area in which G&G Activities could occur

Note: G&G survey activities would be concentrated in a limited subarea comprising less than 5% of the overall Study Area. North Atlantic Right Whale Critical Habitat and Seasonal Management Areas are also shown. The Study Area also includes transit corridors for mobilization and demobilization operations and access to support bases.

2. Description of the Proposed Action and Alternatives

A comprehensive research program of sand resource and borrow area identification is proposed to properly identify OCS sand resources and to enable both long-term and emergency planning goals. The study would use state-of-the-art technology and methods to collect and analyze G&G data, but would also incorporate a rigorous mitigation strategy to minimize environmental effects. BOEM plans to distribute the data widely among coastal stakeholders. The field work would include two components: (1) reconnaissance-scale G&G surveys to identify and delineate OCS sand resources, and (2) geographically focused G&G surveys to further delineate borrow areas and to investigate the presence of objects of archaeological significance, munitions of explosive concern, and hard bottom or other sensitive benthic habitat in the vicinity of potential borrow areas.

The proposed action and action alternative are alike in scope and vary only the sequence of data collection and in mitigation measures affecting the duration/time of operations and technology to be used. The mitigation measures that would be incorporated into the proposed action are described in Section 2.2.7.

2.1. Range of Alternatives

The alternatives must meet the purpose and need as outlined in Section 1.2. The following alternatives are evaluated in this EA:

A – The Proposed Action;

B – Additional Operational Restrictions and Time-Area Closures; and,

C – No Action Alternative.

The alternatives represent different ways of addressing the purpose and need. Analysis of the no action alternative is a NEPA requirement. Descriptions of the alternatives are presented in the following paragraphs.

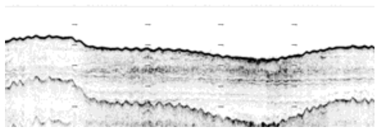
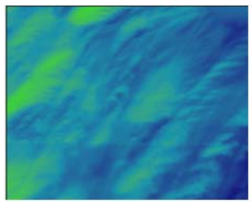
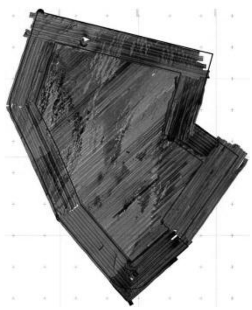
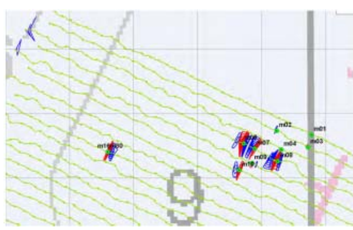
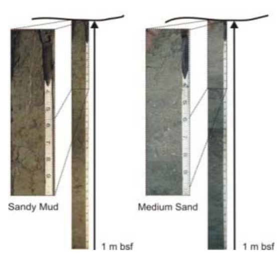
2.2. Alternative A: The Proposed Action

2.2.1. Overview

A comprehensive and systematic approach to collect G&G data to inventory, identify, and delineate Atlantic OCS sand resources is proposed. Varying levels of research have been conducted on the Atlantic OCS regarding sand resources and identification and delineation of potential borrow areas (see the Marine Minerals Resource Evaluation website at: http://www.boem.gov/Non-Energy-Minerals/Marine-Mineral-Resource-Evaluation.aspx). In some areas, reconnaissance studies are still needed as a first step to identify areas potentially containing sand resources. In other areas, reconnaissance-level surveys have already occurred and additional site-specific investigations are needed to map the lateral and vertical extent of new borrow areas and to determine the presence of any limitations to the use of these resources. The proposed action consists of both reconnaissance and site-specific studies, depending on the study location and level of previous investigation.

To complete reconnaissance or site-specific surveys, two general types of G&G surveys would be employed: geophysical surveys for mapping the geologic framework and seafloor condition and geological surveys to collect sediment sampling and shallow cores (approximately 20 feet (6 m) maximum length). The geophysical surveys are conducted to obtain information about sedimentary architecture, shallow hazards (such as presence of MECs or buried cables), archaeological resources, and sensitive benthic habitats. Typical equipment used in these surveys includes sub-bottom profilers (chirp or boomer), swath bathymetric sonar, side-scan sonar, and magnetometers. Geological surveys involve seafloor-disturbing activities such as sample collection through the use of grab samples or a platform-mounted vibracore, which are conducted to ground-truth the geophysical data and to evaluate the quality of mineral resources for their intended use as sand resources. These survey techniques are described in detail in the following paragraphs. The G&G techniques that would be used under the proposed action or alternatives are shown in Table 2-1.

Table 2-1. Summary of Geophysical and Geological Techniques

Survey Purpose	Depiction of Acquired Data	Survey Technology	Platform/Equipment Used	Study Type
Identify near-bottom sedimentary architecture		Sub-bottom profiling: Chirp or Boomer	Vessel, chirp profiler or boomer, and hydrophone array (only with boomer source)	Reconnaissance, Site-Specific
Map seafloor bathymetry, image the seafloor, archaeological resources and benthic habitat potential		Bathymetry: Multibeam or Interferometric swath	Vessel, multibeam or interferometric transducer	Reconnaissance, Site-Specific
Image the seafloor, archaeological resources, benthic habitat potential, and relic landscapes		Side-scan sonar or acoustic backscatter from multibeam or interferometric swath	Vessel, side-scan sonar tow fish, multibeam or interferometric transducer	Site-Specific, possibly Reconnaissance
Archaeological resources and hazards potential, including MECs		Magnetometer	Vessel, magnetometer tow fish	Site-Specific
Verify geophysical data, determine sediment attributes and beach compatibility, delineate borrow areas		Sediment samples: Vibracoring or grab samples	Vessel, vibracore rig, core barrel (20 feet penetration maximum), limited anchoring if not using dynamic positioning or live-boating	Reconnaissance, Site-Specific

2.2.2. Reconnaissance and Site-Specific Investigations

Reconnaissance studies would be performed over comparatively large areas (i.e., regional in scope) to identify sand bodies and characterize the shallow geological framework and surficial geology of potential sand resources. These surveys would help to ascertain if sand resources are of a certain quality (sediment type) and quantity to warrant further exploration. More spatially refined, site-specific studies would be performed to delineate a particular borrow area. In total, it is projected that approximately 4,000 to 8,000 line-miles (6,400–12,800 line-km) of geophysical surveys and up to 500 sediment samples would be collected. Anticipated line-miles for geophysical surveys and the number of sediment samples for each planning area are shown in Table 2-2. It is anticipated that approximately 70–85 percent of the survey work conducted under the proposed action would be reconnaissance in nature and 15–30 percent would be site-specific. The geophysical and geological equipment and techniques are described in detail in the following paragraphs. Geophysical surveys and geological sampling, whether reconnaissance or site-specific in nature, could be conducted simultaneously, or in sequence, depending upon the information needs, field conditions, and various project management issues or cost factors. The principal goals are to decrease the overall number of separate vessel mobilizations and to reduce redundant data collection. The survey design and selection of technologies, deployment modes, and timing should balance data quality needs, potential environmental impacts, and cost factors. To the extent possible, BOEM proposes to use the least number of lowest-energy (and highest-frequency) acoustic sources to obtain the necessary geophysical data, thereby reducing potential impacts and minimizing acquisition costs. This could include using existing available data, including multibeam and side-scan sonar data available from the National Ocean Service, Office of Coast Survey. Conducting geophysical surveys using different sources at the same time requires careful management and planning because systems working within the same frequency band can interfere with each other (e.g., simultaneous use of multibeam or interferometric swath bathymetry and side-scan sonar with overlapping frequencies). If advantageous, BOEM could also conduct reconnaissance-level surveys first to identify principal resource areas before undertaking site-specific surveys. That approach would enable BOEM to further narrow the geographic scope of site-specific geophysical and supporting geological surveys and, in those limited areas, avoid hazards, archaeological resources, or hard-bottom habitat determined to be present.

Table 2-2. Approximate Survey Parameters by Planning Area

Study Area	Geophysical Surveys (Line-Miles)	Geologic Samples
North Atlantic Planning Area	2,000 to 3,000	150 to 200
Mid-Atlantic Planning Area	1,000 to 2,500	100 to 150
South Atlantic-Straits of Florida Planning Areas	1,000 to 2,500	100 to 150
Total	**4,000 to 8,000**	**350 to 500**

The 4,000 to 8,000 line-miles (6,400-12,800 line-km) of geophysical surveys have been spatially allocated (see Table 2-2). The overall number of days estimated to collect all geophysical data is based on a daily average of approximately 35 line-miles (55 km). This assumes that site-specific survey data are not collected simultaneously with reconnaissance-level data. Using this assumption, combined with a conservative estimate of 40 percent lapse time and down time for mobilization, vessel transit, equipment repairs/inspections/calibration, and weather delays, geophysical surveys could be completed within approximately 85 to 130 days in the North Atlantic, and 40 to 100 days each in the Mid-Atlantic and the South Atlantic-Straits of Florida Planning Areas, for a total of 165 to 330 days in the Study Area. This assumption is based on one vessel completing the geophysical surveys; more than one vessel could be used.

Survey vessels would follow planned tracklines so that the desired coverage of the seafloor is achieved. The length and orientation of the lines are determined by the feature to be mapped. In general, lines are oriented longitudinally and transverse to the feature, and would extend beyond the feature itself to define the footprint and further understand the surrounding geology. Although a grid pattern would be used, line spacing could be expanded in some areas and reduced in other areas that require greater detail. The grid pattern for each survey should cover the maximum area of potential effect for all anticipated physical disturbances. General survey requirements are as follows:

- Line spacing for any geophysical data for seafloor hazards assessments (sub-bottom profilers and side-scan sonar) will not exceed 492 feet (150 m) throughout the area.
- Line spacing for all chirp seismic and magnetometer data for archaeological resources assessments will not exceed 98 feet (30 m) throughout the area.
- Line spacing for multibeam, or interferometric swath bathymetry or side-scan sonar would be suitable for the water depths encountered and provide full coverage of the seabed plus suitable overlap and resolution of small discrete targets of 1.5 to 3 feet (0.5 to 1.0 m) in diameter at the relevant slant range.
- For site-specific surveys, the geophysical data requiring the narrowest line spacing will determine the survey coverage and line spacing.
- All track lines should run generally parallel to each other.
- All data would be collected to the highest standard 98 feet (30 m) for site-specific surveys. This standard may be adjusted by BOEM in consultation with state stakeholders if different line spacing is determined to be necessary.

2.2.3. Geophysical Survey Equipment and Techniques

Geophysical surveys would be undertaken to identify OCS sand resources. Geophysical surveys use a high-resolution, low-energy electromechanical sound source and receiver system towed behind a vessel. Electromechanical sound sources, like the ones proposed for use under the proposed action and the alternative action, create an oscillatory overpressure through vibration of a surface, using either electromagnets or the piezoelectric effect of transducer materials. Transducers produce an acoustic wave of a specific peak frequency, often in a highly directive beam. Frequency (i.e., number of cycles per second, with hertz (Hz) as the unit of measurement) and amplitude (loudness, measured in decibels, or dB) are typically used to describe sound. The frequency is often proportional to the resolution of acquired data. The source level is the equivalent of the sound power and is measured as an acoustic pressure at a reference distance of 1 m from the source. Sound source levels are typically based on manufacturer's specifications or, where available, field measurements. Use of manufacturer's specifications often represents a conservative estimation, as equipment power settings and sound output is often adjusted given data needs and/or site-specific conditions.

The level of a sound in water can be expressed in several different ways, but always in terms of dB relative to 1 microPascal (1 µPa). Each 10 dB increase represents a ten-fold increase in sound pressure. Peak pressure level is the maximum sound pressure level (highest level of sound) in a signal measured in dB re 1 µPa. Root mean square (rms) sound pressure level (SPL) is often used to characterize source levels at a reference distance or received levels at some distance from the source. The rms SPL (dB re 1 µPa) is the rms pressure level in an operational frequency band over the time window of the pulse, or pulse length. The rms SPL can be thought of as a measure of the average pressure, or as the "effective" pressure over the duration of an acoustic event. Therefore, pulses that are more spread out in time have a lower rms SPL for the same total acoustic energy as a non-pulsed source. The time window is often defined as the "90% energy pulse duration," or the interval over which the pulse energy rises from 5% to 95% of the total energy. The SPL over this interval is commonly called the 90% rms SPL. Sound Exposure Level is the integration over time of the square of the acoustic pressure in the signal and is thus an indication of the total acoustic energy received. SEL can be used to characterize the source level or the received level.

Section 2.2.4 and Table 2-3 provide a more detailed characterization of these proposed sources and their sound propagation characteristics. No air guns or sparkers are proposed for use; source level, frequency, and operational restrictions are included in the proposed action.

Sub-bottom profiling would be accomplished through use of a chirp and/or boomer system (Figure 2-1). The primary goal of sub-bottom profiler data collection is to provide an accurate depiction of the geologic framework and near-surface sand thickness (isopach) that can be further evaluated for possible recovery and placement as beach restoration material. The chirp system is generally towed at depth off the seafloor, whereas the boomer is towed at or near the surface. These systems are described below:

- <u>Chirp sub-bottom</u>. Chirp sonar uses a transducer to emit a frequency-modulated sound pulse towards the seafloor and to receive the return of the pulse once it is reflected from the seafloor or from the contacts between sedimentary layers near the seafloor (acoustic impedance). Chirp systems are generally single-channel systems that operate around a central frequency that is swept electronically across a range of frequencies to provide improved resolution. The most probable system consists of towfish with internal transducer that imparts an acoustic signal with frequencies potentially ranging from 500 hertz (Hz) up to 24 kilohertz (kHz) approximately every 0.5 to 1 seconds. For optimal data quality, the chirp system is typically towed at water depths where the towfish remains within approximately 10 feet (30 m) above the seafloor. Additionally, the system would be operated at noise levels limited to 220 dB re 1 µPa or less (rms SPL).

Table 2-3. Characteristics of Electromechanical Sources Proposed for use during Geophysical Surveys

Source	Frequency Range	Peak Source Level (re 1 µPa @ 1 m)	Representative Beam Pattern (Horizontal and Vertical)	Representative Pulse Length (ms)*	Distance to Received Level from Representative Sources [Source Level (SL), Operational Frequency]			
					JASCO-Modeled Maximum Distance to rms SPL 160dB[1]	JASCO-Modeled Maximum Distance to rms SPL 160dB[2]	JASCO-Observed Distance to rms SPL 160 dB[3]	JASCO-Observed Distance to rms SPL 160 dB[4]
Boomer (surface tow)	300 Hz — < 10 kHz	< 220 dB	Horizontal: omnidirectional Vertical: downward focused	< 1	1 - 2.1 km [212 dB re 1 µPa at 1 m, 0.2-16 kHz]	< 50 m [206 dB re 1 µPa at 1 m, 0.2-16 kHz]	12 m [SL unknown, 300 Hz – 14 kHz]	-
Chirp sub-bottom profiler (tow above seafloor)	500 Hz — 24 kHz	< 220 dB	Horizontal: omnidirectional Vertical: Downward focused	10-50	0.35 – 1 km [222 dB re 1 µPa at 1 m, 3.5, 12, 200 kHz]	< 40 m [210 dB re 1 µPa at 1 m, 2-16 kHz]	10 m [210 dB re 1 µPa at 1 m, 2-16 kHz]	30 m – 80 m [210 dB re 1 µPa at 1 m, 0.5-12 kHz]
Side-scan sonar (near-surface tow)	> 180– 900 kHz **Frequency above hearing range of cetaceans, manatees, seals, sea turtles, and most fish.**	< 240 dB	Along-track: very narrow Across-track: wide	< 0.5	500 – 650 m [226 dB re 1 µPa at 1 m, 100/400 kHz]	< 700 m [234 dB re 1 µPa at 1 m, 132/500kHz]	-	-
Multibeam (hull or davit mounted)	> 180 - 500 kHz **Frequency above hearing range of cetaceans, manatees, seals, sea turtles, and most fish.**	< 230 dB	Determined by number of beams, beam spacing, frequency, *etc*. Along-track: very narrow Across-track: wide	< 0.5	150 m [173.5 dB re 1 $\mu Pa^2 \cdot s$ at 1 m (SEL), 240 kHz]	< 300 m [221 dB re 1 µPa at 1 m, 200/400kHz]	1 m [SL unknown, 200/400 kHz]	-

Source	Frequency Range	Peak Source Level (re 1 µPa @ 1 m)	Representative Beam Pattern (Horizontal and Vertical)	Representative Pulse Length (ms)*	Distance to Received Level from Representative Sources [Source Level (SL), Operational Frequency]			
					JASCO-Modeled Maximum Distance to rms SPL 160dB[1]	JASCO-Modeled Maximum Distance to rms SPL 160dB[2]	JASCO-Observed Distance to rms SPL 160 dB[3]	JASCO-Observed Distance to rms SPL 160 dB[4]
Interferometric Swath (davit mounted)	> 180 – 600 kHz **Frequency above hearing range of cetaceans, manatees, seals, sea turtles, and most fish.**	< 220 dB	Depends on frequency Along-track: very narrow Across-track: wide	< 0.5	-	-	-	< 10 - 20 m [SL unknown, 234 kHz]
Single Beam (hull mounted)	> 180 – 540 kHz **Frequency above hearing range of cetaceans, manatees, seals, sea turtles, and most fish.**	< 230 dB	Horizontal: omnidirectional Vertical: downward	0.1	-	<30 m [230 dB re 1 µPa at 1 m, 200 kHz]	2 m [Source level unknown, 70 /200 kHz]	-

Key:

1. Source: Zykov and Carr 2012
2. Source: Zykov 2013
3. Source: Martin et al., 2012a
4. Source: Zykov and MacDonnell 2013

Notes: For the geophysical sources considered, Level B harassment may occur when a received level is 160 dB or greater and within the hearing range of an animal under the current MMPA regulatory framework for these types of sources. Under the MMPA, Level B harassment is defined as any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering, but which does not have the potential to injure a marine mammal or marine mammal stock in the wild.

* Pulse length is an important factor to consider in context of an animal's hearing integration time to hear and process an impulsive or non-pulse sound. Received level radii do not factor in integration hearing time.

- <u>Boomer</u>. A boomer is a low-energy towed device typically consisting of a multi-channel acoustic source that uses a magneto-restrictive plate diaphragm to impart an acoustic pressure signal into the water column. The signal output is generally set to less than 100 to 350 joules and ranges between 300 to 10,000 Hz. Boomers are fixed-frequency sources. The boomer imparts an acoustic signal approximately every 0.5 to 1 seconds. A secondary cable of passive hydrophones is used as a signal receiver. Typical tow length for the boomer is approximately 75 to 100 feet (23 to 30 m) behind or alongside the vessel, and the hydrophones are towed at about 100 to 125 feet (30 to 38 m) from the vessel. Both are towed at the water's surface; the boomer plate is installed on a small catamaran or sled structure. Additionally, the system would be operated at noise levels limited to 220 dB re 1 μPa or less (rms SPL).

Figure 2-1. Deployment of Chirp towfish from Port Davit (left). Deployment of Boomer Sled from Stern A-frame (right).

Other geophysical data could be collected using a combination of equipment and techniques. Multibeam or interferometric swath bathymetry is used to gather information about water depths/seafloor topography/seafloor condition. Not only do such systems provide information on the seabed, but the reflected acoustical signal (backscatter) can also be used to characterize the seabed with regard to archaeological resources, benthic habitat, and sediment composition (Dartnell and Gardner, 2004) (Table 2-1).

- <u>Multibeam Bathymetry</u>: Multibeam bathymetry transmits and receives acoustic pulses by sending a sound pulse through the water column until it reaches the seafloor, at which point the pulse reflects off the seafloor and returns to the receiver. The time elapsed between the pulse being emitted and received is converted to a distance by multiplying this number by the speed of sound in water. The source level (rms SPL) for multibeam bathymetry ranges from about 210 to 230 dB re 1 μPa @1 m. Frequency range would be limited to above 180 kHz to avoid/reduce noise impacts on marine mammals. The system records with a sweep appropriate to the range of water depths in the survey area. A bathymetry system is useful in areas characterized by complex topography or fragile habitats.

In addition to identifying sediment features, acoustic backscatter data can be collected using multibeam bathymetry and analyzed to provide valuable information on archaeological resources and sediments. Surface shape and roughness influence backscatter strength from coarser sediments and from other hard surfaces like reefs and shipwrecks (Gustav 2008). When this type of technique is validated by geologic samples or underwater photography, accuracy is approximately 70 to 80 percent (Gustav 2008). No additional equipment would be needed to implement this approach; however, different software/analytical techniques would be employed.

- Interferometric Swath Bathymetry: In contrast with multibeam bathymetry, interferometric swath bathymetry uses two outward-facing transducers, as opposed to an array, to transmit and receive acoustic pulses. The elevation angle of a target on the seafloor is measured from the phase difference between the signals received on the two separate receivers. Frequency range would be limited to above 180 kHz to avoid/reduce noise impacts on marine mammals. Source level (rms SPL) ranges from approximately 200 to 220 dB re 1 µPa. Acoustic backscatter can be used as a substitute for side-scan sonar data, provided that data quality standards are met. Depending on water depth, fewer tracklines could be surveyed using an interferometric swath system, in comparison to multibeam, to achieve the same coverage.

- Side-Scan Sonar: Side-scan sonar generates an image of seabed morphology, submerged objects, and other features by emitting a high-frequency acoustic pulse, which typically ranges from 100 to 900 kHz and attenuates rapidly in the water column. However, to limit sound exposure, any use of side-scan sonar would be limited to operating at frequencies greater than 180 kHz. Source level ranges from approximately 200 to 240 dB re 1 µPa (rms SPL). Because of the highly directional nature and large vertical beam width of the source, the source level tends to be greatest when compared to other geophysical sources. As such, sound source verification studies have shown noise produced from side-scan sonars tends to propagate farther distances at comparatively higher received levels.

When possible, backscatter data for multibeam and/or interferometric swath surveys would be used as a substitute to side-scan sonar, provided along-track resolution is less than 1 m at 100 m slant range. Side-scan sonar and/or swath bathymetry backscatter data would be used to construct a mosaic image to provide a true plan view with 100 percent coverage of the area of interest. The resulting image would be automatically corrected for slant range, lay-back, and vessel speed. As an added data feature, the rate of signal attenuation backscatter can indicate surficial sediment type or seafloor habitat information.

- Magnetometer: The marine magnetometer is a passive remote sensing device (i.e., nothing is emitted) that identifies materials with ferrous or ferric components or other objects having a distinct magnetic signature. For surveys such as these, variations would be caused by local deposits of ferromagnetic material that could be attributable to MECs, objects of archaeological significance, or seafloor hazards such as buried cables (Table 2-1). The magnetometer sensor should be towed as closely as possible to the seafloor not to exceed an altitude of greater than 20 feet (6 m) above the seafloor. The sensor should be towed in a manner that minimizes interference from the vessel hull and other survey instruments. The magnetometer sensitivity should be 1 gamma or less, and the background noise level should not exceed a total of 3 gammas peak-to-peak.

2.2.4. Acoustic Characteristics of Geophysical Sources

There are numerous and complex factors to consider when describing the propagation of sound emitted from a geophysical source in the marine environment. The perception of sound is equally complex and depends on several factors, such as the hearing range of the animal, the intensity of the sound, etc. As sound propagates away from a source, its amplitude, or loudness, decreases exponentially and is influenced by environmental factors including the sound speed profile and temperature of the ocean, as well as its interaction with the seafloor. These interactions ultimately determine the distance that the sound will continue to contribute to ambient noise in the marine environment.

Given a short-duration pulse of sound, the intensity of sound is not uniform in all directions. Directionality is important because it, in part, determines exposure and intensity of exposure in a certain plane or direction. The directional capability generally increases with increasing operating frequency. The main parameter characterizing directivity is beamwidth. The beam pattern of a transducer (or multiple transducers in the case of some sources) is the relative measure of acoustic transmitting or receiving power as a function of spatial angle.

For different transducers, beamwidth varies differently in the horizontal and vertical plane. For example, the horizontal beamwidth for a chirp sonar approaches 180° (almost omnidirectional), whereas, depending on operational frequency, the horizontal beam width for a side-scan sonar can be less an a few degrees. For circular transducers, like boomer, chirp sonar, and single beam sources, the beam pattern in the horizontal plane (assuming a downward-pointing main beam) is equal in all directions. The beam pattern of a rectangular transducer, such as side-scan sonar or multibeam, is variable with the azimuth in the horizontal plane. The pattern is defined largely by the operating frequency of the device and the size and shape of the transducer. Beam patterns generally consist of a main lobe, extending along the central axis of the transducer, and multiple secondary lobes separated by nulls. The true beam pattern of a transducer can be obtained only by in situ measurement of the emitted energy around the device.

2.2.5. Geological and Geotechnical Equipment and Techniques

Information from geological surveys (i.e., sediment sampling) would be used in tandem with geophysical data to ground-truth geophysical data and to determine the geometry, volume, and quality of offshore sand resources\deposits (Table 2-1). Sediment sampling would occur at selected locations where existing geophysical data indicates promising targets for quality sand. Some samples would be taken at sites on the flanks of the geomorphic features or sand resource areas to determine the footprint and other geologic characteristics, and other samples would be taken in the center of the resource areas to obtain data regarding the thickness and textural properties of the sand resource. Sediment sampling could be completed using a vibracore or a grab sampler. In general, grab sampling is conducted when surficial sediment composition needs to be studied as opposed to sediment thickness and stratigraphy. The two techniques of sediment sampling are discussed below.

- <u>Vibracoring</u>. A 3- or 4-inch (7.6- 10.1-centimeter (cm)) diameter aluminum core barrel mounted on a platform or support assembly would be used to penetrate sediments in the upper 20 feet (6 m) of the seafloor. A sediment sample of 5 to 20 feet (1.5 to 6 m) would be acquired to determine sediment characteristics and sand resource thickness. To penetrate seafloor sediments, the core barrel is vibrated by a pneumatic or electric vibrahead, which results in local liquefaction of sediment along the core barrel surface, facilitating penetration into the sediment (Fugro 2003; ISSMGE 2005). Some operations use a single, non-reusable aluminum core barrel to collect and preserve the core sample, whereas others have a reusable core barrel that is lined with a plastic or Kevlar sleeve that collects and preserves the sample. A typical vibracore survey can obtain 15 to 25 cores approximately 20 feet (6 m) deep in an area measuring 1 square mile (640 acres) or 259 hectare) per day. The vibratory mechanism on the vibracorer would introduce underwater sound in addition to broadband noise from the vessel. The vibratory mechanism produces a short-duration broadband noise with peak frequency less than 1 kHz. Source levels are generally expected to be less than 180–190 dB re 1 µPa @ 1 m depending on the intensity of the vibrations, barrel material, and nature of sediment penetration (Reiser et al., 2011). Vessels may be dynamically positioned, live boated, or anchored, under permissible circumstances, during vibracoring. See Figure 2-2.

Figure 2-2. Deployment of a 20-foot Vibracore from Stern A-frame

- Grab Samplers. Grab samplers are one of the most common methods of retrieving sediment samples or biological samples from the seabed. A grab sampler is a device that collects a sample from the surface of the seabed by bringing two steel clamshells together. The grab is lowered to the seabed and activated either automatically or by remote control. The shells swivel together in a cutting action and by so doing remove a section of seabed. The sample is recovered to the ship for examination. One grab sample takes approximately 5–15 minutes to obtain. Grab sampling penetrates from a few inches to a few feet below the seafloor.

It is projected that up to 500 sediment samples would be collected (see Table 2-2). The overall number of days estimated to collect all geological data is based on collecting 15 vibracores per day. Using this assumption, and combined with a conservative estimate of 40 percent downtime for mobilization, equipment repairs/inspections/calibration, and weather delays, geological sampling would be completed in approximately 20 days in the North Atlantic, and 15 days each in the Mid-Atlantic and the South Atlantic-Straits of Florida Planning Areas, for a total of 50 days. Approximately 30 to 50 grab samples could be collected per survey day. Of the up to 500 sediment samples anticipated to be collected, it is anticipated that most of the samples would be vibracores and only a small portion would be grab samples. Grab samples would primarily be collected for ground-truthing geophysical data and interpretations. The time that the coring equipment is on the sea bottom would be less than 15 minutes and is often less than 5 minutes.

Geological sampling disturbs the seafloor; however, due to the small size of the vibracores and associated platforms, the area of seabed to be disturbed during individual sampling events is estimated to range from 1 to 9 square feet (0.3 to 2.7 square m). The total area of seafloor disturbed by bottom sampling and shallow coring activities would be a very small portion of the total Study Area.

2.2.6. Survey Vessels, Timing, and Design

Surveys would occur either through one mobilization for simultaneous collection of data, or through separate mobilizations (one to collect geophysical data and one to collect geological or geotechnical information) from regional ports and shorebases. Either mobilization could potentially use more than one vessel. Before any geological sampling occurs, the area would be investigated by appropriate means to ensure sensitive resources are avoided; this could entail advance or real-time interpretation of geophysical data by qualified personnel or by divers assisting with vibracoring. Data collection would be continuous during the survey, but could stop while the vessel is travelling from line to line or temporarily cease due to environmental considerations.

The survey time of year is largely constrained by seasonal sea state conditions consisting of wave heights of less than 3 feet (1 m) for geophysical surveys and less than 5 feet (1.5 m) for geological sampling. Surveys in the North and Mid-Atlantic are typically more productive after the spring winds of May have subsided and up until mid-September/October, when the probability for nor'easters and other strong storms increases. For the South Atlantic, opportune times for surveying are the same as the North and Mid-Atlantic; however, if the same vessel is used for the surveys, alternative periods when surveying could occur in the South Atlantic include after peak hurricane season through winter and in late winter to early spring. Geophysical activities would be conducted during daylight hours, unless nighttime surveying occurs with implementation of a passive acoustic monitoring system. G&G activities would be scheduled to avoid areas designated as North Atlantic Right Whale critical habitat or seasonal management areas (SMAs) (see Sections 2.2.7 and 3.3 for a discussion on marine mammals).

Depending on the type of equipment being deployed, a vessel with an A-frame, boom, or davit could be required to assist with instrument retrieval. Typically, survey equipment would be deployed from a single vessel ranging from approximately 28 to 120 feet (9 to 37 m) in length, depending on the survey activity to be conducted/equipment needs, and would travel at speeds between 3 and 5 knots (5.6 to 9.3 kilometers per hour (km/hr)). Vessels would be equipped with and transmit Automatic Identification System (AIS) (or equivalent) data to the extent practicable. Vessels would be equipped with an integrated navigational system with layback ranging instrumentation to track the position and depth of towed survey equipment. Bathymetric data would be tidally corrected using satellite altimetry, or in limited cases, coastal or temporarily-installed water level gauges. Depending on the size of the vessel and length of the geophysical survey, operations would generally be managed by a boat captain, crew (optional), one to three researchers, and protected species observers (PSOs) (see Section 2.2.7 for a discussion on observer requirements). Vessels would be generating continuous noise levels from bow-wave slap, wake bubble collapse, propeller cavitation, and engine noise; these sounds are less intense and occur in the broadband spectrum between 10 Hz and 100 kHz. This is especially true during surveying, when vessel speeds are lower and consequentially so is vessel-related noise (Martin et al., 2012a; Zykov and Carr 2012). Vessels would use dynamic positioning or live-boat during coring; anchoring would be avoided to the maximum extent possible.

Vessels with a vibracoring rig could be larger to support the rig and associated equipment. Vibracore rig configurations vary greatly, but typically consist of a tri- or quad-pod consisting of a 20 foot (6 m) -long core barrel with a hydraulic, pneumatic, or electric vibrator at the top of the unit. Some rigs use floats instead of a structural tripod or quad-pod to keep the core barrel and vibrator upright so that the only seafloor disturbance occurs locally at the footprint of the 3- to 4- inch diameter core barrel.

In addition to a boat captain, a vibracoring operation team requires about three to six crew members, including a geotechnical engineer, one to three researchers, and PSOs (see Section 2.2.7 for a discussion on observer requirements), depending on length of survey day. During sampling, the vessel must remain in a stationary position, most often using dynamic positioning, live boating methodology, or in some cases, anchors are used. Because anchor positioning requires additional time and skill, dynamic positioning or live boating is usually the preferred method of choice. Liftboats, or other spudded boats, would not be used as a vibracoring platform.

Depending on the nature of operations, surveys would be conducted by vessels that could potentially remain offshore for up to 5 to 30 days of their survey duration, but could travel periodically to an onshore support base for fuel, supplies, equipment repairs, and crew changes. Smaller vessels may be deployed for daylight or day-long operations. During transit to and from shore bases, survey vessels are expected to travel at comparatively greater speeds except in areas where transit speed is restricted.

2.2.7. Mitigation Measures

All G&G activities would comply with relevant environmental laws and regulations. Mitigation measures applicable to proposed activities would include implementation of:

- time-area restrictions for geophysical surveys;
- a geophysical survey protocol;
- a vibracore sampling protocol;
- nighttime surveying and passive acoustic monitoring protocol;

- a vessel strike avoidance protocol;
- historic and pre-contact site avoidance and reporting requirements;
- sensitive benthic habitat and communities avoidance requirements;
- marine pollution control plan;
- marine debris awareness program; and,
- navigational and commercial fisheries conflicts minimization requirements.

Time-Area Restrictions for Geophysical Surveys to Avoid North Atlantic Right Whales

Geophysical surveys will be scheduled and conducted to the maximum extent practicable so that no active acoustic sources operating below 30 kHz (a conservative estimate of the upper hearing threshold for North Atlantic Right Whales) will be used in the Northeast critical habitat and northeast SMAs (Great South Channel, April 1 through July 31; Off Race Point, March 1 through April 30), mid-Atlantic SMAs (November 1 through April 30), and Southeast critical habitat and southeast SMAs (November 15 through April 15). All operations in these areas during the specified times will occur during daylight hours.

BOEM will require vessel operators make use of the Early Warning System, Sighting Advisory System, and Mandatory Ship Reporting System while operating in the North Atlantic Right Whale critical habitat, SMAs and Dynamic Management Areas (DMAs) at the times of year those designations are active or year round in the case of the North Atlantic Right Whale critical habitat.

If, during the course of a geophysical survey, a DMA is established, use of all sound sources operating below 30 kHz in that DMA must be discontinued within 24 hours of its establishment. Any geophysical surveys in proximity of DMA boundaries are required to remain at a distance such that received levels for all sound sources at these boundaries are no more than 160 dB re 1 μPa rms.

Geophysical Survey Protocol

Only electromechanical sources would be used during geophysical surveys. Electromechanical sources would be limited to boomer and chirp sub-bottom profilers, side-scan sonars, and single beam, interferometric, or multibeam depth sounders. The minimum number of geophysical sources possible would be used to obtain the necessary geophysical data.

Besides noise introduced by the survey vessel, only chirp sub-bottom profiler and boomer would be operated at frequencies below 180 kHz, which is the upper hearing threshold for cetaceans. Source levels for sub-bottom profilers and boomers would not exceed 220 dB re 1 μPa and would be operated at lowest power setting, narrowest beamwidth, and highest frequency possible to fulfill data needs and to effectively reduce exposure and received levels. Consistent with recent sound source verification studies on these active sources (see Table 2-3), threshold radii to 160 dB re 1 μPa are expected to be less than 328 feet (100 m) because of the beam pattern characteristics and downward directivity. Moreover, the chirp towfish would be towed as close to the seafloor as possible to further reduce the zone of ensonification. The use of boomers would be limited to rare circumstances where penetration from chirp sources is insufficient to map or delineate near-surface geologic units.

Protocol requirements include:

1. An acoustic exclusion zone will be monitored during G&G surveys using any boomer or sub-bottom profiler sound source(s) operating below 180 kHz. The acoustic exclusion zone will be a 328 foot (100 m) radius zone around the sound source. Accounting for differences in the source levels, operational frequency, and deployment mode, this 328 foot (100 m) exclusion zone will encompass the 160 dB Level B harassment zone.
2. For geophysical surveys using sound sources operating at frequencies below 180 kHz, operations will be monitored by a trained PSO. At least one PSO will be required aboard G&G survey vessels at all times during daylight hours (dawn to dusk – i.e., from about 30 minutes before sunrise to 30 minutes after sunset) when survey operations are being conducted, including during conditions (e.g., fog, rain, darkness) that adversely affect the effectiveness of sea surface observations. If conditions deteriorate during daylight hours such that the observations are not possible, visual observations will resume as soon as conditions permit. Ongoing activities may continue, but may not be initiated under such conditions (i.e., without appropriate pre-activity monitoring).
3. Visual monitoring of acoustic exclusion zones will be conducted by searching the area around the vessel using hand-held reticle binoculars and the unaided eye to observe and document the presence and behavior of marine mammals and sea turtles. PSOs may be trained third-party observers, crew members trained as observers, or use a combination of both trained third-party and crew observers. PSOs will be solely dedicated to perform visual observer duties. PSOs shall operate under the following guidelines:
   a. Other than brief alerts to make personnel aware of maritime hazards, no additional duties shall be assigned to observers during their watch.
   b. A watch shall be no longer than six continuous hours. Consequently, at least two PSOs will be required on board vessels to monitor the acoustic exclusion zone when daily survey activities exceed six hours.
   c. A break of at least two hours shall occur between 6-hour watches, no other duties shall be assigned during this period.
4. When operating during reduced visibility, observers will monitor the waters around the acoustic exclusion zone using shipboard lighting, enhanced vision equipment, night-vision equipment, and/or passive acoustic monitoring (PAM). During nighttime surveys, PAM is required in addition to night-vision goggles or other appropriate equipment subject to the *Nighttime Geophysical Surveys and Passive Acoustic Monitoring Protocol*. PAM involves towing an additional hydrophone streamer that detects frequencies produced by vocalizing marine mammals and can be used to allow some localization of the bearing (direction) of the animal from the vessel. The PAM system will have real-time processing and detection capability for marine mammal vocalizations over the frequency range of 100 Hz to 175 kHz. G&G sound sources operating at frequencies below 180 kHz may be approved during periods of reduced visibility or at night, provided the nighttime survey and PAM protocol is followed.
5. Start-up and shut-down requirements: The acoustic exclusion zone for sound sources operating below 180 kHz shall be monitored for all marine mammals and sea turtles for no less than 30 minutes prior to start-up and continue until operations cease. Immediate shutdown of the sound source would occur if any non-delphinid cetacean is detected entering or within the acoustic exclusion zone. Immediate shutdown of the sound source

would occur if any sea turtle is detected entering or within the acoustic exclusion zone provided the source is operating below 2 kHz. Subsequent restart of the equipment may only occur following a confirmation that the exclusion zone is clear of all marine mammals and sea turtles for 30 minutes.

6. Shutdown of sound sources operating below 180 kHz will not be required for delphinids approaching the vessel (or vessel's towed equipment) that indicates a "voluntary approach" on behalf of the animal. A "voluntary approach" is defined as a clear approach toward the vessel by the animal(s) with a vector that indicates that it is approaching the vessel and remains near the vessel or towed equipment. The intent of the animal(s) would be subject to the determination of the PSO. If the PSO determines that the animal(s) is actively trying to avoid the vessel or the towed equipment, the acoustic sources must be immediately shutdown. The PSO must record the details of any non-shutdowns in the presence of a delphinid, including the distance of the animal(s) from the vessel at the first sighting, heading, position relative to the vessel, duration of sighting, and behavior.
7. BOEM will notify the National Marine Fisheries Service (NMFS) at least 30 days in advance of the start of the proposed activity to demonstrate how the proposed action is consistent with the activities and conditions considered herein.
8. Data on all marine mammal and sea turtle observations must be recorded by the observer based on standard observer data collection protocols. This information must include the following:

    a. Vessel name;
    b. Observers' names, affiliations, and resumes;
    c. Date;
    d. Time and latitude/longitude when daily visual survey began;
    e. Time and latitude/longitude when daily visual survey ended; and
    f. Average environmental conditions during visual surveys including:
        i. Wind speed and direction;
        ii. Sea state (glassy, slight, choppy, rough, or Beaufort scale);
        iii. Swell (low, medium, high, or swell height in meters); and
        iv. Overall visibility (poor, moderate, good).
    g. Species (or identification to lowest possible taxonomic level);
    h. Certainty of identification (sure, most likely, best guess);
    i. Total number of animals;
    j. Number of calves and juveniles (if applicable/distinguishable);
    k. Description (as many distinguishing features as possible of each individual seen, including length, shape, color and pattern, scars or vessel when sighting occurred.
    l. Whether or not a shutdown was required, marks, shape and size of dorsal fin, shape of head, and blow characteristics);
    m. Direction of animal's travel relative to the vessel (drawing preferably);
    n. Behavior (as explicit and detailed as possible; note any observed changes in behavior);
    o. Activity of requested/completed.

9. BOEM will require the contractor to prepare a monthly report that summarizes the survey activities and an estimate of the number of listed marine mammals, sea turtles, and any other protected species observed during these survey activities. BOEM will provide a consolidated annual report to NMFS.

Vibracore Sampling Protocol

Only vibracorers and grab samplers will be used to sample near-surface sediments during geological surveys. The vibratory mechanism on the vibracorer will be the primary source of underwater sound during geological sampling operations in addition to broadband noise from the vessel. The vibrahead will not be operated until the vibracore platform makes contact with the seabed and core barrel makes contact with the seafloor. The vibrahead will not be operated when vibracore platform is being retrieved. No noise is associated with use of grab samplers. Visual monitoring of an acoustic exclusion zone of 328 feet (100 m), consistent with the geophysical protocol, will be implemented. The same startup and shutdown requirements, consistent with the geophysical protocol, will be implemented when marine mammals and sea turtles are observed approaching or within the acoustic exclusion zone.

Nighttime Geophysical Surveys and Passive Acoustic Monitoring Protocol

Geophysical surveys will occur during day-light hours to the maximum extent practicable or cost-effective. If nighttime operations occur, a PAM system will be used as long as the following conditions are met: (1) the system is deployable from the same survey platform, (2) the system is demonstrated to be effective, and (3) its use does not unreasonably interfere with geophysical equipment deployment and data acquisition. If BOEM, working with its contractor, determines that PAM cannot effectively be used to monitor the 328-foot (100-m) exclusion zone, operational frequencies of geophysical equipment will be modulated provided adequate data quality is achievable. PAM will be used in addition to observers visually monitoring the exclusion zone with night-vision goggles or other appropriate equipment. Because PAM does not aid in the detection of non-vocalizing animals, including sea turtles and sturgeon, the frequency of chirp and boomer sources during nighttime surveys will be modulated to operate outside the upper limit of hearing range of the species most likely to be present in the survey area (e.g., loggerhead: less than 1 kHz; leatherback: less than 2 kHz; sturgeon: less than 1 kHz). PAM would not be required to be used as a supplement during daylight operations because acoustic exclusion and vessel strike zones can be effectively monitored by observers.

The efficacy of PAM as a mitigation measure can be limited by bottom configuration (water depth) and other environmental factors. In some cases, towing the PAM equipment is not practicable. Additionally, BOEM will impose a 328-foot (100-m) limit on the streamer length, which could effectively limit the utility of PAM in context of the sources being used and their operational frequencies and propagation characteristics. Inclusion of PAM does not reduce the need for visual observers at the same time, including nighttime surveys. PAM could require additional personnel (i.e., PAM operators). In some circumstances, this requirement may result in changes to the size of the survey vessel, potentially increasing risk of vessel strike.

If nighttime geophysical surveys are conducted, the lighting scheme on the survey vessel will be adjusted, through reduction, shielding, lowering, and appropriate placement of light sources, to avoid attracting or otherwise disturbing sea turtles, sea birds, and other marine species. Adjustments to the lighting on the vessel would not fall below the minimum standard required by the U.S. Coast Guard (USCG) and Occupational Safety and Health Administration.

Vessel Strike Avoidance Protocol

All G&G surveys, regardless of host vessel size, will be required to comply with the following requirements:

1. Vessel operators, crews, and visual observers or PSOs must maintain a vigilant watch for marine mammals, sea turtles, and smalltooth sawfish, and slow down or stop their vessel regardless of vessel size to avoid striking protected species. A visual observer aboard all G&G survey vessels will monitor an area around a transiting survey vessel, the vessel strike exclusion zone, to ensure it is free of marine mammals, sea turtles, and smalltooth sawfish. At least one observer will be required aboard all vessels. Visual observers, for the purpose of vessel strike, may be third-party or not third-party, but require training. In addition, vessel operators would be required to comply with NMFS marine mammal and sea turtle viewing guidelines for the Northeast Region or the Southeast Region.
2. Marine mammals and sea turtles may surface in unpredictable locations or approach slowly moving vessels. When marine mammals or sea turtles are sighted in the vessel's path or in close proximity to a moving vessel regardless of vessel size, vessel operators must reduce speed and shift the engine to neutral. Engines will not be re-engaged until the animals are clear of the exclusion area specified below.
3. In accordance with NMFS Compliance Guide for the Right Whale Ship Strike Reduction Rule (50 CFR 224.105 and 78 FR 73726–73736), when safety allows, vessels, regardless of size, shall transit within the 10-knot (18.5-km/h) speed restriction in DMAs, Northeast critical habitat and SMAs (Great South Channel, April 1 through July 31 Off Race Point, March 1 through April 30), mid-Atlantic SMAs (November 1 through April 30), and critical habitat and southeast SMAs (November 15 through April 15). When safety permits, vessel speeds should also be reduced to 10 knots (18.5 km/h) or less when mother/calf pairs, pods, or large assemblages of right whales are observed near a transiting vessel. A single animal at the surface may indicate the presence of submerged animals in the vicinity of the vessel; therefore, precautionary measures should be exercised when an animal is observed. Mandatory reductions in speed will also limit continuous noise levels related to propeller cavitation and hull-wave interaction.
4. When North Atlantic right whales are sighted at any time during the year, vessels, regardless of size, must maintain a minimum separation distance of 1,640 feet (500 m). The following avoidance measures must be taken if a vessel comes within 1,640 feet (500 m) of a right whale:
    a. While underway, the vessel operator shall steer a course away from the right whale at 10 knots (18.5 km/h) or less until the minimum separation distance has been established.
    b. If a right whale is spotted in the path of a vessel or within 328 feet (100 m) of a vessel underway, the operator shall reduce speed and shift engines to neutral. The operator shall only re-engage engines after the right whale has

moved out of the path of the vessel and is more than 328 feet (100 m) away. If the right whale is still within 1,640 feet (500 m) of the vessel, the vessel shall select a course away from the whale's course at a speed of 10 knots (18.5 km/h) or less. This procedure shall also be followed if a right whale is spotted while a vessel is stationary. Whenever possible a vessel should remain parallel to the whale's course while transiting, avoiding abrupt changes in direction until it has left the area.

5. Vessels regardless of size must maintain a minimum separation distance of 328 feet (100 m) year-round if whales other than right whales, seals, or manatees are sighted. The survey will comply with other relevant manatee construction conditions when operating within the species' range. All vessels will follow routes of deep water whenever possible. Year-round, vessels, regardless of size, shall maintain a distance of 164 feet (50 m) or greater from delphinid cetaceans. If encountered during transit, a vessel shall attempt to remain parallel to the animal's course, avoiding excessive speed or abrupt changes in course.
6. All vessels, regardless of size, must maintain a distance of 164 feet (50 m) or greater if sea turtles or smalltooth sawfish are sighted, whenever possible. The survey will comply with other relevant smalltooth sawfish construction conditions when operating within the species range. During nighttime geophysical surveys and transit, nighttime observer requirements will be implemented and vessel speed will not exceed 5 knots (9.3 km/hr) in areas where sea turtles are most likely to be present.
7. Sightings of any injured or dead protected species must be reported to BOEM and NMFS or U.S. Fish and Wildlife Service (FWS) within 24 hours, regardless of whether the injury or death was caused by their vessel.

Historic and Pre-contact Sites Avoidance and Reporting Requirements

The proposed action will generally limit vibracore and grab sampling to near-surface sand deposits with a maximum seafloor disturbance footprint of less than 21.5 square feet (2 square meters) for each sample. The sampling duration for a 20-foot (6-m), 3-4-inch (7.6–10.1-cm) diameter vibracore is typically less than 15 minutes in place. Samples are being collected to characterize sand resources and are not expressly for archaeological interest or identification. The sediment targeted is generally limited to near-surface sands rather than other geologic deposits, such as finer-grained material typical to near-surface or exposed Holocene and Pleistocene back-barrier deposits (where potentially intact cultural layers may be preserved). Those other geological units are not the target for sampling and or potential subsequent use. Any penetration below the surface sand layer will be incidental and limited in nature. Any geologic or other information of archaeological interest will be documented, and any potential cultural layers will be noted and photographed. This information will be made available for use in the design of any future borrow area(s) to ensure future activities that may be proposed include necessary avoidance or protection measures. The following mitigation measures are proposed:

1. BOEM will require, to the maximum extent possible, the use of a dynamically positioned vessel or live boating methodology during vibracore and grab sampling operations to avoid unnecessary anchoring and seafloor disturbance. No spudding or clump weight

anchoring will be allowed. Although BOEM plans to minimize anchoring to the extent possible, there could be instances where anchoring cannot be avoided due to emergency situations or field conditions. In these instances, a minimum-sized anchor/anchor array will be used and advance or real-time clearance, through remote sensing, diver observation, or other means within the footprint of anchoring, will be required.

2. Before seafloor sampling is conducted, a geological sampling plan will be submitted to BOEM, and BOEM will share with relevant and interested stakeholders as appropriate. Upon request, BOEM will make pertinent geological data, including core logs, photographs, and related textural data, available in an electronic format. Prior to distribution, BOEM will review this information and determine if any of the data contains sensitive cultural information.
3. BOEM will require advance (sequential) or real-time (concurrent) site-specific information, from sub-bottom, side-scan sonar, or multibeam/swath backscatter of equivalent resolution, magnetometer data, and/or direct observation, to determine the presence of potential archaeological resources prior to undertaking any seafloor-disturbing activities. BOEM or its contractors would use this information to ensure that physical impacts on archaeological resources would not take place. All sampling must occur within the effective coverage of geophysical data. In the instances of sequential geophysical and geological data, the contractor must provide to BOEM a determination by a Qualified Marine Archaeologist as to whether any potential archaeological resources are present in the area. In instances where sequential data collection is not possible, concurrent geophysical surveys and geological sampling may occur, provided a Qualified Marine Archaeologist participates in the field effort or has concurrent access to review data quality, interpret data, and provide assurance that the immediate area is clear before vibracoring, grab sampling, and/or associated anchoring can begin. A "Qualified Marine Archaeologist" must meet the Secretary of the Interior's Professional Qualifications Standards for Archaeology (Federal Register 1983); must have demonstrable, professional experience in interpretation of marine geophysical data; and familiarity with the Study Area.
4. All geological sampling must avoid potential archaeological resources by a minimum of 164 feet (50 m). All associated anchoring, if any, must avoid potential archaeological resources by 328 feet (100 m). The avoidance distance must be calculated from the maximum discernible extent of the archaeological resource. During vibracoring, vibracore penetration rates will also be monitored to help ensure minimum sampling in geology units not indicative of surface sands.
5. Contractors will report suspected historic and pre-contact archaeological resources to BOEM and take necessary precautions to protect said resources. BOEM will also require reporting and avoidance for any previously undiscovered suspected archaeological resource and precautions to protect the resource from seafloor-disturbing activities. Undiscovered archaeological resources could include items such as a shipwreck (e.g., a sonar image or visual confirmation of an iron, steel, or wooden hull, wooden timbers, anchors, concentrations of historic objects, piles of ballast rock), or pre-contact artifacts within the Study Area. If the contractor discovers any archaeological resource while conducting operations, operations that could continue to affect the discovery must be immediately halted and the discovery reported to BOEM within 24 hours. In the event

that the seafloor-disturbing activities impact potential historic properties, the operator and Qualified Marine Archaeologist who prepared the report must instead provide a statement documenting the extent of these impacts to BOEM within 24 hours.

Sensitive Benthic Habitat and Communities Avoidance Requirements

BOEM will generally avoid anchoring, geological sampling, and any other seafloor-disturbing activities in the vicinity of sensitive benthic habitat and associated communities, including hard bottom, rippled scour depressions, cobbled seafloor, reef tract, and Habitat Areas of Particular Concern (HAPCs) not only because of their conservation value but also because these areas are not likely to be host to sand rich deposits. Any seafloor-disturbing activities in these areas will avoid these habitats and general seafloor impacts by either 1) using a dynamically positioned vessel or live boating methodology to support geological sampling and/or, 2) require site-specific geophysical data in advance of sampling to map and otherwise avoid benthic resources. All sensitive benthic habitat must be avoided by at least 164 feet (50 m) during vibracoring or other seafloor-sampling activities, whereas anchoring must avoid sensitive benthic habitat by 328 feet (100 m).

1. As previously described, BOEM will require, to the maximum extent possible, the use of a dynamically positioned vessel or live boating methodology during vibracore and grab sampling operations to avoid unnecessary seafloor disturbance. No spudding or clump weight anchoring will be allowed. Although BOEM plans to minimize anchoring, there may be instances where anchoring cannot be avoided due to emergency situations or field situations/conditions. In these instances, a minimum-sized anchor/anchor array will be used and advance or real-time clearance, through remote sensing, diver observation, or other means within the footprint of anchoring, will be required.
2. BOEM would require advance (sequential) or real-time (concurrent) site-specific information from sub-bottom, side-scan sonar, or multibeam/swath backscatter of equivalent resolution, and/or direct observation, to determine the presence of potential sensitive benthic resources prior to undertaking any seafloor-disturbing activities. BOEM or its contractors would use this information to ensure that physical impacts on sensitive benthic resources are avoided or minimized.
3. Before seafloor sampling is conducted, a geological sampling plan will be submitted to BOEM, and BOEM will confirm that the plan is consistent with the required mitigation measures. Upon request, BOEM will make pertinent geological and or geophysical data available in an electronic format to interested stakeholders.

Marine Pollution Control Plan

All G&G survey activities will occur under a contractor-developed marine pollution control plan. The marine pollution control plan must address the marine debris awareness requirement. The contractor must prepare for and take all necessary precautions to prevent discharges of waste or hazardous materials that may impair water quality. Sufficient spill response equipment and supplies shall be available onboard (or readily mobilized with a secondary vessel) to contain and recover the maximum scenario spill keyed to the proposed operations and disclosed in the marine pollution control plan. In the event of such an occurrence, notification and response will be in accordance with applicable requirements of 40 CFR Part 300. All vessel operations must be compliant with USCG regulations and the U.S. Environmental Protection Agency's (USEPA) Vessel General Permit, as applicable. BOEM, the USCG, and the USEPA, as necessary, will be notified of a noncompliant discharges and remedial actions taken. Reports of the incident and resultant actions will be provided to BOEM.

As an additional measure to reduce the likelihood of accidental spills, vessel fueling will only occur in-port at a docking facility; no at-sea cross-vessel fueling will be permitted.

Marine Debris Awareness Program

All participants in G&G surveys will be educated on marine trash and debris awareness elimination. The contractor would be required to ensure that its employees and sub-contractors are made aware of the environmental and socioeconomic impacts associated with marine trash and debris and their responsibilities for ensuring that trash and debris are not intentionally or accidentally discharged into the marine environment where it could affect protected species.

Navigation and Commercial Fisheries Operations Conflict Minimization Requirements

Notification of pending activities will be made in the USCG Local Notice to Mariners no less than 48 hours prior to the commencement of all G&G activities. The call sign of the survey vessel and preferred communication channel must be identified.

Consistent with applicable USCG regulations, all designated vessels will be equipped with AIS and broadcast vessel's identity, type, position, course, speed, and navigational status during surveying activities. BOEM will require any vessel greater than 65 feet (20 m), regardless of operational status, to employ an AIS system.

No hydrophone streamer or other source towline may exceed 328 feet (100 m) beyond the survey vessel to minimize the effective footprint of operations and minimize disturbance to fisheries vessels, fisheries gear, and/or other shipping or boating traffic.

During surveys, the survey operator must notify all fisheries vessels observed within 6,500 feet (2 km) of a geophysical survey to avoid potential entanglement in fishing gear. Vessels will "fly" the appropriate USCG-approved day shapes (mast head signals used to communicate with other vessels) and display the appropriate lighting, during daylight and any nighttime operations, to designate the vessel has limited maneuverability.

To minimize interaction with fishing gear that may be present, the survey operator will traverse or visually scan the general survey area, or use other effective methods, prior to commencing survey operations to determine the presence of deployed fishing gear. Observed fishing gear must be avoided by a minimum of 100 feet (30 m). Fishing gear must not be relocated or otherwise disturbed.

2.3. Alternative B: Additional Operational Restrictions and Time-Area Closures

Under this alternative, the same suite of G&G activities would occur with the implementation of the same mitigation suite as Alternative A, but additional mitigation requirements and restrictions on G&G operations would be employed. This alternative is designed to meet the underlying need for G&G data, while incrementally reducing environmental impacts from G&G surveys.

Operational Restrictions. Under this alternative, G&G survey operations would be subject to an additional operational restriction: geological surveys would occur only after geophysical surveys have been conducted and analyzed. The difference between this alternative and Alternative A is that there is no option for simultaneous deployment and geophysical and geological data collection. This alternative could require two mobilizations to an area if it is determined that additional (site-specific) investigation is warranted. Additionally, no anchoring would be permitted during geological surveys, except in the case of an emergency. This alternative provides for a more deliberate assessment and consideration of seafloor-disturbing activities and provides for an incremental improvement in impact avoidance and sensitive resource protection, but increases the number of trips, as well as logistical planning and vessel, crew, and other equipment costs.

Additional source frequency restrictions would be applied to minimize potential effects on loggerhead sea turtles (and incidentally other sea turtles) during the loggerhead nesting season (May 1 to October 31) offshore of southeastern Florida. These restrictions would limit G&G surveys to frequencies that are below the upper hearing threshold for loggerhead sea turtles, which is approximately 1 kHz (Martin et al., 2012b). Nighttime surveys would be avoided altogether in that area to minimize noise-related harassment and vessel strike risk.

Additional Time-Area Closures. Alternative B would also incorporate additional time-area closures to specifically avoid particularly important biological areas of other protected and managed species. The exact closure areas and value of those closures would be determined in context of the areas ultimately nominated for study. However, BOEM anticipates that the actual survey areas may include important foraging grounds or may be located in migratory corridors, depending on the time of year. NMFS, through regional Fishery Management Councils, is tasked with identifying HAPCs within Essential Fish Habitat (EFH)-designated areas to focus conservation priorities on specific areas that play a particularly important role in the life cycles of federally managed fish species. HAPCs identified for spawning and nursery areas (Appendix A, Table A-12) help safeguard fish breeding and overall fish population and can protect fish during this vulnerable time of their lifecycle. Once the exact survey areas are determined, geophysical surveys would be scheduled to avoid HAPCs (e.g., cape-associated shoals) during critical spawning and nursing windows to the maximum extent practicable. These time-area closures may contribute to a small reduction in vessel strike risk and minimize the likelihood of noise-related effects depending on location, time of year, and characteristic behavior.

2.4. Alternative C: No Action Alternative

Under Alternative C, the no action alternative, the proposed action would not occur and a comprehensive and systematic inventory of sand resources along the Atlantic OCS would not be conducted. Additional borrow areas for coastal restoration and resiliency would not be delineated. The no action alternative would not meet the objectives of the Disaster Relief Appropriations Act, and BOEM would forfeit the funds. Analysis of this alternative is required under 40 CFR 1502.14(d).

3. Description of the Affected Environment and Environmental Consequences

This section characterizes the environmental resources in the Study Area and describes the potential impacts on those resources that could occur from implementing the proposed action and alternatives.

3.1. Resources Dismissed from Further Detailed Analysis

BOEM reviewed several recent environmental documents that address potential effects from geophysical surveys and shallow geological sampling to determine which physical, biological, and sociocultural resources should be considered in detail in this EA. Environmental documents reviewed included, but were not limited to, the *Programmatic EA for G&G activities in the Gulf of Mexico* (MMS 2004), *Programmatic EIS for NSF and USGS Marine Seismic Research* (NSF and USGS 2011), *Atlantic OCS Proposed G&G Activities Draft Programmatic EIS* (BOEM 2012a), *NOAA Office of Coast Surveys Hydrographic Surveys Projects Programmatic EA* (NOAA 2013a), and *California Low Energy Offshore Geophysical Update, Mitigated Negative Declaration* (CSLC, 2013).

The following physical, biological, and sociocultural resource areas or issues were identified for possible consideration in this EA: air quality, water quality, primary and secondary production, benthic habitat and communities, marine mammals, sea turtles, fish and EFH, marine and coastal birds and bats, historic/pre-contact resources, aesthetics, recreation, and environmental justice. Other marine uses/cumulative actions, such as marine recreation, recreational/commercial fisheries, shipping, and military exercises, were also considered for incorporation and analysis.

BOEM considered these physical, biological, and sociocultural resource categories in context of the range of potential impacting activities expected to occur during G&G surveys. Impacting factors most relevant to the proposed G&G survey activities include:

1. noise from active sound sources and vessel operations;
2. vessel presence/traffic;
3. vessel wastes and accidental discharges; and,
4. seafloor disturbance.

NEPA instructs Federal agencies to focus the analysis on those effects and issues in a manner proportional to their relevance and potential significance. No or very limited impacts were expected to result from the proposed G&G activities to five resource areas (i.e., air quality, water quality, phytoplankton and zooplankton, aesthetics, and environmental justice). Therefore, these resource areas are briefly discussed below and will not be evaluated further:

- Air Quality: Small survey vessels involved in G&G activities emit a variety of air pollutants including nitrogen oxides, sulphur oxides, particulate matter, volatile organic compounds, carbon monoxide, and greenhouse gas emissions (e.g., carbon dioxide). However, vessel emissions would only slightly and temporarily increase ambient concentrations of criteria pollutants offshore due to the combustion of diesel fuel. Further, emissions in coastal areas would be limited to when survey vessels are mobilizing, demobilizing, and refueling. During G&G

activities, emissions from vessel operations are generally expected to be far enough offshore and disperse rapidly, given prevailing meteorological conditions, so as to not contribute to onshore air quality or ozone violations and/or increase pollutants such that public health is affected. Therefore, BOEM has determined that impacts on air quality would be very limited and further analysis is not warranted.

- Water Quality: Very short-term and localized deterioration in water quality could occur during survey operations following discharge of sanitary and domestic wastes and cooling water. Waste would be either treated onboard the vessel using an approved marine sanitation device or stored aboard to be pumped out later onshore, depending upon vessel size. All vessel operations would comply with the regulatory requirements of the USCG and USEPA's Vessel General Permit. Hazardous materials routinely onboard survey vessels include diesel fuel, hydraulic fluid, and lubricants. Although accidental spills are unexpected, all operations would be conducted under a marine pollution control plan (see Section 2.2.7). Survey operations would have immediate access (or readily mobilized via a secondary vessel) to sufficient spill response equipment and supplies to contain and recover any spill. To further reduce the risk of spills, all vessel fueling would occur at a docking facility in-port; cross-vessel fueling would not be permitted. Due to the operational and regulatory requirements regarding wastes and spills, BOEM has determined that impacts on water quality would be very limited and localized, such that further analysis regarding water quality impacts is not warranted. The principal indirect effects of water quality degradation could include potentially adverse effects on biological resources from exposure to those discharges. Those indirect effects related to degradation in water quality have been addressed in each biological resource section.

- Phytoplankton and Zooplankton: Primary and secondary production supports higher trophic levels, including forage fishes, large fishes, seabirds, sea turtles, and marine mammals. Species diversity and population sizes vary seasonally and geographically throughout the Study Area. Impacts on phytoplankton and zooplankton from G&G surveys would be minimal and limited to the area immediately around sound sources or impaired water quality conditions. Therefore, BOEM has determined that impacts on phytoplankton and zooplankton would be very limited and further analysis is not warranted.

- Aesthetics: The presence of intermediate-size survey vessels (typically 50 to 150 feet (15 to 46 m) in length) is not unusual offshore the Atlantic seaboard, considering that other vessels (commercial vessels, recreational fishing boats, and large and small pleasure boats) regularly operate in offshore waters. G&G survey vessels would be far enough offshore, with some beyond the visibility of the shoreline, and spread over a relatively large inner shelf area, to limit visual impacts at any specific location. Moreover, most surveys in any given location or coastal segment would be limited to a few days or weeks. Also, BOEM expects survey operations to occur mostly during daylight hours so that lighting during nighttime operations is minimized. As a result, aesthetic impacts due to vessel operations in a survey area, including disruption of scenic resources important to wildlife viewing and cultural heritage, would be minimal and short-term. BOEM has determined that further analysis of potential effects to aesthetics is not warranted.

- Environmental Justice: The proposed G&G survey activities are not expected to result in disproportionate impacts on minority or low-income populations that could reside in nearby communities or populations that use the surrounding area for recreation or commerce because effects on the coastal environment, especially in the vicinity of ports and coastal inlets, would be very limited and short-term. Otherwise, the activities on the OCS would be far enough offshore and disbursed over a large geographic area so as to not contribute to environmental justice issues for a specific community. Further analysis of environmental justice issues is not warranted.

3.2. Definition and Description of Impact Levels

This EA addresses the environmental consequences of each alternative by resource area. Effects could include direct, indirect, and cumulative impacts. Direct impacts are caused by the activity and occur at the same time and place as the activity. Indirect impacts are caused or induced by the activity and occur later in time, or are removed spatially from the location of the activity. Cumulative impacts (discussed in Section 4) are those that result from the incremental effect of the activity, in combination with other past, present, or reasonably foreseeable future actions in the Study Area during the period of analysis (2014 to 2017).

Impact levels were developed for each of the resource areas to be analyzed based on the results of the resource screening (Section 3.1). Criteria reflect consideration of the context and intensity of impact (40 CFR 1508.27), based on four parameters – detectability (i.e., measurable or detectable impact), duration (i.e., short-term, long-term), spatial extent (i.e., localized, extensive), and severity (i.e., severe, less than severe). For the purposes of this analysis, impacts can be classified into one of four levels – negligible, minor, moderate, or major, as defined below:

- ***Negligible***: Little or no measurable/detectable impact.
- ***Minor***: Impacts are detectable, short-term, extensive or localized, but not severe;
- ***Moderate***: Impacts are detectable, short-term, extensive, and severe; impacts are detectable, short-term or long-lasting, localized, and severe; or impacts are detectable, long-lasting, extensive or localized, but less than severe.
- ***Major***: Impacts are detectable, long-lasting, extensive, and severe.

Each impact parameter was evaluated on a resource-specific basis to determine the appropriate impact level, considering the unique attributes of the resource being evaluated. For biological resources, attributes such as distribution/range, life history, and susceptibility to impacts on individuals and populations were considered, among other factors. Additionally, for cultural resources, the potential for the presence of significant historic/pre-contact archaeological resources and the risk of potential impacts on these resources were considered.

3.3. Marine Mammals

3.3.1. Affected Environment

In the western North Atlantic Ocean, there are numerous species of marine mammals representing three taxonomic orders: Cetacean (baleen whales, toothed whales, dolphins, and porpoises), Sirenia (manatee), and Carnivora (true seals) (Waring et al., 2010). A listing of species, including current status, occurrence, and auditory range, is provided in Table 3-1.

All marine mammals are protected under the MMPA. Some species are also protected under the ESA. Under the ESA, 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 throughout all or a significant portion of its range."

Some marine mammal species or specific stocks (defined as a group of nonspecific individuals that are managed separately (Wang 2002)) may be designated as strategic under the MMPA, which requires the jurisdictional agency (NMFS or FWS) to impose additional protective measures. A stock is considered strategic if the following were to occur:

- direct human-caused mortality exceeds a stock's Potential Biological Removal level (defined as the maximum number of animals, not including natural mortality, that can be removed from the stock while allowing the stock to reach or maintain its optimum sustainable population level);
- it is listed under the ESA;
- it is declining and likely to be listed under the ESA; or
- it is designated as depleted under the MMPA.

The following provides a brief description of each marine mammal species or species group (where appropriate) potentially occurring within the Study Area, including current status, distribution, and behavior.

3.3.1.1. Threatened and Endangered Species

Seven marine mammal species that could be in the Study Area are federally listed as endangered species. These include five baleen whales (North Atlantic right whale, blue whale, fin whale, sei whale, and humpback whale), one toothed whale (sperm whale), and the Florida subspecies of the West Indian manatee (Waring et al., 2010). Of the listed species in the Study Area, only the North Atlantic right whale, fin whale, and humpback whale are likely to occur. The other species are unlikely to occur in the Study Area, especially given the relatively shallow water depths, and will therefore not be addressed further in this EA.

Table 3-1. Marine Mammals Potentially Occurring in the Study Area

Common Name	Species	Stock	ESA/ Stock Status[1]	Occurrence	Best Pop. Estimate[2]	Critical Habitat in Study Area	Function Hearing Group[3]
ORDER CETACEA							
Suborder Mysticeti (Baleen Whales)							
Common Minke Whale	*Balaenoptera acutorostrata acutorostrata*	Canadian East Coast		Unlikely	8,987	--	L
Sei Whale	*Balaenoptera borealis*	Nova Scotia	E/S	Unlikely	386	--	L
Bryde's Whale	*Balaenoptera brydei*	N/A		Unlikely	N/A	--	L
Blue Whale	*Balaenoptera musculus*	Western North Atlantic	E/S	Unlikely	unknown	--	L
Fin Whale	*Balaenoptera physalus*	Western North Atlantic	E/S	Likely	3,985	--	L
North Atlantic Right Whale	*Eubalaena glacialis*	Western Atlantic	E/S	Likely	361	Yes	L
Humpback Whale	*Megaptera novaeangliae*	Gulf of Maine	E/S	Likely	847	--	L
Suborder Odontoceti (Toothed Whales, Dolphins, and Porpoises)							
Short-beaked Common Dolphin	*Delphinus delphis*	Western North Atlantic		Unlikely	120,743	--	
Pygmy Killer Whale	*Feresa attenuata*	Western North Atlantic		Unlikely	unknown	--	M
Short-Finned Pilot Whale	*Globicephala macrorhynchus*	Western North Atlantic		Unlikely	24,674	--	M
Long-Finned Pilot Whale	*Globicephala melas*	Western North Atlantic		Unlikely	12,619	--	M
Risso's Dolphin	*Grampus griseus*	Western North Atlantic		Unlikely	20,479	--	M
Northern Bottlenose Whale	*Hyperoodon ampullatus*	Western North Atlantic		Unlikely	unknown	--	M
Pygmy Sperm Whale	*Kogia breviceps*	Western North Atlantic		Unlikely	395	--	H
Dwarf Sperm Whale	*Kogia sima*	Western North Atlantic		Unlikely	395	--	H
Atlantic White-sided Dolphin	*Lagenorhynchus acutus*	Western North Atlantic		Unlikely	63,368	--	M
Fraser's Dolphin	*Lagenodelphis hosei*	North Atlantic		Unlikely	unknown	--	M
Sowerby's Beaked Whale	*Mesoplodon bidens*	Western North Atlantic		Unlikely	3,513	--	M
Blainville's Beaked Whale	*Mesoplodon densirostris*	Western North Atlantic		Unlikely	3,513	--	M
Gervais' Beaked Whale	*Mesoplodon europaeus*	Western North Atlantic		Likely	3,513	--	M
True's Beaked Whale	*Mesoplodon mirus*	Western North Atlantic		Unlikely	3,513	--	M
Killer Whale	*Orcinus orca*	Western North Atlantic		Unlikely	unknown	--	M
Melon-Headed Whale	*Peponocephala electra*	Western North Atlantic		Unlikely	unknown	--	M
Harbor Porpoise	*Phocoena phocoena*	Gulf of Maine/Bay of Fundy		Likely	89,054	--	H
Sperm Whale	*Physeter macrocephalus*	North Atlantic	E/S	Unlikely	4,804	--	M

Common Name	Species	Stock	ESA/ Stock Status[1]	Occurrence	Best Pop. Estimate[2]	Critical Habitat in Study Area	Function Hearing Group[3]
False Killer Whale	*Pseudorca crassidens*	N/A		N/A	unknown	--	M
Pantropical Spotted Dolphin	*Stenella attenuata*	Western North Atlantic		Unlikely	4,439	--	M
Clymene Dolphin	*Stenella clymene*	Western North Atlantic		Unlikely	unknown	--	M
Striped Dolphin	*Stenella coeruleoalba*	North Atlantic		Likely	94,462	--	M
Atlantic Spotted Dolphin	*Stenella frontalis*	Western North Atlantic		Likely	50,978	--	M
Spinner Dolphin	*Stenella longirostris*	Western North Atlantic		Unlikely	unknown	--	M
Rough-Toothed Dolphin	*Steno bredanensis*	Western North Atlantic		Unlikely	unknown	--	M
Bottlenose Dolphin	*Tursiops truncatus*	Western North Atlantic Offshore		Likely	81,588	--	M
		Coastal and estuarine stocks (12 stocks; see text)	S	Likely	varies	--	M
Cuvier's Beaked Whale	*Ziphius cavirostris*	Western North Atlantic		Unlikely	3,513	--	M
ORDER SIRENIA							
West Indian Manatee (Florida subspecies)	*Trichechus manatus latirostris*	Florida	E/S	Unlikely	3,802	Nearby (FL inland waters)	P[4]
ORDER CARNIVORA							
Suborder Pinnipedia							
Hooded Seal	*Cystophora cristata*	Western North Atlantic		Unlikely	unknown	--	P
Gray Seal	*Halichoerus grypus*	Western North Atlantic		Likely	unknown	--	P
Harbor Seal	*Phoca vitulina*	Western North Atlantic		Likely	unknown	--	P
Harp Seal	*Phoca groenlandica*	Western North Atlantic		Unlikely	unknown	--	P

N/A = Not available.
[1] ESA = Endangered Species Act; E = endangered; S = strategic stock.
[2] Best population estimate "NBest" from Table 1 of the Waring et al. (2010) stock assessment report.
[3] Functional marine mammal hearing groups and specific auditory ranges (Adapted from Southall et al., 2007). L = Low-Frequency Cetacean (7 Hz–22 kHz); M = Mid-Frequency Cetacean (150 Hz–160 kHz); H = High-Frequency Cetacean (200 Hz–180 kHz); P = Pinniped in Water (75 Hz–75 kHz).
[4] Manatee hearing is not addressed by Southall et al. (2007). Based on review of marine mammal hearing capabilities in BOEM 2012a (Appendix H), manatee hearing is generally similar to that of phocid pinnipeds except at the lowest frequencies.

Source: Waring et al., 2010.

North Atlantic Right Whale (*Eubalaena glacialis*)

The North Atlantic right whale is the only member of the baleen whale family Balaenidae found in north Atlantic waters. It is medium in size when compared to other baleen whale species, with adult size ranging from 46-56 feet (14-17 m) (NMFS 2005).

Status. The North Atlantic right whale is considered one of the most critically endangered whales (Jefferson et al., 2008). The western Atlantic stock is classified as strategic because the average annual human-related mortality and serious injury exceeds Potential Biological Removal (Waring et al., 2010). Today, the minimum population size is approximately 361 individuals (Waring et al., 2010). Continued threats to the North Atlantic right whale population include commercial fishing interactions, vessel strikes, underwater noise, habitat degradation, and predators (NMFS 2005; Waring et al., 2010).

In 1994, three critical habitats for the North Atlantic right whale were designated by NMFS along the eastern coast of the U.S. (Federal Register 1994). These include Cape Cod Bay/Massachusetts Bay, Great South Channel, and selected areas off the southeastern United States.

In addition to the critical habitat, SMAs have been designated along the Atlantic coast to reduce right whale ship strikes (Figure 1-2). All vessels greater than 65 feet (19.8 m) in overall length must operate at speeds of 10 knots or less within these areas during specific time periods.

Distribution. The North Atlantic right whale is a migratory species usually found within waters of the western North Atlantic between 20° and 60° N latitude. Generally, individual right whales undergo seasonal coastal migrations from summer feeding grounds off eastern Canada and the U.S. northeastern coast to winter calving grounds off the U.S. southeastern coast.

Recent sightings data also report a few North Atlantic right whales as far north as Newfoundland, the Labrador Basin, and southeast of Greenland (Waring et al., 2010; Mellinger et al., 2011). Research suggest the existence of six major congregation areas for North Atlantic right whales: the coastal waters of the southeastern U.S.; the Great South Channel; Georges Bank/Gulf of Maine; Cape Cod and Massachusetts bays; the Bay of Fundy; and the Scotian Shelf (Waring et al., 2010). Movements of individuals within and between these congregation areas are extensive, and data show distant excursions, including into deep water off the continental shelf (Mate et al., 1997; Baumgartner and Mate, 2005; Mellinger et al., 2011). Using acoustic survey methods, Morano et al. (2012) found that North Atlantic right whales are present in Massachussetts Bay year-round for at least 24 percent of every month, suggesting that the whales could be using the Bay not only as a migratory corridor to and from Cape Cod Bay, but also as non-migratory habitat. The North Atlantic Right Whale Sighting Survey program showed that some individuals may stay in the northern Gulf of Maine during the winter. Further, in 2008 and 2009, right whales were sighted during the North Atlantic Right Whale Sighting Survey program off Jeffrey's and Cashes Ledge, Stellwagen Bank, and Jordan Basin from December to February (Khan et al., 2009, 2010). The groupings of individual right whales within these congregation areas are likely to be a function of acceptable prey distribution, since right whales must locate and exploit extremely dense patches of zooplankton to feed efficiently (Mayo and Marx 1990). These dense zooplankton patches are likely a primary characteristic of the spring, summer, and fall right whale habitats (Kenney et al., 1986, 1995).

Behavior. North Atlantic right whales are usually observed in groups of less than 12 individuals, and most often as single individuals or pairs. Larger groups may be observed in feeding or breeding areas (Jefferson et al., 2008). Right whales feed on zooplankton (e.g., calanoid copepods) generally by skimming through concentrated patches of prey at or below the sea surface. The typical reproductive cycle in mature female right whales is 3 years between births. The age at sexual maturity is estimated at 9 or 10 years, and gestation length is about 12 months; calves nurse for almost 12 months.

Auditory and Vocalization Range. North Atlantic right whale vocalizations are primarily low-frequency (below 1,000 Hz), with some sounds up to 1,500–2,000 Hz (Kenney 2002). Moans, groans, belches, and pulses have most of their acoustic energy below 500 Hz. Some vocalizations will occasionally reach up to 4 kHz (DOSIT 2013). While there are no direct hearing data available (Ketten 2000), North Atlantic right whales are classified within the low-frequency cetacean functional marine mammal hearing group (i.e., 7 Hz–22 kHz) (Southall et al., 2007). However, Parks et al. (2007) reviewed anatomical predictions of hearing in the North Atlantic right whale and stated that "the total hearing range for the North Atlantic right whale predicted from measurements presented here is 10 Hz–22 kHz, with functional ranges probably being 15 Hz–18 kHz."

Humpback Whale (*Megaptera novaeangliae*)

The humpback whale is medium in size, and adults range from 50-60 feet (15-18 m). The body is more robust than other rorqual whales (Balaenoptera spp.), and humpbacks are distinguished from all other large whale species by their long flippers, which are approximately one-third the length of the body.

Status. Distinct geographic forms of humpback whales are not widely recognized, though genetic evidence suggests there are several subspecies (e.g., North Atlantic, Southern Hemisphere, and North Pacific subspecies) (NMFS 1991; Waring et al., 2010). In 2000, NMFS Atlantic Stock Assessment Team reclassified the western North Atlantic humpback whale as a separate and discrete management stock (Gulf of Maine stock) (Waring et al., 2010).

The humpback whale is currently listed as endangered under the ESA. The Gulf of Maine stock is classified as strategic because of its listing under the ESA. The NMFS has recently estimated the humpback population in the western North Atlantic as 7,698 individuals (4,894 males and 2,804 females) (Waring et al., 2010). No critical habitat has been designated for the humpback whale.

Distribution. The humpback whale is a cosmopolitan species that can be found from the equator to subpolar latitudes, and is less commonly in the Arctic. Some individuals are found year-round at certain locations (e.g., Gulf of Maine), while others display highly migratory patterns. Humpback whales are generally found within continental shelf areas. Most humpback whales in the western North Atlantic Ocean migrate to the West Indies (e.g., Dominican Republic) to mate; however, some whales do not make the annual winter migration (Waring et al., 2010). Sightings data show that humpback whales traverse through coastal waters of the northeastern U.S., including within the Study Area (Waring et al., 2010) (Figure 3-1). While feeding and calving, humpbacks prefer shallow waters. During calving, humpbacks are usually found in the warmest waters available at that latitude.

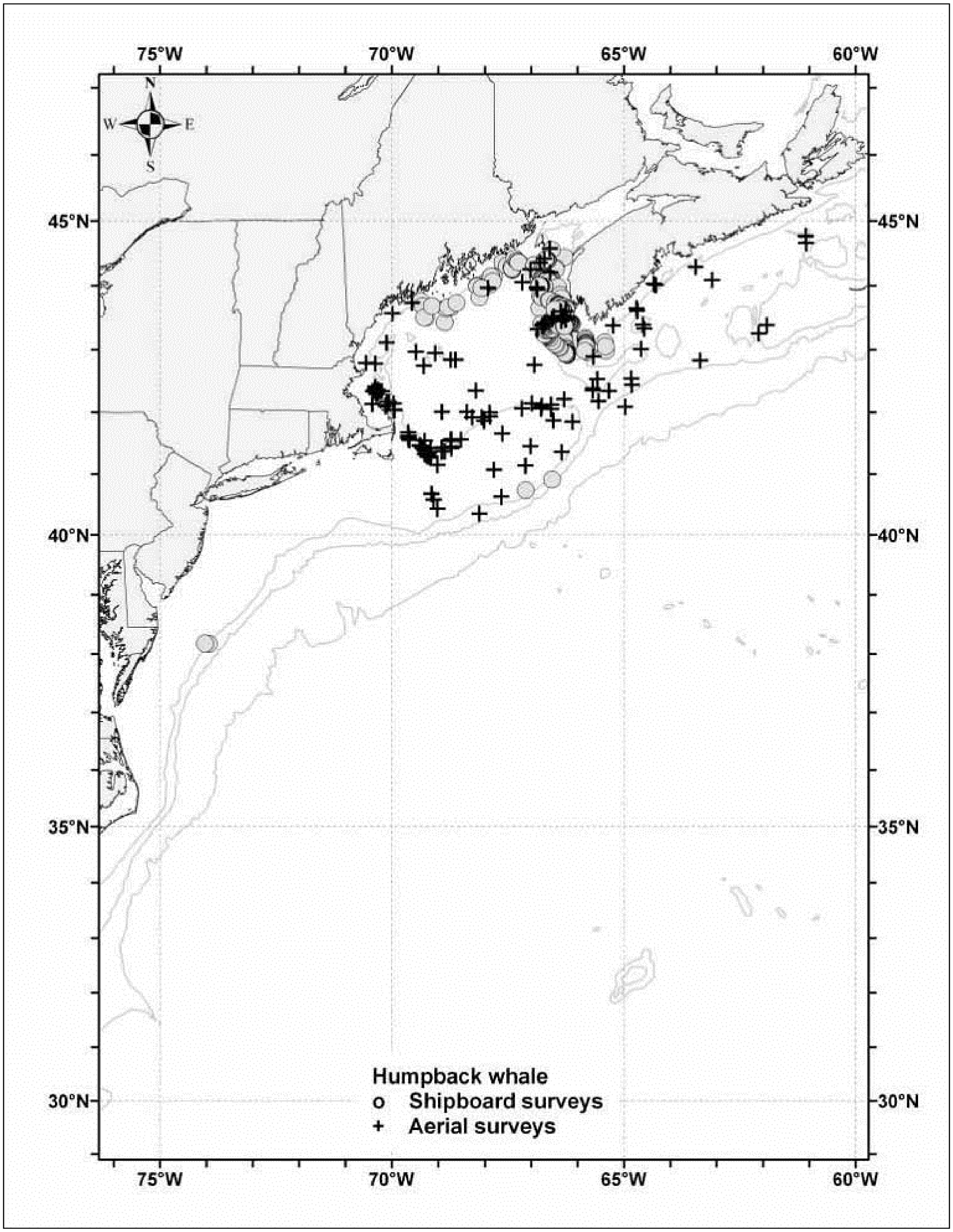


Figure 3-1. Distribution of Humpback Whale Sightings

Notes: From NEFSC and SEFSC shipboard and aerial surveys during the summers of 1998, 1999, 2002, 2004, 2006, and 2007. Isobaths are the 328-feet (100-m), 3,280-feet (1,000-m), and 13,124-feet (4,000-m) depth contours (Waring et al., 2010).

Swingle et al. (1993) and Barco et al. (2002) reported humpback sightings off Delaware Bay and Chesapeake Bay during the winter, which suggests the Mid-Atlantic region may also serve as wintering grounds for some Atlantic humpback whales. This region has also been suggested as important area for juvenile humpbacks (Wiley et al., 1995).

Behavior. Humpback whales feed on krill and small schooling fishes (Jefferson et al., 2008). In New England waters, humpback whales prey upon herring, sand lance, and euphausiids (Paquet et al., 1997). Humpback whales use unique behaviors such as bubble nets, bubble clouds, and flickering their flukes and flippers to herd and capture prey (NMFS 1991). They are also one of the few species of baleen whales to use cooperative feeding techniques. The age at sexual maturity is between 4 and 6 years (NMFS 1991), and gestation length is 11 months; calves are nursed for 6–10 months.

Auditory and Vocalization Range. Humpback vocalizations are complex and range from low-frequency (40-5,000 Hz) to higher frequency (2-14 kHz) sounds (Winn and Reichley 1985). While there are no direct hearing data available (Ketten 2000), humpback whales are classified within the low-frequency cetacean functional marine mammal hearing group (i.e., 7 Hz–22 kHz) (Southall et al., 2007). Houser et al. (2001) developed a mathematical function to describe the frequency sensitivity by integrating position along the humpback basilar membrane with known mammalian data. The results predict a typical U-shaped audiogram with sensitivity to frequencies from 700 Hz-10 kHz, with maximum sensitivity between 2 and 6 kHz. Humpbacks have been observed reacting to low-frequency industrial noises with estimated received levels of 115–124 dB (Malme et al., 1983) and have been observed reacting to conspecific calls at received levels as low as 102 dB (Frankel et al., 1995).

Fin Whale (*Balaenoptera physalus*)

The fin whale is the second largest species of whale (NMFS 2010a). Some authors recognize separate northern and southern hemisphere subspecies, although this designation is not widely accepted (Jefferson et al., 2008). Adult fin whales in the northern hemisphere may reach a length of approximately 80 feet (24 m).

Status. Fin whales off the eastern U.S. and eastern Canada are believed to constitute a single stock (Western North Atlantic stock) (Waring et al., 2010). The species is currently listed as endangered under the ESA. The Western North Atlantic stock is classified as strategic because of its listing under the ESA. There is no designated critical habitat for the fin whale (NMFS 2010a).

Distribution. The fin whale is found primarily within temperate and polar latitudes. Seasonal migration patterns within its range remain undetermined (Waring et al., 2010). Singing fin whales have been found in Bermuda from early September through mid-May (Clark and Gagnon, 2004). Fin whales have also been seen in the mid-ocean near the Mid-Atlantic ridge from late fall through early winter. Blue and fin whale species have no known breeding or calving grounds but have been found singing during summer months at > 70° N latitudes, where they are known to feed. These observations of singing in high latitudes during months when food is abundant, though contrary to general knowledge, were consistent from year-to-year and most likely represent normal activities (Clark and Gagnon, 2004). The fin whale is the most commonly sighted whale in northwestern Atlantic waters from Cape Hatteras, North Carolina, to Maine (Waring et al., 2010; NMFS 2010a). Fin whales have been sighted and detected acoustically in the U.S. mid-Atlantic off of New Jersey and New York year-round (Turgut and Lefler 2006, Biedron et al. 2009; NJDEP 2010). Hamazaki (2002) developed a habitat prediction model demonstrating that preferred fin whale habitat includes the nearshore and shelf waters from south of the Chesapeake Bay north to the Gulf of Maine.

Behavior. Fin whales are observed singly or in groups of two to seven individuals. In the North Atlantic, fin whales are often seen in large mixed-species feeding aggregations including humpback whales, minke whales, and Atlantic white-sided dolphins (Jefferson et al., 2008). Fin whales feed on zooplankton (euphausiids and copepods); small schooling fishes such as capelin, herring, mackerel, sandlance, blue whiting, and squids (Jefferson et al., 2008). NMFS (2010a) reports that summer feeding grounds are found mostly between 41°20’ and 51°00’ N latitude (from shore to a depth of 6,000 feet (1,829 m)). Fin whale mating and births occur in the winter (November–March), with reproductive activity peaking in December and January.

Auditory and Vocalization Range. Fin whale vocalizations are low frequency, generally below 70 Hz but ranging up to 750 Hz (Clark et al., 2002; Navy 2007). Estimated source levels are as high as 180 to 190 dB re 1 µPa @ 1 m (Patterson and Hamilton 1964; Watkins et al., 1987; Thompson et al., 1992; McDonald et al., 1995; Charif et al., 2002; Croll et al., 2002). Short sequences of rapid frequency modulated calls in the 20–70 Hz band are associated with social groups (McDonald et al., 1995). The most typical vocalizations are long, patterned sequences of low and infrasonic pulses in the 18–35 Hz range. This sound is referred to as the “20-Hz pulse” (Clark et al., 2002). While there are no direct hearing data available (Ketten 2000), fin whales are classified within the low-frequency cetacean functional marine mammal hearing group (7 Hz–22 kHz) (Southall et al., 2007).

West Indian Manatee (Florida subspecies) (*Trichechus manatus latirostris*)

The Florida subspecies of the West Indian manatee is the only sirenian that occurs along the eastern coast of the U.S. The average adult West Indian manatee ranges from 10–13 feet (3-4 m) in length and between 800 and 1,200 pounds (lbs) (362 and 544 kilograms (kg)) in weight (FWS 2001; 2007).

Status. The Florida manatee is currently listed as endangered under the ESA, a “strategic stock” under the MMPA, and vulnerable under the International Union for Conservation of Nature. The species is also protected under the Florida Manatee Sanctuary Act. The majority of the Atlantic population of the Florida manatee is in eastern Florida and southern Georgia (Waring et al., 2010), and is managed within four distinct regional management units: Atlantic Coast (northeastern Florida to the Florida Keys), Upper St. Johns River (St. Johns River, south of Palakta), Northwest (Florida Panhandle to Hernando County), and Southwest (Pasco County to Monroe County) (FWS 2001; 2007). The Atlantic Coast unit is the most relevant to the Study Area. Critical habitat was designated for the Florida manatee on September 24, 1976 (Federal Register 1976) and includes inland waterways in four northeastern Florida coastal counties (Brevard, Duval, St. Johns, and Nassau) that are adjacent to the Study Area (Figure 3-2).

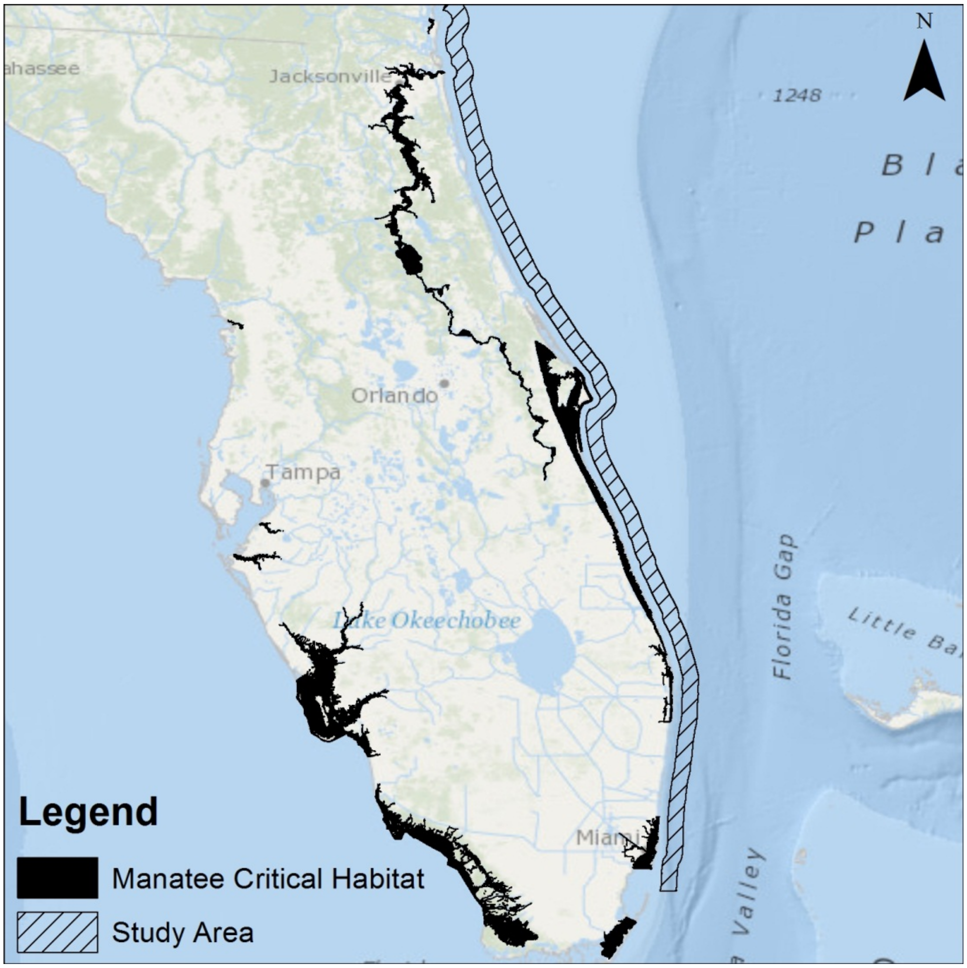


Figure 3-2. Florida Manatee Critical Habitat

Distribution. Within the northwestern Atlantic, manatees occur in coastal marine, brackish, and freshwater areas from Florida to Virginia, with occasional extralimital sightings as far north as Rhode Island (Jefferson et al., 2008). Because they have little tolerance for cold, they are generally restricted to the inland and coastal waters of peninsular Florida during the winter, where they shelter in or near sources of warm water (e.g., springs, industrial effluents, and other warm water sites) (FWS 2001, 2007).

Behavior. Manatees are herbivorous, feeding on a wide array of aquatic plants (freshwater and marine) such as water hyacinths and marine seagrasses. They generally prefer shallow seagrass beds, especially areas with access to deep channels. Preferred coastal and riverine habitats (e.g., near the mouths of coastal rivers) are also used for resting, mating, and calving (FWS 2001; 2007).

Auditory and Vocalization Range. Recent studies estimate the maximum hearing range for the manatee to be from 0.4-90 kHz, but peak sensitivity lies within the 3–32 kHz range (Steel and Morris 1982; Thomson and Richardson 1995; Gerstein et al., 1999; Reynolds and Powell 2002; Niezrecki et al., 2003; O'Shea and Poche 2006; Navy 2007; Gaspard et al., 2012). Manatee vocalizations, including chirps and squeaks, range between 0.6 and 16 kHz, although most vocalizations occur between 2.5 and 5 kHz (Schevill and Watkins 1965; Bengtson and Fitzgerald 1985; Nowacek et al., 2003; Miksis-Olds and Tyack 2009). Previous studies describing West Indian manatee vocalizations indicate the use of two different vocalization types: tonal harmonic calls and broader-band, less tonal calls. Low critical ratios, which are the thresholds for tone detection in the presence of masking noise, indicate the ability of manatees to detect tonal signals, such as vocalizations, in the presense of noise (Gaspard et al., 2012).

3.3.1.2. Non-listed Marine Mammals

There are 31 marine mammal species that could occur in Atlantic OCS waters that are not classified as endangered or threatened under the ESA (Table 3-1), composing two mysticete (baleen) whales, 26 odontocete (toothed) whales and dolphins, and four pinnipeds (seals). Of these 31 species, only the 11 dolphin species, harbor porpoise, and four pinnipeds are likely to occur within the Study Area; the other nonlisted marine mammals are not likely to occur, given the relatively shallow water depths and typical range and are, therefore, not discussed further in this EA.

Stenella Dolphins

Five species of oceanic dolphins of the genus *Stenella* occur within the northwestern Atlantic. These include the pantropical spotted dolphin (*S. attenuata*), striped dolphin (*S. coeruleoalba*), Clymene dolphin (*S. clymene*), Atlantic spotted dolphin (*S. frontalis*), and spinner dolphin (*S. longirostris*). *Stenella* body lengths typically range between 5.6 and 8.5 feet (1.7 and 2.6 m) (Jefferson et al., 2008).

Status. Each western Atlantic *Stenella* species is managed as a separate Western North Atlantic stock. None of these species are listed as threatened or endangered under the ESA, and none of the management stocks are classified as strategic (Waring et al., 2010).

Distribution. The five species of western Atlantic *Stenella* occur within both coastal and oceanic waters from 40° S to 40° N (Perrin and Gilpatrick 1994; Perrin and Hohn 1994). Atlantic spotted, pantropical spotted, Clymene, and spinner dolphins are distributed primarily in tropical and subtropical waters, whereas the distribution of striped dolphins extends from tropical to temperate waters (Jefferson et al., 2008). Generally, *Stenella* occur along the continental shelf edge and slope within their range. The Atlantic spotted dolphin, however, can also occur on the continental shelf in some areas, including the Study Area (Jefferson et al., 2008; Waring et al., 2010).

Behavior. Atlantic spotted dolphins are often observed in small groups of generally less than 50 individuals. They feed on a wide variety of mesopelagic fishes and squids, as well as on benthic invertebrates (Perrin 2002a; Jefferson et al., 2008). Little is known about their life history, though tropical populations are thought to have protracted breeding seasons.

Pantropical spotted dolphins are gregarious and commonly form aggregations ranging from less than 100 to thousands of individuals. Offshore individuals feed on small epi- and mesopelagic fishes, squids, and crustaceans. Individuals on the continental shelf are thought to feed on larger pelagic and demersal fishes (Perrin 2002b; Jefferson et al., 2008).

Clymene dolphins are found in groups of less than 200 individuals, generally segregated by age and sex (Jefferson et al., 2008). They are thought to feed on small fishes and squids, primarily at night (Jefferson 2002).

Spinner dolphins are highly gregarious and form large groups ranging in size from a few individuals to several thousand (Perrin 2002c; Jefferson et al., 2008). They commonly school together with other cetacean species (Perrin 2002c). Spinner dolphins usually feed at night on small mid-water fishes, squids, and crustaceans.

Striped dolphins feed on small fishes and cephalopods (Perrin et al., 1994). They are somewhat gregarious, often forming pods of 20 or more individuals, and are active at the surface (Whitehead et al., 1998; Archer 2002). Baird et al., (1997) reported that striped dolphins can be found in groups of 100-500 individuals and are sometimes associated with other species of marine mammals and seabirds. The pod composition of striped dolphins may vary and can include adult males and females as well as juveniles (Perrin et al., 1994). They feed primarily on a wide variety of small mid-water and demersal fishes and squids (Jefferson et al., 2008).

Auditory and Vocalization Range. *Stenella* species produce sounds that range from 0.1-160 kHz (Richardson et al., 1995). As a group, *Stenella* dolphins are classified within the mid-frequency cetacean functional marine mammal hearing group (150 Hz-160 kHz) (Southall et al., 2007).

Bottlenose Dolphin (*Tursiops truncatus*)

Adult bottlenose dolphins range in length from 5.9-12.5 feet (1.8-3.8 m). Within the western North Atlantic, including the Study Area, there are two distinct bottlenose dolphin forms, or ecotypes: coastal and offshore. The two forms are genetically and morphologically distinct, though regionally variable (Jefferson et al., 2008).

Status. The offshore and coastal forms of the bottlenose dolphin are classified as separate stocks: the Western North Atlantic Offshore and the Western North Atlantic Coastal morphotype stocks (Waring et al., 2010). Based on genetic differences, coastal form bottlenose dolphins in the Study Area are divided into a complex mosaic of separate stocks (Waring et al., 2010) that include the following:

- Western North Atlantic Northern Migratory Coastal stock;
- Western North Atlantic Southern Migratory Coastal stock;
- Western North Atlantic South Carolina/Georgia Coastal stock;
- Western North Atlantic Northern Florida Coastal stock;
- Western North Atlantic Central Florida Coastal stock;
- Northern North Carolina Estuarine System stock;
- Southern North Carolina Estuarine System stock;
- Charleston Estuarine System stock;
- Northern Georgia/Southern South Carolina Estuarine System stock;
- Southern Georgia Estuarine System stock;
- Jacksonville Estuarine System stock; and
- Indian River Lagoon Estuarine System stock.

There are insufficient data to determine the status of the Western North Atlantic Offshore stock in the U.S. Atlantic Economic Exclusive Zone (EEZ). All coastal form stocks have been designated as "depleted" under the MMPA but not listed as threatened or endangered under the ESA. Consequently, all of the coastal form stocks are classified as strategic because of their depleted listing (Waring et al., 2010).

NMFS declared an Unusual Mortality Event (UME) for bottlenose dolphins in the Mid-Atlantic region from early July 2013 through the present. Elevated numbers of strandings of this species have occurred in New York, New Jersey, Delaware, Maryland, and Virginia, with the highest number of strandings to date occurring in Virginia. All age classes of bottlenose dolphins are involved, and strandings range from a few live animals to mostly dead animals with many very decomposed. A team of independent scientists is engaged with the Working Group on Marine Mammal Unusual Mortality Events to review the data collected. Currently, the tentative cause for the strandings is a morbillivirus infection. However, the UME investigation is ongoing and additional contributory factors to the UME are under investigation, including other pathogens, biotoxins, and range expansion. BOEM will continue to monitor this UME and will evaluate it in further NEPA analyses, as more data become available (NMFS 2013a).

Distribution. The bottlenose dolphin is widely distributed throughout the western North Atlantic. The offshore form is distributed primarily along the OCS and continental slope in the northwest Atlantic Ocean from Nova Scotia to the southern Florida peninsula, but has been documented to occur relatively close to shore within areas south of Cape Hatteras, North Carolina. The coastal form is continuously distributed along the Atlantic coast from south of New York to around the Florida peninsula and could overlap with the offshore form off the southeastern U.S. Generally, population density appears to be higher within inner shelf areas (Jefferson et al., 2008).

Behavior. Group size of bottlenose dolphins is commonly less than 20 individuals, although larger groups are occasionally observed. They are considered to be generalist feeders and use a wide variety of prey species, including fishes, squids, shrimps, and other crustaceans (Jefferson et al., 2008). Sexual maturity ranges from 5-13 years for females and 9-14 years for males (NMFS 2011f). Gestation length is around 12 months, and calves are weaned at around 18-20 months. Births occur in late spring to early summer (Thayer et al., 2003). Bottlenose dolphins are long-lived, with life expectancies around 25 years, with some individuals living longer (Duffield and Wells 1990).

Auditory and Vocalization Range. The auditory range of bottlenose dolphins is between 150 Hz and 135 kHz (Ljungblad et al., 1982). The species is classified within the mid-frequency cetacean functional marine mammal hearing group (150 Hz-160 kHz) (Southall et al., 2007).

Risso's Dolphin (*Grampus griseus*)

Risso's dolphins are large dolphins with characteristic blunt head and light coloration, often with extensive scarring. Adults reach body lengths of more than 12.5 feet (3.8 m).

Status. The status of the Western North Atlantic stock of the Risso's dolphin in the U.S. Atlantic EEZ is not well documented. There are insufficient data to determine population trends for this species.

Distribution. Risso's dolphins are widely distributed in tropical and temperate seas. In the Northwest Atlantic, they occur from Florida to eastern Newfoundland (Leatherwood et al., 1976; Baird and Stacey 1990). Risso's dolphins occur along the continental shelf edge from Cape Hatteras to Georges Bank, including in the Cape Hatteras Special Research Area, during spring, summer, and autumn. In winter, they occur in oceanic (slope) waters within the Mid-Atlantic Bight (MAB) (Waring et al., 2010). Although unlikely to occur in the Study Area, on rare occassions, Risso's dolphins have been observed in shallow waters, such as Massachusetts Bay, the Gulf of Maine, and offshore coastal Virginia (Duke University 2011).

Behavior. Risso's dolphins are often observed in small to moderate-sized groups of 10-100 individuals, though larger aggregations have been reported. They commonly associate with other cetacean species. They feed on crustaceans and cephalopods (primarily squids). Data suggest a summer calving peak within the North Atlantic.

Auditory and Vocalization Range. The auditory range of Risso's dolphins is between 4 and 80 kHz (Au et al., 1997). The species is classified within the mid-frequency cetacean functional marine mammal hearing group (150 Hz-160 kHz) (Southall et al., 2007).

Short-beaked Common Dolphin (*Delphinus delphis*)

The common dolphin may be one of the most widely distributed species of cetaceans, as it is found worldwide in temperate, tropical, and subtropical seas. Two species have been recognized: the long-beaked common dolphin (*Delphinus capensis*) and the short-beaked common dolphin (which includes individuals within the northern Atlantic). Common dolphins attain a body length of 8.2 feet (2.5 m) (Jefferson et al., 2008).

Status. Short-beaked common dolphins within the northwestern Atlantic are classified within one stock (Western North Atlantic stock). Their status in the U.S. Atlantic EEZ is not well documented.

Distribution. Common dolphins are distributed in waters off the northeastern U.S. coast (CETAP 1982; Selzer and Payne 1988; Waring et al., 1992; Hamazaki 2002). They regularly occur along the continental shelf and slope (328-6,562 feet (100-2,000 m)) from 50º N to Cape Hatteras, North Carolina, although aggregations have been reported as far south as eastern Florida (Gaskin 1992). They occur from Cape Hatteras northeast to Georges Bank (35°-42° N) during mid-January to May and move as far north as the Scotian Shelf from mid-summer to autumn (Selzer and Payne 1988). Although common dolphins are generally found in relatively deeper waters than the Study Area, they are often associated with the Gulf Stream current, so they could be present offshore Cape Hatteras, where the Gulf Stream and continental shelf break are closest to shore.

Behavior. Common dolphins are often observed in groups ranging in size from 10-10,000 individuals. These groups are often segregated by age and sex. The prey of common dolphins consists of small schooling fishes and squids. Their calving interval is 1 to 3 years, with peak calving occurring in summer months.

Auditory and Vocalization Range. The auditory range of common dolphins is between 60 and 128 kHz (Popov and Klishin 1998). The species is classified within the mid-frequency cetacean functional marine mammal hearing group (150 Hz-160 kHz) (Southall et al., 2007).

Atlantic White-Sided Dolphin (*Lagenorhynchus acutus*)

The Atlantic white-sided dolphin is robust and attains a body length of approximately 9 feet (2.8 m) (Jefferson et al., 2008). It is characterized with a strongly "keeled" tail stock and distinctive color pattern.

Status. Atlantic white-sided dolphins observed off the eastern U.S. coast are classified within the Western North Atlantic stock. The distribution of sightings, strandings, and incidental takes suggest the possible existence of three stock units within this region: Gulf of Maine, Gulf of St. Lawrence, and Labrador Sea stocks (Waring et al., 2010). There are insufficient data to determine seasonal abundance estimates of Atlantic white-sided dolphins off the eastern U.S. coast and their status in the U.S. Atlantic EEZ.

Distribution. Atlantic white-sided dolphins are found in cold temperate and subpolar waters of the North Atlantic (Cipriano 2002). Their preferred habitat appears to be waters of the outer continental shelf and slope, although there are regular sightings of this species within the western North Atlantic waters along the mid-shelf to the 328-foot (100-m) depth contour (Waring et al., 2010). Although unlikely to be found in most of the Study Area, this species exhibits seasonal movements, moving closer inshore and north in the summers and offshore and south in the winters. The Western North Atlantic stock inhabits waters from central West Greenland to North Carolina (about 35° N) (Waring et al., 2010).

Behavior. Atlantic white-sided dolphins form groups of varying size, ranging from less than 100 to more than 1,000 individuals. Data suggest that there may be age and/or sex segregation of these groups, with evidence of stable subgroups within the large groups. They are often observed feeding in mixed-species groups with pilot whales and other dolphin species. Atlantic white-sided dolphins feed mostly on small schooling fishes, shrimps, and squids (Cipriano 2002; Jefferson et al., 2008).

Auditory and Vocalization Range. The hearing sensitivity of the Pacific white-sided dolphin, a congener of the Atlantic species, is 75 Hz-150 kHz (Tremel et al., 1998). They are classified within the mid-frequency cetacean functional marine mammal hearing group (150 Hz-160 kHz) (Southall et al., 2007).

Fraser's Dolphin (*Lagenodelphis hosei*)

Fraser's dolphins are characterized by an extremely robust body and small appendages. Maximum length is approximately 9 feet (2.8 m).

Status. Fraser's dolphins are distributed worldwide in tropical waters (Perrin et al., 1994) and are assumed to be part of the cetacean fauna of the tropical western North Atlantic. The species is considered uncommon within the Study Area. There are insufficient data to determine the status of the Western North Atlantic stock of Fraser's dolphins in the U.S. Atlantic EEZ or population trends for this species.

Distribution. Fraser's dolphins are distributed within tropical, oceanic waters between 30° N and 30° S. They may also occur closer to shore in areas where deep water approaches the coast, which generally does not occur in the Study Area, except for offshore the coast of Florida (Dolar 2002; Jefferson et al., 2008).

Behavior. Very little is known about the life history of Fraser's dolphin. They are commonly observed in large aggregations consisting of hundreds or thousands of individuals (Dolar 2002). Fraser's dolphin aggregations are often mixed with other cetacean species. Data show that Fraser's dolphins feed on mid-water fishes (such as myctophids), squids, and crustaceans.

Auditory and Vocalization Range. Fraser's dolphins produce vocalizations ranging from 4.3 to more than 40 kHz (Watkins et al., 1994). The species is classified within the mid-frequency cetacean functional marine mammal hearing group (150 Hz-160 kHz) (Southall et al., 2007).

Rough-Toothed Dolphin (*Steno bredanensis*)

The rough-toothed dolphin is a relatively robust dolphin that attains a body length of 9 feet (2.8 m) (Jefferson et al., 2008). It is characterized by a long, conical head with no demarcation between the melon and beak.

Status. Rough-toothed dolphins observed off the eastern U.S. coast are classified within the Western North Atlantic stock. There are insufficient data to determine seasonal abundance estimates of rough-toothed dolphins off the eastern U.S. coast or their status in the U.S. Atlantic EEZ. The stock is not classified as strategic.

Distribution. Rough-toothed dolphins are distributed within tropical and subtropical waters between 40° N and 35° S. They generally inhabit deep, oceanic waters, but have been observed on the shelf in limited numbers. Records from the Atlantic are mostly from between the southeastern U.S. and southern Brazil (Jefferson 2002).

Behavior. The rough-toothed dolphin is commonly observed in groups of 10-20 individuals, although aggregations of over 100 individuals have been reported. They frequently associate with other cetacean species. Rough-toothed dolphins feed on cephalopods and fishes, including large pelagic fishes.

Auditory and Vocalization Range. Rough-toothed dolphins produce vocalizations ranging from 0.1-200 kHz (Yu et al., 2003). The species are classified within the mid-frequency cetacean functional marine mammal hearing group (150 Hz-160 kHz) (Southall et al., 2007).

Harbor Porpoise (*Phocoena phocoena*)

The harbor porpoise is the only porpoise species found in the Atlantic. It is a small, stocky cetacean with a blunt, short-beaked head. There are four subspecies, with *P. p. phocoena* in the North Atlantic. This subspecies reaches a body length of 6 feet (1.9 m) (Jefferson et al., 2008).

Status. The Gulf of Maine/Bay of Fundy stock of harbor porpoise is found in U.S. and Canadian Atlantic waters. There are insufficient data to determine the status of this stock in the U.S. Atlantic EEZ. It is classified as a strategic stock (Waring et al., 2010).

Distribution. The harbor porpoise is usually found in shallow waters of the continental shelf. Waring et al. (2010) reports that harbor porpoise are generally concentrated along the continental shelf within the northern Gulf of Maine and southern Bay of Fundy region during summer months (July-September). During fall (October-December) and spring (April-June), they are widely dispersed from New Jersey to Maine. During winter (January-March), they range from New Brunswick, Canada, to North Carolina.

Behavior. Most harbor porpoise groups are small, usually between five and six individuals, although they aggregate into large groups for feeding or migration (Jefferson et al., 2008). They eat a wide variety of fishes and cephalopods.

Auditory and Vocalization Range. An auditory study of harbor porpoise found hearing sensitivity between 2 and 180 kHz (Kastelein et al., 2002). Harbor porpoise is classified within the high-frequency cetacean functional marine mammal hearing group (200 Hz-180 kHz) (Southall et al., 2007).

Seals

Four species of phocid seals (earless seals or true seals) could occur within the Study Area. Listed in alphabetical order, these include the gray seal (*Halichoerus grypus)*, harbor seal (*Phoca vitulina*), harp seal (*Pagophilus groenlandicus*), and hooded seal (*Cystophora cristata*). Generally, the normal range of these species is north of the Study Area. Over the past decade, increases in pinniped sightings and stranding events have been documented in the Study Area, even though there are very few historical records. The increases in sighting and stranding events in these areas suggest that the distributions of these species could be expanding into areas outside of their documented ranges.

Status. Each of the four seal species is known to occur within the western North Atlantic. Currently, there are insufficient data to determine the status of these seal stocks, and none of the stocks are classified as strategic.

Distribution. The gray seal ranges from Canada to New York; however, there are strandings records as far south as Cape Hatteras (Katona et al., 1993; Lesage and Hammill 2001).

The harbor seal is found in all nearshore waters of the Atlantic Ocean and adjoining seas north of 30º N (Katona et al., 1993). In the western North Atlantic, they are distributed from eastern Canada to southern New England and New York, and occasionally to the Carolinas (Katona et al., 1993; Gilbert and Guldager 1998; Baird 2001). For example, between Delaware and Virginia, there were 161 harbor seal strandings between 2007 and 2011 (NOAA Northeast Stranding Network, unpublished pinniped stranding records for New Jersey, Delaware, Maryland, and Virginia, 2007-2011).

The harp seal occurs throughout much of the North Atlantic (Ronald and Healey 1981). They are divided into three separate stocks, with the largest stock located off eastern Canada (Waring et al., 2012). Harp seals are highly migratory (Stenson and Sjare 1997). In recent years, the number of sightings and strandings from January to May have increased off the U.S. eastern coast from Maine south to Virginia. Within the Study Area between Delaware and Virginia, there were 180 harp seal strandings between 2007 and 2011 (NOAA Northeast Stranding Network, unpublished pinniped stranding records for New Jersey, Delaware, Maryland, and Virginia, 2007-2011).

The hooded seal occurs throughout much of the North Atlantic and Arctic Oceans (King 1983), preferring deeper water and occurring farther offshore than harbor seals (Campbell 1987; Lavigne and Kovacs 1988; Stenson et al., 1996). Individuals may wander widely, with sightings records as far south as Puerto Rico (Mignucci-Giannoni and Odell 2001). There are increased occurrences of hooded seals from Maine to Florida in summer and autumn (McAlpine et al., 1999; Harris et al., 2001; Mignucci-Giannoni and Odell 2001).

Behavior. Gray seals dive to depths of 984 feet (300 m) but spend most of their time in coastal waters (Jefferson et al., 2008). They are opportunistic feeders that primarily feed on fish, crustaceans, squid, and octopus (Bonner 1981; Reeves et al., 1992; Hall 2002; Jefferson et al., 2008).

Harbor seals complete both shallow and deep dives during hunting, depending on the availability of prey (Tollit et al., 1997). Harbor seals eat a variety of prey consisting mainly of fish, shellfish, and crustaceans (Bigg, 1981; Reeves et al., 1992; Burns 2002; Jefferson et al., 2008).

Harp seals live primarily on pack ice, but may be found in other environments in summer. They are known to eat a variety of fish and invertebrates, primarily capelin, arctic and polar cod, and krill (Ronald and Healey 1981; Reeves et al., 1992; Lavigne 2002; Jefferson et al., 2008).

Hooded seals are generally found in pack ice environments, but may migrate as far south as the Caribbean. Adult hooded seals feed on squid, starfish, mussels, and fish such as Greenland halibut, redfish, cod, capelin, and herring (Reeves and Ling 1981; Reeves et al., 1992; Kovacs 2002; Jefferson et al., 2008).

Auditory and Vocalization Range. The auditory range of phocid seals is generally from less than 1-60 kHz, although some intraspecific variability in high-frequency sensitivity has been observed (Richardson et al., 1995). Southall et al. (2007) classified pinnipeds within two separate functional marine mammal hearing groups ("pinnipeds in water" (75 Hz-75 kHz) and "pinnipeds in air" (75 Hz-30 kHz)), since these species communicate acoustically in both air and water, and have significantly different hearing capabilities in the two media.

3.3.2. Environmental Consequences

3.3.2.1. Alternative A: Proposed Action

This section discusses potential impacts of routine events associated with Alternative A on marine mammals. Federally listed endangered and threatened species are included in the discussion with nonlisted species because the potential impact mechanisms are the same. The IPFs from routine events that could impact marine mammals within the Study Area include:

1) active acoustic and vessel noise, 2) vessel presence/traffic, 3) vessel wastes and discharges (including marine debris), and 4) bottom disturbance.

Noise from Active Sound Sources and Vessel Operations

The various marine mammal species could be exposed to sound from electromechanical sources used during geophysical surveys. Electromechanical sources would be limited to boomer and chirp sub-bottom profilers; side-scan sonars; and single beam, interferometric, or multibeam depth sounders. This equipment produces sound at or above the frequency ranges audible to marine mammals. Only chirp sub-bottom profilers and boomer would be operated at frequencies below 180 kHz, which is the upper hearing threshold for cetaceans and pinnipeds.

The vast majority of the species likely to occur within the Study Area fall within the low- or mid-frequency hearing category (Table 3-2). Most of these are cetaceans with few pinnipeds (generally present in small numbers within the Study Area from Chesapeake Bay north to the Gulf of Maine) and manatees (potentially present in southern, near-coastal waters of the Study Area).

Table 3-2. Functional Marine Mammal Hearing Groups

Functional Hearing Group	Estimated Auditory Bandwidth	Marine Mammal Species Present in the Study Area
Low-frequency cetaceans	7 Hz–22 kHz	North Atlantic right whale; blue whale; fin whale; humpback whale; sei whale; Bryde's whale; common minke whale
Mid-frequency cetaceans	150 Hz–160 kHz	Sperm whale; beaked whales; *Stenella* dolphins; bottlenose dolphin; killer whale; pygmy killer whale; false killer whale; Risso's dolphin; short-finned and long-finned pilot whales; common dolphin; melon-headed whale; Atlantic white-sided dolphin; Fraser's dolphin; rough-toothed dolphin
High-frequency cetaceans	200 Hz–180 kHz	Pygmy and dwarf sperm whales; harbor porpoise
Pinnipeds in water	75 Hz–75 kHz	Harbor, gray, hooded, and harp seals
Pinnipeds in air	75 Hz–30 kHz	Harbor, gray, hooded, and harp seals
Sirenians	0.4- 90 kHz	Manatees

Source: Southall et al., 2007.

NMFS has specified that marine mammals should not be exposed to pulsed sounds with received SPLs exceeding 180 or 190 dB re 1 μPa, depending upon whether the marine mammal is a cetacean or a pinniped (NMFS 2003). The lower threshold, 180 dB re 1 μPa, has been used as the Level A harassment threshold (i.e., potential to injure) for cetaceans. The upper threshold, 190 dB re 1 μPa, has been used as the Level A harassment threshold for pinnipeds. The NMFS also considers that cetaceans and pinnipeds exposed to pulsed sound levels greater than or equal to 160 dB re 1 μPa are subject to Level B harassment (i.e., potential to disturb or elicit a behavioral response). Various exposure criteria have been proposed (Table 3-3).

Table 3-3. Existing and Proposed Injury and Behavior Exposure Criteria for Cetaceans and Pinnipeds Exposed to Pulsed Sounds

Group	Level A (Injury)			Level B (Behavior)
	NMFS Criteria (Federal Register 2000): SPL (dB re 1 μPa rms)	Southall et al. (2007) Criteria: SPL (dB re 1 μPa^2 s)	Southall et al. (2007) Criteria: Single Pulse, SPL (dB re 1 μPa rms)	NMFS Criteria (Federal Register 2000): SPL (dB re 1 μPa rms)
Cetaceans	180	198	230	160
Pinnipeds	190	186	218	160

Level A and Level B harassment levels correspond to moderate and minor impact categories, respectively, which has been previously described in Section 3.2. Distinctions between moderate and major impacts are based on the respective definitions of each. Moderate impacts on marine mammals are defined as injury or mortality, but would occur in low enough numbers, such that the continued viability of the local population or stock would not be threatened and the annual rates of recruitment or survival of the local population or stock would not be seriously affected. Major impacts on marine mammals are defined as extensive levels of life-threatening or debilitating injury or mortality in sufficiently high numbers that would render the continued viability of the population seriously threatened, including serious diminishment of annual rates of recruitment or survival.

Since development and application of the 180- and 190-dB re 1 μPa criteria, additional scientific research has been completed that further clarifies the received levels of underwater sound that cause a temporary threshold shift (TTS) or a permanent threshold shift (PTS) in marine mammals (e.g., see Kastak et al., 1999; 2005; Finneran and Jenkins 2012). Additional information about the onset of TTS and PTS are presented in BOEM's Atlantic G&G PEIS (BOEM 2012a).

Section 2.2.7 discusses the comprehensive survey protocols and mitigation measures that would be implemented during surveys, including time-area restrictions, nighttime survey and/or PAM restrictions, visual monitoring of an exclusion zone by PSOs, and startup and shutdown requirements. Geophysical surveys would be scheduled and conducted (to the maximum extent practicable) so that no active acoustic sources operating below 30 kHz (hearing threshold for North Atlantic right whales) would be used in the Northeast critical habitat and SMAs (i.e., Great South Channel, April 1 through July 31; Off Race Point, March 1 through April 30), mid-Atlantic SMAs (November 1 through April 30), and Southeast critical habitat and southeast SMAs from November 15 through April 15. All other sources would operate above 180 kHz except continuous broadband sound produced from survey vessels (discussed in the Vessel Noise section below).

All operations in these areas during the specified times must occur during daylight hours. BOEM would require vessel operators to make use of the Early Warning System, Sighting Advisory System, and Mandatory Ship Reporting System while operating in North Atlantic Right Whale critical habitat, SMAs, and DMAs at the times of year those designations are active or year-round in the case of the North Atlantic Right Whale critical habitat. If during the course of a geophysical survey, a DMA is established, use of all sound sources operating below 30 kHz in that DMA must be discontinued within 24 hours of its establishment. Any geophysical surveys in proximity of DMA boundaries are required to remain at a distance such that received levels, for all sound sources, at these boundaries are no more than 160 dB re 1 μPa.

To further mitigate sound exposure, source levels for the sub-bottom profilers and boomers used in the proposed geophysical surveys would not exceed 220 dB re 1 μPa and would be operated at the lowest power setting, narrowest beamwidth, and highest frequency possible to fulfill data needs while effectively reducing exposure and received levels. Consistent with recent sound source verification studies on these active sources (see Table 2-3), threshold radii to 160 dB re 1 μPa are expected to be less than 328 feet (100 m) because of the beam pattern characteristics and downward directivity of the sub-bottom profilers and boomers. The use of boomers would be limited to circumstances where penetration from chirp sources would be insufficient to map or delineate near-surface geologic units. Moreover, the chirp towfish would be towed as closely to the seafloor as possible to further reduce the zone of ensonification and possible exposure. Operational mitigation monitoring measures would be implemented during G&G surveys to ensure that marine mammals are not present within a pre-determined exclusion zone around the sound source, both prior to and during its operation. These combined operational restrictions would significantly minimize the risk and degree of noise exposure to marine mammals.

Other restrictions (survey and transit speed) are supported in recognition of the endangered status of the North Atlantic right whale, as well as the potential sensitivity or susceptibility of cow/calf/yearling pairs in calving and nursery grounds offshore Florida and Georgia. The potential for such effects remain hard to objectively identify or predict in realistic conditions (Southall et al., 2007, Rolland et al., 2012). Although some age and sex classes are more sensitive to noise disturbance, and such disturbance may be more detrimental to young animals (Bejder et al. 2006), most disturbance studies on cetaceans reflect data collected from direct boat approaches (e.g., whale watching vessels).

With these mitigation measures in place, effects are limited to sound masking, possible initiation of avoidance behavior, and short-term interruption of foraging, resting, other behaviors, or avoidance of area. Effects related to fitness or increased energy-expenditure, as well as stress-related responses would be limited to due to the short duration and limited area of Level B ensonification. Sound masking effects can reduce the range of communication, particularly long-range communication. Recent scientific evidence suggests that marine mammals compensate for masking by changing the frequency, source level, redundancy, or timing of their signals, but the long-term implications of these adjustments are currently unknown (Parks et al. 2007; Parks et al. 2010). An ongoing study to describe the acoustic behavior of North Atlantic right whale mother-calf pairs presents preliminary data that show overall consistent trends in behavior. Mother-calf pairs produced very few sounds that were detectable (at ranges of ~328 feet (100 m) or more) in the southeastern U.S. when the calf was less than four months of age. Instances when sounds were documented involved interaction between the mother-calf pair and either another whale or a novel object in their environment that elicited a curious approach. In contrast, right whale vocalizations produced in bouts were commonly detected in the Bay of Fundy during reunion events between mothers and their older, more independent calves, and when calves were alone at the surface for extended periods of time. In terms of surface behavior, calves were consistently in much closer proximity to their mothers in the southeastern U.S. than in the Bay of Fundy habitat and spent more time at the surface. These results indicate that passive acoustic detection might not be effective in specifically detecting right whale mother-calf pairs in the southeastern U.S (Parks and Van Parijs 2013). Although preliminary, these results indicate that masking of mother/calf communication when calves are less than four months of age (in the southeastern U.S.) is less of a concern than potential communication masking in the northeastern U.S. when the calves are older. In context of the proposed mitigation measures, the effects of project-related survey noise on marine mammals within the Study Area are expected to be negligible. Any potential impacts would be limited to short-term disruption of behavioral patterns or displacement of individual marine mammals from discrete areas within the Study Area, including both critical and preferred habitats.

In addition to noise from the geophysical survey equipment, noise is also generated from the vessels used during the survey. Vessel noise is a combination of narrow-band (tonal) and broadband sound (Richardson et al., 1995). Tones typically dominate up to about 50 Hz, whereas broadband sounds may extend to 100 kHz. The dominant source of noise from vessels is from the propeller operation, including cavitation, singing, and propulsion, and the intensity of this noise is largely related to ship size and speed. Broadband source levels for most vessels are in the range of 150-170 dB re 1 μPa at 1 m (Richardson et al., 1995). For non-impulsive (continuous) sound sources, such as those associated with vessel traffic, the sub-injurious threshold is 120 dB re 1 μPa.

The exact effects of vessel noise on marine mammals are difficult to assess because of the wide array of reports of their observed behavioral responses, both between and among species. Several species of small toothed cetaceans have been observed to avoid boats when they are approached to within 0.3–0.9 miles (0.5–1.5 km), with occasional reports of avoidance at greater distances (Richardson et al., 1995). Reports of responses of cetacean species to moving power vessels are variable, both between species and temporally. Right whales may alter calling behavior (shifting call frequency) to compensate for increased low-frequency noise, such as vessel-related noise (Parks et al., 2007). Studies of right whales within specific areas of high shipping traffic also showed decreased stress-related hormone metabolites following reductions in local ship traffic levels (Rolland et al., 2012). Most beaked whales tend to avoid approaching vessels (Würsig et al., 1998) and may dive for an extended period when approached by a vessel (Kasuya 1986). Northern bottlenose whales (*Hyperoodon ampullatus*), however, are sometimes quite tolerant of slow-moving vessels (Reeves et al., 1993; Hooker et al., 2001). Dolphins may tolerate boats of all sizes, often approaching and riding the bow and stern waves (Shane et al., 1986). At other times, dolphin species that are known to be attracted to boats will avoid them. Such avoidance is often linked to previous boat-based harassment of the animals (Richardson et al., 1995). Coastal bottlenose dolphins that are the object of whale watching activities have been observed to swim erratically (Acevedo 1991), remain submerged for longer periods of time (Janik and Thompson 1996; Nowacek et al., 2001), display less cohesiveness among group members (Cope et al., 1999), whistle more frequently (Scarpaci et al., 2000), and be restless often (Constantine et al., 2004) when boats were nearby. Pantropical spotted dolphins (*Stenella attenuata*) and spinner dolphins (*S. longirostris*) in the eastern tropical Pacific, where they have been targeted by the tuna fishing industry because of their association with these fish, show avoidance of survey vessels up to 5.9 nmi (11 km) away (Au and Perryman 1982; Hewitt 1985), whereas spinner dolphins in the Gulf of Mexico were observed bowriding the survey vessel in all 14 sightings of this species during one survey (Würsig et al., 1998). Harbor porpoises tend to avoid boats. In the Bay of Fundy, Polacheck and Thorpe (1990) found harbor porpoises to be more likely to swim away from the transect line of their survey vessel than swim toward it, and more likely to head away from the vessel when they were within 1,312 feet (400 m) of the vessel. Similarly, off the western coast of North America, Polacheck and Thorpe (1990) observed harbor porpoises avoiding a survey vessel by moving rapidly out of its path within 0.6 miles (1 km) of that vessel.

During the proposed geophysical surveys, small or large vessels could be used. Smaller survey vessels are expected to make daily round trips to their shore base, whereas larger survey vessels could remain offshore for weeks, depending on fuel capacity and crew requirements. Vessels conducting G&G surveys would operate under mandatory speed restrictions during both transit and surveying in water depths less than 131 feet (30 m). Most of the time vessel speeds would be less than 5 knots. The reduced vessel speed would in turn reduce vessel-associated noise levels, especially noise associated with operation and hull-wave slap. For this analysis, it is expected that the proposed additional volume of vessel traffic would not constitute a substantial increase to existing vessel traffic within the Study Area, especially in the vicinity of ports and shorebases. In general, marine geophysical vessels are designed to operate quietly to minimize potential sources of interference with collected geophysical data (IAGC 2002). Absent a mitigative approach, noise associated with geophysical survey vessels may, in some cases, elicit behavioral changes in individual marine mammals that are in very close proximity to these vessels. These behavioral changes may include evasive maneuvers such as diving or changes in swimming direction and/or speed. However, observer and avoidance requirements should substantially reduce the incremental risk of exposure to vessel-associated noise. Because these vessels are generally quiet, machinery and other associated propulsion-related noise is transitory and generally does not propagate at great distances from the vessel. Exposure levels beyond the effective range of observers should be near ambient levels.

The proposed action includes mandatory exclusion zones and separation distances between G&G vessels and protected species. This would minimize potential impacts from vessel and equipment noise and should avoid collisions with these protected species. Operational restrictions within the North Atlantic right whale critical habitat, SMAs, and DMAs are expected to reduce vessel-related noise impacts on this species during its seasonal migration and calving/nursing periods. These restrictions are also protective of other protected marine mammals that could occur in the study area. Based on the proposed volume of vessel traffic associated with project activities within the Study Area and the presumption that individual or groups of marine mammals within the Study Area could be familiar with various and common vessel-related noises, particularly within frequented shipping lanes, the effects of project-related (non-survey) vessel and equipment noise on marine mammals within the Study Area would be negligible.

Besides noise from geophysical operations and vessel use, noise can also be generated during geological sampling. Proposed activities under Alternative A include bottom sampling of up to 500 core or grab samples. No noise is associated with use of grab samplers, but noise is generated during vibratory core sampling. The vibratory mechanism on the vibracorer would be the primary source of underwater sound during geological sampling operations, in addition to broadband noise from the vessel. The vibratory mechanism produces a short-duration broadband noise with peak frequency less than 1 kHz. Source levels are generally expected to be less than 180-190 dB re 1 μPa @ 1 m depending on the intensity of the vibrations, barrel material, and nature of sediment penetration (Reiser et al., 2011). The vibratory mechanism would be operated at the sample location for 5 to 15 minutes. The vibrahead would not be operated until the vibracore platform makes contact with the seabed and core barrel makes contact with the seafloor. Visual monitoring of an acoustic exclusion of 328 feet (100 m), consistent with the geophysical protocol, would be implemented. The same startup and shutdown requirements, consistent with the geophysical protocol, would be implemented when marine mammals and sea turtles are observed approaching or within the acoustic exclusion zone. After applying the mitigating measures outlined above, the effects of geological sampling noise on marine mammals within the Study Area would be negligible.

Vessel Presence/Traffic

Marine mammals could be vulnerable to physical disturbance from or collisions (ship strikes) with moving vessels (Laist et al., 2001; Douglas et al., 2008; Pace 2011). Most reports of collisions involve large whales, but collisions with smaller species also occur (van Waerebeek et al., 2007). Laist et al. (2001) provides records of the following vessel types associated with collisions with whales (listed in descending order): tanker/cargo vessels; whale watch vessels; passenger liners; ferries; naval vessels; recreational vessels; USCG vessels; fishing vessels; research vessels; dredges; and pilot boats. Most severe and lethal whale injuries involved large ships of lengths greater than 262 feet (80 m). Vessel speed was also found to be a significant factor, with most (89 percent) of the records involving vessels moving at 14 knots (26 km/hr) or greater. There are reports of collisions between moving vessels and most of the listed species that occur within the Study Area, particularly the fin whale (IWC, 2011b). Collision with vessels is the leading human-caused source of mortality for the endangered North Atlantic right whale (NMFS 2005). Their slow movements, time spent at the surface, and time spent near the coast make them highly vulnerable ship strikes. Studies suggest that right whales do not actively move out of the path oncoming ships, which greatly increases their chances of collisions (Nowacek et al., 2004).

Marine mammal species of concern for possible ship strikes with all vessels operating at speed include primarily slow-moving species (e.g., North Atlantic right whales) and deep-diving species while on the surface (e.g., sperm whales, pygmy/dwarf sperm whales, and beaked whales; species unlikely to be present in the Study Area). Generally, it is assumed that the probability of this encounter, and thus impact, is very low. However, vessel operations within areas such as the North Atlantic right whale critical habitat and migration corridor during calving and nursing or migration periods could increase the probability of ship strike with this species. Certain cetacean species, including bottlenose dolphin and other dolphin species (e.g., *Stenella* spp.), actively approach vessels moving at speed to swim within the pressure wave produced by the vessel's bow.

Under the proposed action, all G&G surveys, regardless of host vessel size, must comply with the following requirements (see Section 2.2.7):

- implementation of a vessel strike avoidance protocol;
- implementation of North Atlantic right whale time-area closures;
- implementation of standard manatee conditions.

With these mitigation measures in place including speed restrictions, observer requirements, and avoidance requirements, G&G survey vessels are unlikely to strike marine mammals. Survey vessels, which account for most of the project-related vessel traffic associated with Alternative A, survey at a speed of approximately 4.5 knots (8.3 km/hr). Transit speeds when traveling to and from shore bases would also be limited in sensitive areas, such as SMAs. In addition, waters surrounding survey vessels while on survey would be continuously monitored for the presence of marine mammals. The likelihood of a collision between a project-related vessel and a marine mammal is considered to be very low because of the combined efficacy of the mitigation measures: relatively low vessel speeds (particularly within seasonal restricted areas and inshore waterways), time-area closures for the most susceptible species, the presence of PSOs on board certain survey vessels, and adherence to vessel operations guidelines for avoidance of vessel strikes with listed species. Under these conditions, vessel collisions with marine mammals would be avoided, and, as a result, impacts would be negligible.

Vessel Wastes and Accidental Discharges

Lost and discarded marine debris, particularly those items made of synthetic materials, is a major form of marine pollution. The types of objects most commonly encountered in offshore waters include plastic bags, wrappers, bottles, cups, and raw plastic pellets; synthetic rope; glass bottles; metal cans; lumber; and cigarette butts (Laist 1996, 1997; Barnes et al., 2009; Gregory 2009). Marine debris poses two types of potentially negative impacts on marine biota, including marine mammals: (1) entanglement, and (2) ingestion. Records suggest that entanglement is a far more likely cause of mortality to marine mammals than ingestion-related interactions. Entanglement records for marine mammals show that entanglement is most common in pinnipeds, less common in mysticete cetaceans, and rare among odontocete cetaceans (Laist et al., 1999). Entanglement data for mysticete cetaceans may reflect a high interaction rate with active fishing gear rather than with marine debris. Abrasion and chafing scars from rope and line have been reported on numbers of photographed North Atlantic right whales in the western North Atlantic. These scars were attributed to entanglement in fishing gear (NMFS 2005). Entanglement records for odontocete cetaceans that are not clearly related to bycatch in active fisheries are almost absent (Laist 1996).

G&G survey operations generate trash made of paper, plastic, wood, glass, and metal. Most of this trash is associated with galley and offshore food service operations. The discharge of trash and debris is prohibited (33 CFR 151.51–77) unless it is passed through a comminutor (a machine that breaks up solids) and can pass through a 25-millimeter mesh screen. All other trash and debris must be returned to shore for proper disposal with municipal and solid waste. Some personal items, such as hardhats and personal flotation devices, are occasionally accidentally lost overboard. However, USCG and USEPA regulations require operators to become proactive in avoiding accidental loss of solid waste items by developing waste management plans, posting informational placards, manifesting trash sent to shore, and using special precautions such as covering outside trash bins to prevent accidental loss of solid waste.

Along with solid waste and debris, G&G survey vessels may generate treated sanitary waste, cooling/bilge water, and other discharges. These wastes/discharges would likely be minimal considering the vessel sizes and small footprint relative to the Study Area. Under the proposed action, G&G activities would occur under a marine pollution control plan and marine debris awareness guidance as outlined in Section 2.2.7. Taking this and the USCG and USEPA regulations into account, it is unlikely that significant amounts of trash and debris from G&G activities would be released into the marine environment. Therefore, debris entanglement and these debris and waste/discharge ingestion impacts on marine mammals are expected to be negligible.

Although unexpected, an accidental release of fuel or diesel by a survey vessel could occur. The G&G survey vessels are fairly small and, in the event of a spill, would not have a large volume of fuel. Spills occurring at the ocean surface would disperse and weather rapidly. Volatile components of the fuel would evaporate. Fuel and diesel used for survey vessel operations is light and would float on the ocean surface. There is the potential for a small proportion of the heavier fuel components to adhere to particulate matter in the upper portion of the water column and sink. Under the marine pollution control plan, operators are required to immediately respond and contain the spill. Marine mammals could be affected by accidentally spilled diesel fuel from a vessel associated with project activities. Effects of spilled oil on marine mammals are discussed by Geraci and St. Aubin (1980, 1982, 1985, and 1990) and Lee and Anderson (2005), as well as within spill-specific study results (*Exxon Valdez*; Frost and Lowry 1994; Paine et al., 1996; Hoover-Miller et al., 2001; Peterson et al., 2003). Quantities of diesel fuel on the sea surface may affect marine mammals through various pathways: surface contact of the fuel with skin and other mucous membranes, inhalation of concentrated petroleum vapors, or ingestion of the fuel (direct ingestion or by the ingestion of oiled prey). The likelihood of a fuel spill during G&G activities is considered to be remote, and the potential for impacts on marine mammals would depend greatly on the size and location of a spill, and meteorological conditions at the time of the spill. It is assumed that spilled fuel would rapidly spread to a layer of varying thickness and break up into narrow bands or windrows parallel to the wind direction. The rate at which the fuel spreads would be determined by prevailing conditions such as temperature, water currents, tidal streams, and wind speeds. Lighter, volatile components of the fuel would evaporate to the atmosphere almost completely in a few days. Evaporation rates could increase as the oil spreads because of the increased surface area of the slick. Rougher seas, high wind speeds, and high temperatures also tend to increase the rate of evaporation and the proportion of oil lost by this process (API 1999; USDOC, NOAA 2006). An accidental diesel fuel spill adjacent to or within the North Atlantic right whale critical habitat during the winter calving period could result in the direct contact of the spilled fuel with both adult and newly born whales. It is presumed that the fuel would disperse to a very light sheen and would weather rapidly. Impacts from this event, if it were to occur, are not likely to seriously injure individual whales and thus are expected to be minor. Fuel spills in other areas of the Study Area are expected to result in negligible to minor impacts on marine mammals.

Seafloor Disturbance

Due to the small footprint and the isolation of these impacts on the seafloor, the potential impact on marine mammals from physical disturbance of the seafloor, such as vibracoring and grab samplers, is negligible.

3.3.2.2. Alternative B: Additional Operational Restrictions and Time-Area Closures

The impact-producing factors (IPFs) from routine events that may impact marine mammals would be the same as discussed in Alternative A and include 1) active acoustic and vessel noise, 2) vessel presence/traffic, 3) vessel wastes and discharges (including marine debris), and 4) seafloor disturbance. The potential impacts on the each of the marine mammal species are largely similar as the impacts described under Alternative A.

The sequential G&G surveys, which would contribute to more vessel trips and related noise, could lead to increased exposure to acoustic and marine noise (vessels, vibracores, and equipment) and a greater chance for vessel collisions or trash and debris entanglement and ingestion to occur than as outlined in Alternative A.

This alternative would also incorporate additional geographic-specific time-area closures to specifically avoid HAPCs critical to fish spawning and nursery, and incidentally avoid any marine mammals that may also be present These time-area closures, especially in the South Atlantic Planning Area, would lead to fewer incidental acoustic and marine noise (i.e., vibracore) impacts on marine mammals at certain times of year, but those same closures could also concentrate exposure and impacts within a different season.

3.3.2.3. Alternative C: No Action Alternative

Under Alternative C, the no action alternative, the proposed action would not occur and there would be no potential impacts on marine mammals. A comprehensive and systematic inventory of sand resources along the Atlantic OCS would not be conducted, and additional borrow areas for coastal restoration and resiliency would not be delineated. This could lead to delays in coastal restoration from future storms and/or erosion, and could lead to the loss of critical shoreline habitat. The no action alternative would not meet the objectives of the Disaster Relief Appropriations Act, and BOEM would be required to forfeit funds.

3.4. Fish and Essential Fish Habitat

3.4.1. Affected Environment

3.4.1.1. Fish Resources

A wide variety of fish species inhabit the waters of the Atlantic Ocean. Appendix A, *Fish and Essential Fish Habitat Tables*, includes tables that describe fish species and EFH present in the Study Area (Tables A-1 through A-12). Fish species present in any region can vary in type and numbers based on latitude, habitat type, temperature gradients, salinity gradients, location of major ocean currents, and the availability of food sources. Fish assemblages are generally categorized according to life habits or preferred habitat associations; potential categories include diadromous, pelagic, demersal, and highly migratory species.

Diadromous fishes spend portions of their life cycle in freshwater and portions in saltwater, and are further divided into anadromous and catadromous. Sturgeons (family Acipenseridae), herrings and shad (family Clupeidae), temperate basses (family Moronidae), smelts (family Osmeridae), lampreys (family Petromyzontidae), and trout and salmon (family Salmonidae) are examples of Atlantic anadromous fishes that spend their adult lives in saltwater but spawn in freshwater. The catadromous American eel (*Anguilla rostrata*) spends most of its adult life in freshwater and migrates to saltwater to spawn.

Fishes that spend most of their lives swimming in the water column, rather than on or near the ocean bottom are referred to as pelagic fishes. Pelagic fishes can be found anywhere in the water column from shallow water to very deep water. Some pelagic fish species rely on coastal wetlands, seagrass habitats, and estuaries for specific life stages and migrate north and south along the Atlantic coast during different periods of the year. Other pelagic fishes can be found distributed from the shore to the continental shelf edge; many of these species are sought by recreational and commercial fisheries. These fish share characteristics of rapid growth, high feeding rates, and high reproductive capacity. Many of these fish use the highly productive coastal waters within the Atlantic region during the summer months and migrate to deeper waters during the rest of the year. Fishery management plans have been put in place to regulate and manage the pelagic fisheries in the Atlantic; these include plans for Atlantic salmon (*Salmo salar*), Atlantic herring (*Clupea harengus*), bluefish (*Pomatomus saltatrix*), dolphin (*Coryphaena hippurus*), and wahoo (*Acanthocybium solandri*), among others. Coastal pelagic fishes can associate with structured bottom, but they primarily respond to water column structure (temperature, salinity, dissolved oxygen), and circulation (currents, eddies, fronts); because these physical characteristics vary spatially and seasonally, locations of fish assemblages also vary.

Demersal fish spend at least the adult portion of their life cycle associated with the ocean bottom. These fish are considered high-value fish and are sought by both commercial and recreational anglers. Many demersal fish species have pelagic eggs or larvae that can be carried long distances by ocean currents. Some common demersal fish are flounders (family Pleronectidae), hakes and cods (family Gadidae), and sea basses and groupers (family Serranidae). Demersal fish can be associated with hard bottom substrates such as rock outcroppings, wrecks, coral growths, and sponges, while others are associated with soft bottom substrates such as medium to coarse carbonate sands or carbonate shell hash. Fish associated with hard bottoms include snappers (family Lutjanidae) groupers (family Serranidae), Atlantic cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), and pollock (*Pollachius virens*), and fish associated with soft bottoms include skates (family Rajidae), drums and croakers (family Sciaenidae), sand flounders (family Paralichthyidae), hakes (family Merlucciidae), and spiny dogfish (*Squalus acanthias*). Demersal fish associated with soft bottoms vary with season, migrating both north and south as well as across the shelf with changing water temperatures.

Another category of fishes is the highly migratory fishes, often thought of as "blue water" species. Highly migratory fishes often migrate from southern portions of the Atlantic to the Gulf of Maine. Some examples of highly migratory species are Atlantic swordfish (*Xiphias gladius*), tunas (family Scombridae), billfish (family Istiophoridae), and sharks; because they are sought by commercial and recreational anglers, highly migratory species are also managed under fisheries management plans.

3.4.1.2. Threatened and Endangered Species

This section discusses marine fishes that are listed as threatened or endangered under the ESA. Two marine fish species that occur in the Study Area, the smalltooth sawfish (*Pristis pectinata*) and the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), are currently listed as endangered.

Two endangered anadromous fish species potentially occurring in the Study Area are the shortnose sturgeon (*Acipenser brevirostrum*) and the Atlantic salmon (*Salmo salar*) (NMFS 1998). The Atlantic salmon inhabits rivers in Maine and migrates to the North Atlantic Ocean (NOAA 2013b), and the shortnose sturgeon inhabits rivers along the Atlantic coast but rarely ventures into coastal marine waters (NMFS 1998).

Smalltooth Sawfish (*Pristis pectinata*)

Status (Endangered). On April 1, 2003, NMFS published a final rule (Federal Register 2003) listing the Distinct Population Segment (DPS) of smalltooth sawfish in the Atlantic as endangered under the ESA. Over the past 200 years, smalltooth sawfish populations have declined considerably, primarily because of incidental capture by fishing gear as well as destruction of habitat. The ESA listing was based on the following considerations: the threatened destruction, modification, or curtailment of habitat or range; overutilization for commercial, recreational, scientific, or educational purposes; inadequacy of existing regulatory mechanisms; and other natural and manmade factors affecting the continued existence of the species. Critical habitat was designated in 2009 (Federal Register 2009b) in southern and southwestern Florida. Maintenance and protection of habitat is an important component of the recovery plan for this species (NMFS 2009). Recent studies indicate that key habitat features (particularly for immature individuals) consist of shallow water, especially near mangroves, with estuarine conditions.

Distribution. The historic range of smalltooth sawfish extended throughout the Gulf of Mexico and north to Long Island Sound on the east coast but has contracted considerably in U.S. coastal waters over the past 200 years. Currently, the core of the smalltooth sawfish DPS is surviving and reproducing in the waters of southwest Florida and Florida Bay, primarily within the jurisdictional boundaries of Everglades National Park where important habitat features are still present and are less fragmented than in other parts of the historic range (Simpfendorfer and Wiley 2005; NMFS 2009).

Life History. Little is known about smalltooth sawfish habitat use, age, growth, reproduction, feeding, or predators and competitors (NMFS 2009, 2010b). The smalltooth sawfish normally inhabits shallow waters (< 10 m (33 feet)), often near river mouths or in estuarine lagoons over sandy or muddy substrates, but can also occur in deeper waters (< 50 m (164 feet)) of the continental shelf. Shallow water less than 1 m (3 feet) appears to be important nursery area for young smalltooth sawfish. Smalltooth sawfish grow slowly and mature at about 10 years of age. Females bear live young, and litters reportedly range from 1-20 embryos (NMFS 2009).

Smalltooth sawfish feed on benthic invertebrates and fishes. The saw of the sawfish has been considered as a trophic apparatus, used to herd and even impale shallow-water schooling fishes such as herrings and mullets (Breder 1952). It appears more likely that the saw is used to rake the seafloor to uncover partially buried invertebrates. Small juvenile sawfishes may be susceptible to predation from bull sharks (*Carcharhinus leucas*) and lemon sharks (*Negaprion brevirostris*) that inhabit similar water depths as the smalltooth sawfish. The toothed saw of fish of all sizes will readily entangle in nets, ropes, monofilament line, discarded pipe sections, and other debris (Seitz and Poulakis 2006). Some sawfish are caught incidentally on hook-and-line by fishers seeking sharks, tarpon, or groupers, and though most are released unharmed, many of these interactions will result in death of the individual. There was and may still be some incentive to collecting the saws as curios, but this has not been well documented. There have been no studies on competition between sawfishes and other co-occurring species.

Shortnose Sturgeon (Acipenser brevirostrum)

Status (Endangered). The shortnose sturgeon belongs to the family Acipenseridae and is one of several members of the family found exclusively in North America. This species was originally listed as endangered on March 11, 1967 (Federal Register 1967) under the Endangered Preservation Act of 1966. Subsequently, NMFS prepared a recovery plan for the species under the ESA (Federal Register 1998a), and at present there are 19 east coast rivers considered to support DPSs (NMFS 1998b). Population declines were attributed to habitat loss or alteration, pollution, and incidental capture in nets set for other species.

Distribution. The shortnose sturgeon is primarily an estuarine and riverine species and rarely enters the coastal ocean of the Study Area. Most of the river systems listed as DPSs are in North Carolina, South Carolina, Georgia, and northern Florida (NMFS 1998b). Although these systems drain into the estuaries or the coastal ocean portion of the Study Area, shortnose sturgeon have rarely been found in coastal or shelf waters (Dadswell et al., 1984; Moser and Ross 1995; Collins and Smith 1997). Collins and Smith (1997) reviewed available records and reported 39 individuals ranging from 2-3.3 feet (60-100 cm) total length caught offshore of South Carolina during the months of January to March. Dadswell et al. (1984) reported eight recorded catches from the Atlantic Ocean between Cape Henry, Virginia, and Cape Fear, North Carolina.

Life History. The shortnose sturgeon is an anadromous species found in larger rivers and estuaries of the North America eastern seaboard from the St. Johns River in Florida to the St. Johns River in Canada. Although shortnose sturgeons occur primarily in fresh and estuarine waters, occasionally they will enter the coastal ocean. Adults ascend rivers to spawn from February to April; eggs are deposited over hard bottom, in shallow, fast-moving water (Dadswell et al., 1984; Murdy et al., 1997). Fecundity ranges from 27,000-208,000 eggs per female (Murdy et al., 1997). Growth is relatively slow, with females reaching maturity in 6-7 years, whereas males mature in 3-5 years. Shortnose sturgeon can live more than 67 years, with an average life span of 30-40 years.

Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus)

Status (Threatened: Gulf of Maine DPS; Endangered: New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs). In 2009, the National Resources Defense Council (NRDC 2009) petitioned NMFS to list the Atlantic sturgeon as endangered under the ESA. The NRDC requested that the species be segregated into five DPSs, including Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic. On February 6, 2012, NMFS issued final rules classifying the Gulf of Maine DPS as threatened and the other four DPSs, which are in the Study Area, as endangered (Federal Register 2012a, 2012b). These recent listings did not designate critical habitat due to a lack of information on individual DPSs.

Distribution. Historically, Atlantic sturgeons were distributed along the east coast and inhabited 38 coastal rivers from the St. Johns River, Florida, to Hamilton Inlet, Labrador. Today they inhabit 32 coastal rivers over a reduced geographic range, with the center of abundance being the New York Bight (Atlantic Sturgeon Status Review Team, 2007; Dunton et al., 2010).

Life History. The Atlantic sturgeon is an anadromous species that resides for much of each year in estuarine and marine waters, but ascends coastal rivers in spring to spawn in freshwater. Spawning populations occur in 20 of the 32 east coast rivers that support Atlantic sturgeon. Atlantic sturgeon are generally slow growing and late maturing, and mature individuals may not spawn every year; generally, the range between spawning is 1-5 years. Spawning takes place in flowing freshwater. Depending on their size, mature females produce between 400,000 and 8 million eggs. The eggs are adhesive and attach to gravel or other hard substrata. Larvae develop as they move downstream to the estuarine portion of the spawning river, where they reside as juveniles for years. Subadults will move into coastal ocean waters where they may undergo extensive movements usually confined to shelly or gravelly bottoms in 33-164 feet (10-50 m) water depths (Stein et al., 2004; Erickson et al., 2011). Fish distribution varies seasonally within this depth range. During summer months (May to September) fish are primarily found in the shallower depths of 33-66 feet (10-20 m). In winter and early spring (December to March), fish move to depths between 66 and 165 feet (20 and 50 m) (Erickson et al., 2011). Shelf areas less than 59 feet (18 m) deep off Virginia and the sandy shoals offshore of Oregon Inlet, North Carolina, appear to be areas of concentration during summer months (Laney et al., 2007). The area of high concentration offshore of Virginia was centered from 9.3-23.3 miles (15-37.5 km) from shore, and the maximum distance from shore during winter was about 70 miles (112.5 km). Although there is considerable intermingling of populations in the coastal oceans, adults return to their natal rivers to spawn. Adults grow to lengths of 14 feet (4.3 m), weigh up to 800 lbs (363 kg), and live for up to 60 years. Age at maturity varies with subpopulation but ranges from 5-10 years in South Carolina to 22-34 years in the St. Lawrence River, Canada.

Atlantic salmon (*Salmo salar*)

Status (Endangered: Gulf of Maine DPS). On November 17, 2000, NMFS and FWS jointly published a final rule (Federal Register 2009a) listing the Gulf of Maine DPS of Atlantic salmon as endangered under the ESA. In 2006, the Gulf of Maine DPS underwent a Status Review by a Biological Review Team. As a result, on July 20, 2009, NMFS and FWS jointly determined that the Gulf of Maine DPS should be expanded to include additional freshwater habitats as well as those already listed in November 2000 (Federal Register 2009c).

Distribution. Historically, anadromous Atlantic salmon have been found on both sides of the North Atlantic: from Connecticut to Ungava Bay in the western Atlantic and from Portugal to Russia's White Sea in the eastern Atlantic, including the Baltic Sea (Federal Register 2009c). Atlantic salmon originally occurred in almost every river north of the Hudson River but now are only known to be present in 11 rivers. By the 19th century, populations of U.S. Atlantic salmon were severely depleted as a result of overexploitation, degradation of water quality, and damming of rivers; they continued to decline through the first half of the 20th century. Despite current conservation efforts, the number of adult Atlantic salmon returning to New England rivers remains low (NOAA 2013c).

Life History. Adult Atlantic salmon return to their natal rivers from the open ocean to spawn (NOAA 2013b). The adults ascend the rivers from spring to fall with peak migrations occurring in June and spawning occurring in early November (Federal Register 2009c). The eggs remain in a redd, or series of nests in the gravel, until they hatch in late March or April. After the eggs hatch, they go through a series of life stages: alevin (recently hatched), fry (active feeders), and parr (juveniles with vertical bars). The juveniles remain in the rivers as they develop and undergo smoltification (physical and biological changes required for the transition to salt water) at around 2 years of age. The smolt emigrate down the river over a 2- to 3-week time period. After reaching the Atlantic Ocean, the salmon migrate long distances to open ocean between Labrador and Greenland. The juvenile Atlantic salmon typically mature over 2 years, after which they return to their natal rivers to spawn (Federal Register 2009c).

3.4.1.3. Fish Hearing

Fish use underwater sounds to obtain a great deal of information about their environment. In addition to listening to sounds to detect information about their physical environment, many species of bony fishes (but not elasmobranchs) use sound for communication as well as mating and territorial interactions (Zelick et al., 1999). There is very limited information available about fish hearing; the available data shows that, with a few exceptions, bony fishes cannot hear sounds above about 3-4 kHz and the majority of species are only able to detect sounds to 1 kHz or below, while cartilaginous fishes detect sounds to no more than 600 or 800 Hz (see Table A-13 in Appendix A). More detailed information about fish hearing and underwater sound is in the Appendix J of Atlantic OCS Proposed G&G Activities Programmatic EIS (BOEM 2012a).

3.4.1.4. Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation Management Act (16 U.S.C. 1801–1882) established regional Fishery Management Councils (FMCs) and mandated that Fishery Management Plans (FMPs) be developed to responsibly manage exploited fish and invertebrate species in U.S. Federal waters. When Congress reauthorized this Act in 1996 as the Sustainable Fisheries Act, several reforms and changes were made. One change was to charge NMFS with designating and conserving EFH for species managed under existing FMPs. This is intended to minimize, to the extent practicable, any adverse effects on habitat caused by fishing or non-fishing activities, and to identify other actions to encourage the conservation and enhancement of such habitat.

EFH is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity” (16 U.S.C. 1801(10)). The EFH final rule summarizing EFH regulation (50 CFR 600) outlines additional interpretation of the EFH definition. Waters, as defined previously, include “aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include aquatic areas historically used by fish where appropriate.” Substrate includes “sediment, hard bottom, structures underlying the waters, and associated biological communities.” Necessary is defined as “the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem.” “Fish” includes “finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds,” whereas “spawning, breeding, feeding or growth to maturity” covers the complete life cycle of those species of interest. Tables A-1 and A-2 in Appendix A describe the EFH in the Study Area; the table was defined using habitat information provided in the New England, Mid-Atlantic, South Atlantic, and Highly Migratory Species FMPs. Some species-specific GIS information by lifecycle is available for EFH in the Study Area and is shown in Tables A-3 and A-4 in Appendix A. GIS species-specific information is not readily available for the Study Area in the Mid-Atlantic and South Atlantic FMPs, so representative species are identified in Tables A-4 to A-11 in Appendix A.

Within the EFH designated for various species, particular areas termed HAPCs are also identified. HAPCs are discrete subsets of EFH that provide extremely important ecological functions or are especially vulnerable to degradation. FMCs may designate a specific habitat area as an HAPC based on four criteria: (1) importance of the ecological function provided by the habitat; (2) extent to which the habitat is sensitive to human-induced environmental degradation; (3) whether, and to what extent, development activities are, or will be, stressing the habitat type; or (4) rarity of the habitat type. While the HAPC designation does not confer additional protection for or restrictions on an area, it can help prioritize conservation efforts. Healthy populations of fish require not only the relatively limited habitats identified as HAPCs, but also other areas that provide suitable habitat functions. Thus, protection of designated HAPCs alone may not suffice in supporting the larger numbers of fish needed to maintain sustainable fisheries and a healthy ecosystem. Many specific HAPCs have been identified for fishes in the Atlantic Region. Table A-12 in Appendix A shows the relevant HAPCs in the Study Area identified by FMPs.

3.4.2. Environmental Consequences

Potential impacts on fish and EFH from routine events associated with the proposed action and alternatives are discussed in this section. The details of G&G surveys, equipment, and temporal and geographic coverage were discussed in Section 2. Although there is little specific information on any of these impacts in relation to fish resources or EFH in the Study Area, the following analysis assumes that at least some members of the regional ichthyofauna including the demersal and pelagic categories discussed above could be affected to some degree by G&G activities. IPFs related to fish resources and EFH identified in the initial screening include (1) active sound sources (i.e., boomer and chirp sub-bottom profilers, side-scan sonars, and single beam, interferometric, or multibeam depth sounders) and vessel and equipment noise, including vibracoring; (2) vessel presence and traffic; (3) vessel waste and accidental discharge (including marine trash); and (4) seafloor disturbance.

3.4.2.1. Alternative A: The Proposed Action

Noise from Active Sound Sources and Vessel Operations

Sound sources associated with the proposed action and described in Section 2 include electromechanical (boomer and chirp sub-bottom profilers, side-scan sonars, and single beam, interferometric, or multibeam depth sounders) as well as vessel and equipment noise, including vibracoring. The potential effects of noise on fishes can be categorized in increasing order of severity as follows:

- behavioral responses

- masking of biologically important sounds
- temporal threshold shifts (hearing loss)
- physiological/anatomical effects
- mortality

Potential for any of the aforementioned effects is related to sound levels and frequencies, distance from sound source, and species-specific hearing sensitivity. Fishes hear biologically relevant sounds and detect near-field particle motion with auditory anatomy, lateral lines, and sensory pore systems (Lobel 2009). All fishes, including elasmobranchs, detect particle motion when differences in density cause otoliths within the ear to move differentially to clusters of hair cells. Bony fishes that contain an air bubble (typically a swim bladder) have the ability to detect pressure signals that are re-radiated to the inner ear as particle motion. Fish species with an air bubble hear a wider range of frequencies and sounds of lower intensity than those without one since the bubble re-radiates the received signal, which is then detectable by the ear as a secondary sound source (Popper et al., 2003; Popper and Fay 2010). The presence of an air bubble can increase the potential for non-auditory physical damage to the fish. Intense sounds can cause rapid and substantial expansion and contraction of the air bubble walls within fishes (such as the swim bladder or air bubbles in the blood) that strike against nearby tissues or from air bubbles within the blood bursting or expanding and damaging tissues (Stephenson et al., 2010). Findings from studies on fish hearing showed that many fishes cannot detect sounds above about 3–4 kHz, and most are only able to detect sounds to 1 kHz or below. Based on limited studies, it appears that a few species of cartilaginous fishes can only detect sounds that are around 600 or 800 Hz (Myrberg et al., 1976; Myrberg 2001; Casper et al., 2003; Casper and Mann 2006).

Several of the commercially important fish families that occur within the Study Area have similar hearing sensitivity characteristics. The highest frequency detected for some commercially important fish families (Labridae, Lutjanidae, Moronidae, Sciaenidae, and Scombridae) was around 1,000 Hz. However, members of the Clupeidae (important baitfishes) can detect higher frequencies that are around 4,000 Hz, and shad and menhaden can detect some very high frequencies that are greater than 120,000 Hz. In general, commercial fish species would be most susceptible to low-frequency sound sources, such as sub-bottom profilers. Very little information is available concerning the effects of mid- and high-frequency equipment on fishes and available studies were conducted on species and in environments that differ from the Study Area. Nevertheless, it is possible that noise from these surveys may temporarily affect the behavior of some fish species within the Study Area, particularly those such as herrings, menhaden, and anchovies capable of hearing in the high frequency range (25-135 kHz) (Mann et al., 1997; Popper et al., 2003).

These results and others on related species (Doksaeter et al., 2009) confirm that high-frequency sounds emitted by active electromechanical acoustic operations in the Study Area would likely affect the behavior of herrings and other fish resources in a detectable way. Changes in behavior, particularly in pre-spawning fish assembling to move into spawning rivers, could affect reproductive potential or feeding activity. In addition, temporary displacement of prey species could affect feeding routines of predatory fish and marine mammals. Because the use of electromechanical sources would be mostly from moving vessels and individual surveys would be temporary and spatially limited, the impacts on pelagic, demersal, and highly migratory fish resources and associated EFH are expected to be minor.

Vessel noise is a combination of narrow-band (tonal) and broadband sound (Richardson et al., 1995). Broadband source levels for the smaller boats that would be used in the proposed action are in the range of 150-170 dB re 1 µPa at 1 m (Richardson et al., 1995). Although vessel and equipment noise would increase in the Study Area as a result of the proposed action scenario, negative effects on fish behavior are expected to be short-term and localized to areas where increased activity is concentrated. For these reasons, the impacts of vessel and equipment noise on pelagic, demersal, and highly migratory fish resources and associated EFH are expected to be minor. There is potential for impacts on fish resources as a result of sound emitted from vibracoring. Because the sampling will be localized and short in duration, impacts on pelagic, demersal, and highly migratory fish resources and associated EFH are expected to be minor.

Potential impacts from active sound sources and vessel noise on ESA-listed species are expected to be negligible for the shortnose sturgeon, which rarely enters the coastal ocean, and the Atlantic salmon, which only spends a short period of time migrating through the North Atlantic portion of the Study Area. Endangered Atlantic sturgeon have been observed to congregate on sandy shoals offshore Virginia (generally further offshore than the Study Area) and North Carolina's Oregon Inlet (generally further inshore of the Study Area) during the summer months. Endangered smalltooth sawfish are mostly found in very shallow water off the coast of Florida, inshore of the Study Area. These ESA-listed species would not commonly be present in dense aggregations in the area likely to be surveyed; if present (migrating/foraging), these species are likely to temporarily avoid the ensonified area and move to adjacent comparable habitat. Therefore, the potential impacts are expected to be temporary and minor in nature.

Vessel Presence/Traffic

Vessel presence and traffic would increase in the Study Area as a result of the proposed action scenario. The presence of additional vessels is not expected to cause observable changes in the behavior and/or presence of pelagic, demersal, or highly migratory fish resources and associated EFH. The impacts on fish resources, including ESA-listed species, and associated EFH as a result of vessel presence are expected to be negligible.

Vessel Waste and Accidental Discharges

Survey and sampling operations generate trash comprising paper, plastic, wood, glass, and metal. Most trash is associated with galley and offshore food service operations. In addition, over the last several years, companies operating offshore have developed and implemented trash and debris reduction and improved handling practices to reduce the amount of offshore trash that could potentially be lost into the marine environment. These trash management practices include substituting paper and ceramic cups and dishes for those made of Styrofoam, recycling offshore trash, and transporting and storing supplies and materials in bulk containers when feasible and have resulted in a reduction of accidental loss of trash and debris.

All survey vessels performing work within U.S. jurisdictional waters are expected to comply with Federal regulations that implement the International Convention for the Prevention of Pollution from Ships (MARPOL) as amended by the 1978 Protocol (MARPOL 73/78). Within MARPOL Annex V, Regulations for the Control of Pollution by Garbage from Ships, as implemented by 33 CFR 151, are requirements designed to protect the marine environment from various types of garbage generated onboard vessels. In addition, all authorizations for shipboard surveys would include guidance for marine debris awareness. Because operators must comply with Federal regulations and would be expected to follow the guidance provided by BOEM, the amount of trash and debris dumped offshore would be minimal because only accidental loss of trash and debris is anticipated, some of which could sink to the seafloor. Therefore, impacts from trash and debris on pelagic, demersal, and highly migratory fish resources and EFH, as generated by G&G activities, would be negligible.

Potential impacts from marine trash and debris on ESA-listed species are expected to be negligible for the shortnose sturgeon, which rarely enters the coastal ocean, and the Atlantic salmon, which only spends a short period of time migrating through the North Atlantic portion of the Study Area. Endangered Atlantic sturgeon are known to congregate on sandy shoals offshore Virginia and North Carolina during the summer months, and endangered smalltooth sawfish are mostly found in shallow water off the coast of Florida. They are believed to use their saw to feed on the benthos, which creates the potential for the entanglement of marine debris in the saw; therefore, potential impacts on smalltooth sawfish off the coast of Florida are expected to be negligible to minor.

Vessels used for G&G surveys could spill diesel fuel following a collision or other accident. Diesel fuel is an acutely toxic oil to algae, invertebrates, and fishes, and any contact with a diesel spill can result in death. However, small spills in open water rapidly dissipate, and fish kills rarely result. For the duration of such a spill, species and life stages residing in the upper water column are most at risk for contact with the spilled fuel. Coastal pelagic and epipelagic adults that forage at the ocean surface would be most likely to encounter a surface spill. Spanish mackerel (*Scomberomorus maculatus*), king mackerel (*Scomberomorus cavalla*), little tunny (*Euthynnus alletteratus*), and yellowfin tuna (*Thunnus albacares*), species known to feed at the ocean surface, are at the greatest risk of exposure but would likely swim away from a small diesel spill. Plankton in early life stages (i.e., eggs of both demersal and pelagic species) would be less able to avoid a spill and, therefore, are most vulnerable to toxic properties of the diesel (e.g., Mos et al., 2008).

Numerous federally managed species have pelagic eggs and larvae that would be at risk if they encountered a diesel spill. The EFH most at risk from a small diesel spill would be pelagic *Sargassum*. Drifting in mats, *Sargassum* supports numerous fishes and invertebrates including the young of several federally managed species such as greater amberjack (*Seriola dumerili*), almaco jack (*Seriola rivoliana*), gray triggerfish (*Balistes capriscus*), blue runner (*Caranx crysos*), dolphin (*Coryphaena hippurus*), and wahoo (*Acanthocybium solandri*). Because the exposure of spilled diesel fuel on early life stages of pelagic, demersal and highly migratory species as well as *Sargassum* is expected to last for a day or less and have limited spatial extent, the impacts of a small accidental diesel fuel spill from G&G activities would be negligible to minor.

Potential impacts from accidental fuel spills on ESA-listed species are expected to be negligible for the shortnose sturgeon, which rarely enters the coastal ocean, and the Atlantic salmon, which only spends a short period of time migrating through the North Atlantic portion of the Study Area. Endangered Atlantic sturgeon are known to congregate on sandy shoals offshore Virginia and North Carolina during the summer months, and endangered smalltooth sawfish are mostly found in shallow water off the coast of Florida; therefore, these ESA-listed species would not commonly be present in the Study Area and potential impacts on are expected to be minor.

Seafloor Disturbance

Sources of seafloor disturbance that could result from G&G activities are placement of anchors and bottom sampling using grab samplers and/or cores. Demersal hard bottom and hard bottom-associated fish resources will be avoided and therefore potential for physical damage to those areas is expected to be negligible. In addition, impacts on pelagic and highly migratory species are expected to be negligible due to the lack of seafloor associations. Placement of anchors on the seafloor would damage areas where direct contact with the seafloor occurs; on demersal soft bottom, the damage can mean loss of small patches of epifauna and infauna. Demersal soft bottom areas where deployments are made would lose benthic organisms (because of burial and crushing), and bottom-feeding fishes would be temporarily displaced from feeding areas. The proposed action scenario indicates that individual grab and core samples would affect a relatively small portion of the seafloor within the Study Area (Section 2). An estimate of up to 500 sediment samples is proposed, with the majority being vibracore samples. Given these estimates of minimal seafloor disturbance by projected G&G activities, the impacts on demersal soft bottom fish resources and associated EFH are expected to be negligible to minor. Mitigations for fish and EFH include avoidance of unnecessary anchoring and seafloor disturbance, as well as avoidance of sensitive benthic communities and habitats found near the seafloor.

Potential impacts from seafloor disturbance on ESA-listed species are expected to be negligible for the shortnose sturgeon, which rarely enters the coastal ocean, and the Atlantic salmon, which only spends a short period of time migrating through the North Atlantic portion of the Study Area. Endangered Atlantic sturgeon are known to congregate on sandy shoals offshore Virginia and North Carolina during the summer months; therefore, potential impacts are considered minor in these areas. Endangered smalltooth sawfish are mostly found in shallow water off the coast of Florida and are believed to forage on benthic organisms; therefore, potential impacts on smalltooth sawfish off the coast of Florida are considered to be minor.

3.4.2.2. Alternative B: Additional Operational Restrictions and Time-Area Closures

Noise from Active Sound Sources and Vessel Operations

Under this alternative, the same suite of G&G activities would occur but with additional restrictions on G&G activities. Geological surveys would only occur after geophysical surveys have been conducted and analyzed. This would provide for a more deliberate assessment and provides incremental improvement in avoiding sensitive resources. This alternative could require two mobilizations to an area if it is determined that additional site-specific investigation is warranted. Additional mobilizations would increase the potential impacts of vessel noise to pelagic, demersal, and highly migratory fish resources and EFH; however, impacts from sound sources and vessel and equipment noise would still be considered minor. There is potential for impacts on fish resources as a result of sound emitted from vibracoring. The number of vibracores would not increase under this alternative. Because the sampling would be localized and short in duration, impacts on pelagic, demersal, and highly migratory fish resources and associated EFH are expected to be minor. G&G surveys would not occur at sensitive times of year in spawning and nursery HAPC in the Study Area, including in sensitive cape-associated shoals, ephemeral hard-bottom areas, or important shark habitat (Appendix A, Table A-12). Once the survey areas were determined, BOEM would more clearly define those time-area closures to minimize incidental acoustic and marine noise (vibracore) impacts on the important life stages of shark, migratory pelagics, and other species. For ESA-listed species such as the shortnose sturgeon and the Atlantic salmon, which are rarely present in the Study Area, potential impacts are expected to be negligible. The Atlantic sturgeon and smalltooth sawfish are more commonly present in the Study Area; therefore, potential impacts are expected to be minor.

Vessel Presence/Traffic

Under this alternative, there is potential for additional vessel mobilizations for site-specific investigations. While there could be additional vessel presence and traffic as a result, the subsequent mobilizations would occur at a later point in time and therefore the potential impact would not be additive; therefore, impacts from implementing Alternative B would be slightly greater than those discussed for Alternative A. The impacts on pelagic, demersal, and highly migratory fish resources, ESA-listed species, and associated EFH are considered to be negligible.

Vessel Waste and Accidental Discharges

Under this alternative, additional mobilizations could be necessary. With additional mobilizations comes the risk of additional marine trash and debris being lost in the environment. However, the impact on pelagic, demersal, and highly migratory fish resources and associated EFH is still considered negligible. The impacts on ESA-listed shortnose sturgeon and Atlantic salmon are still considered negligible, and impacts on ESA-listed Atlantic sturgeon and smalltooth sawfish are still considered minor.

Under this alternative, additional mobilizations could be necessary. With additional mobilizations comes the risk of additional accidental fuel spills, although still unexpected. The impact on pelagic, demersal, and highly migratory fish resources and associated EFH is considered minor. Impacts on ESA-listed shortnose sturgeon and Atlantic salmon would be considered negligible, whereas impacts on ESA-listed Atlantic sturgeon and smalltooth sawfish would be considered minor.

Seafloor Disturbance

Under this alternative, additional restrictions would be included. No bottom anchoring would be permitted during geological surveys, except in the case of emergency. This provides for a more deliberate assessment of sand resources and provides additional protections for sensitive bottom resources. Seafloor-disturbing activities would be more limited than in the proposed action. Geological sampling would not occur in spawning and nursery HAPC during sensitive windows under this alternative, incrementally reducing indirect effects on demersal fish from seafloor disturbance. Overall, impacts on pelagic, demersal hard and soft bottom, and highly migratory fish resources, as well as ESA-listed species, and associated EFH as a result of seafloor disturbance would be negligible.

3.4.2.3. Alternative C: No Action Alternative

Under the No Action Alternative, the proposed action would not occur and a comprehensive inventory of sand resources within the Atlantic OCS would not be conducted. Therefore, there would be no impacts on pelagic, demersal, and highly migratory fish resources and associated EFH.

3.5. Benthic Habitat and Communities

3.5.1. Affected Environment

Introduction. Benthic communities refer to both substrate (habitat) and organisms that occupy that substrate. Benthic habitats support a wide diversity of marine life by providing spawning, nursery, refuge, and foraging grounds for fish species. They help to cycle nutrients and contribute to the removal of contaminants from the water column. Benthic organisms are also important members of the lower food web, consuming organic matter and phytoplankton, and serving as food sources for higher level consumers (NOAA 2012).

Epibenthic organisms are those who live on the seafloor bottom or on firm surfaces, and include organisms in the Study Area such as mussels, barnacles, shrimp species, crab species, and lobsters. Infauna, those benthic organisms that reside within the sediments, include polychaete worms, clams, and crustaceans.

Soft sediments on the OCS are dynamic habitats, not just mixtures of different grain-sized mineral particles. Seafloor sediments contain varying amounts of organic matter depending on grain size and oceanographic conditions. A single square meter of ocean bottom sediment supports thousands of invertebrates, bacteria, and protozoa.

The abundance and species composition of benthic communities are affected by a number of environmental factors, including temperature, sediment type, sediment stability/rate of disturbance, and the availability of organic matter (Stevenson et al., 2004). A sand-shell mixture is characteristic of the OCS. The benthic communities of the OCS are diverse, and organism density tends to decrease with decreasing grain size. Density and biomass of macrofauna are greater in finer shelf sediments found on the outer shelf compared to the coarser sediments found on the inner shelf (Boesch 1979). Coarse-grained sediment (e.g., pebble-sized or larger grains) would be avoided during geophysical and geological surveys because these sediments would not be targeted for sand resource borrow areas. More stable, fine-grained sediments within swale areas support large burrowers and surface tube-dwellers that use surface and subsurface deposits for food. Dominant species include the polychaetes *Notomastus latericuns* and *Typosyllis tegula*, the bivalve *Cyclocardia borealis*, and peracaridea (amphipod crustaceans) such as *Ampelisca agassiz* (Wigley and Theroux 1981).

The OCS is dominated by deposit-feeding polychaetes, bivalves, and echinoderms. Boesch (1979) found that small polychaetes, peracarid crustaceans, mollusks, and echinoid and ophiuroid echinoderms were the dominant macrofauna along the MAB shelf. Numerically dominant taxonomic groups in shallow habitats of the Atlantic region include Bivalvia, Crustacea, Annelida, Echinoidea, Sipunculidae, Echiura, and Holothuroidea. In terms of biomass, the leading groups include Crustacea, Bivalvia, Annelida, Echinoidea, Ophiuridea, Holothuroidea, and the bathyal assemblages (BOEM 2007).

Benthic Habitats within the Study Area. The Study Area can be distinguished by geographic features within the North Atlantic, Mid-Atlantic, and South Atlantic-Straits of Florida Planning Areas (see Figure 1-1). Benthic environments within the North Atlantic portion of the Study Area include the Gulf of Maine and the New York Bight. The Gulf of Maine covers a broad area between Cape Cod, Massachusetts, and beyond the Study Area into southwestern Nova Scotia. The New York Bight is defined as the water body between Cape May, New Jersey, and Montauk Point, Long Island, New York. A portion of the MAB is also contained within the North Atlantic Planning Area. The MAB consists of the continental shelf between Georges Bank (a southeasterly bulge in the shelf off of Cape Cod, Massachusetts) and Cape Hatteras, North Carolina. Forty percent of the surveys to be conducted would occur within the North Atlantic portion of the Study Area. See Table 3-4 for the geographic features associated with the Study Area.

Only one comprehensive sampling program (1956 through 1965) has been conducted to gather information on broad-scale distribution patterns for benthic resources throughout the northeastern continental shelf (NOAA 2011). This survey found that mollusks (particularly clams and scallops) and echinoderms (including starfish, brittle stars, sand dollars, sea urchins, and sea cucumbers) compose the majority of the benthic invertebrate biomass throughout the continental shelf. The MAB contained the greatest benthic invertebrate biomass, which was dominated by mollusks with highest levels observed in the Southern New England-New York Bight regions. Relatively low biomass was found in the Gulf of Maine and Chesapeake Bight regions. Typically, reduced benthic biomass is associated with increased depth, which is attributed to a decrease in available food supply.

In contrast, annelids (marine worms) and small crustaceans (amphipods) were numerically dominant on the shelf. The highest concentrations of arthropods were found from Georges Bank to the New York Bight. Annelids generally declined from north to south, and echinoderms were most abundant on Georges Bank and off southern New England.

Hard bottom habitats are sparsely distributed over the MAB shelf and are composed of bare rock, gravel, shell hash, and artificial reefs (Steimle and Zetlin 2000). In contrast, there are extensive areas of hard/live bottom on the South Atlantic Bight (SAB) shelf (Van Dolah et al., 1994). In other areas where the presence of deepwater corals is known but the distribution of coral sites is not well documented, broad areas have been designated as HAPCs by the South Atlantic Fishery Management Council (SAFMC) to protect these communities from physical damage by fishing gear. Although the SAFMC does not regulate activities unrelated to fishing, the designation highlights the ecological importance of these areas and their sensitivity to seafloor-disturbing activities. Hard bottom habitats would not contain the sand resources of interest and therefore will not be discussed in detail.

Surveys on benthic resources in the North Atlantic portion of the Study Area conducted in the 1970s and 1980s yielded 1,250 taxa, with polychaete worms most numerous (45% of the total), followed by crustaceans (23%), bivalves (12%), and gastropods (11%) (USGS 1998). A 1995 study of benthic resources offshore New Jersey found similar results of species abundance, with annelids accounting for more than 35% of all animals collected (Burlas et al., 2001). Shifts in species distribution can occur seasonally or over time in general, due to life history patterns of species, changes in water temperature, storm frequency and intensity, volume and timing of coastal sediment inputs from rivers and streams, reproductive periodicity, and effects from climate change such as acidification of ocean waters (Byrnes et al., 2004).

Benthic environments within the Mid-Atlantic portion of the Study Area include the MAB, which also extends into the North Atlantic Planning Area (see discussion above). In addition to the MAB, the SAB extends from Cape Hatteras, North Carolina, to West Palm Beach, Florida, and therefore is within portions of both the Mid-Atlantic and South Atlantic-Straits of Florida Planning Areas. Characterizations of benthic community composition and diversity are available for these areas (e.g., Byrnes et al., 2003; Byrnes et al., 2004; Cutter et al., 2000; Hammer et al., 2009; Kaplan et al., 2012; Michel, ed. 2013; Slacum et al. 2006; Zarillo et al., 2009)

Threatened and Endangered Species. Two species of coral, elkhorn coral (*Acropora palmata*) and staghorn coral (*Acropora cericornis*), are listed as threatened under the ESA. Elkhorn coral can be found as far north as Broward County, Florida, which is in the southern extent of the Study Area. It is most commonly found in depths of 3–16 feet (1–5 m), but can also be found in water depths up to 98 feet (30 m) (Federal Register 2006). The staghorn coral can be found as far north as off Palm Beach County, Florida, which is in the southern extent of the Study Area. It is most often in depths of 16–65 feet (5–20 m), but can occasionally be found in water depths up to 197 feet (60 m) in depth (Federal Register 2006).

Critical habitat has been designated for both coral species and includes an area in Florida (see Figure 3-3) (Federal Register 2008a). In December 2012, NMFS proposed reclassifying the elkhorn and staghorn corals as endangered, but a decision is pending. In addition to the listed species, there are a number of coral species proposed for listing. NFMS is proposing to list five additional Atlantic/Caribbean species as endangered and two as threatened, but no decision on listing has been made (Federal Register 2012c).

Table 3-4. Summary of Benthic Species and Trends within the Study Area

Planning Area	Geographic Feature	Feature Location	Benthic Species/Trends
North Atlantic	Gulf of Maine	Cape Cod, MA to offshore Maine[1]	Relatively low biomass
	New York Bight	Cape May, NJ, and Montauk Point, Long Island, NY	Dominant species: Lady crab (*Ovalipes ocellatus*), rock crab (*Cancer irroratus*), American lobster (*Homarus americanus*), northern quahog (*Mercenaria mercenaria*), and blue crab (*Callinectes sapidus*). Highest concentrations of arthropods Highest abundance of echinoderms Density of benthic organisms is approximately 50 to 200 grams per square meter on the shelf.
	Mid-Atlantic Bight	Georges Bank to Cape Hatteras, NC	Greatest benthic invertebrate biomass. Common species include polychaetes, bivalves, and amphipods. Density of benthic organisms decreases markedly from north to south and from shallow to deep water (13–10,102 feet [4–3,080 m]).
Mid-Atlantic	Mid-Atlantic Bight	Georges Bank to Cape Hatteras, NC	Greatest benthic invertebrate biomass. Common species include polychaetes, bivalves, and amphipods. Density of benthic organisms decreases markedly from north to south and from shallow to deep water (13–10,102 feet [4–3,080 m]).
	South Atlantic Bight	Cape Hatteras, NC, to West Palm Beach, FL	High species diversity but low densities because of unstable sediments, wide temperature fluctuations, and low nutrient and organic carbon inputs.
South Atlantic-Straits of Florida	South Atlantic Bight	Cape Hatteras, NC, to West Palm Beach, FL	High species diversity but low densities because of unstable sediments, wide temperature fluctuations, and low nutrient and organic carbon inputs.
	Straits of Florida	West Palm Beach, FL to Miami, FL[2]	Polychaete worms (47%–51%), crustaceans (28%–29%), and mollusks (10%–17%).

Notes:
1. The Gulf of Maine in this Study Area is truncated to the north to offshore Maine.
2. The Straits of Florida Planning Area within this Study Area is truncated to the south to Miami, Florida.

Sources:

BOEM 2007, Boesch 1979, Tenore 1985, Steimle and Zetlin 2000, Schaffner and Boesch 1982, Brooks et al. 2006, Normandeau Associates 2007, Woodward-Clyde Consultants and CSA 1987

Threats to the various coral species include ocean warming, disease, acidification, and sedimentation. Areas supporting coral would generally be avoided because these areas would not contain the sand resources of interest, and therefore proposed G&G survey activities are not expected to occur in close proximity. In areas adjacent to reef or hard bottom communities, all sensitive habitat would be identified in advance using geophysical survey data and subsequently avoided by at least 164 feet (50 m). Because of this conservative approach, no direct effects are expected to coral species from seafloor disturbance, the principal impacting factor. Any potential for noise-related or discharge-related impacts are very limited and are discussed in the effects analysis.

3.5.1. Environmental Consequences

3.5.1.1. Alternative A: Proposed Action

Implementation of the proposed action would result in short-term, negligible, direct and indirect impacts on benthic resources, primarily through seafloor disturbance. Under the proposed action, seafloor disturbance would occur due to geologic sampling or anchoring.

Noise from Active Sound Sources and Vessel Operations

The impacts on benthic communities from geophysical surveys are not well documented, and there are no known systematic studies of the effects of sonar sound on invertebrates. Most marine invertebrates do not have sensory organs that can perceive sound pressure, but many have tactile hairs or sensory organs that are sensitive to water disturbances. The limited available data assessing physiological effects or biochemical responses of marine invertebrates to acoustic noise do not indicate serious pathological or physiological effects (LGL, 2011). Based on results of studies of invertebrate communities following acoustic exposure, only limited impacts on benthic organisms would be expected to be detectable, especially given the short duration of sound exposure, and no overall changes in species composition, community structure, and/or ecological functioning benthic communities are expected. Therefore, impacts on benthic communities from G&G surveys would be negligible.

Vessel Waste and Accidental Discharges

Typical vessel discharges, including bilge water and treated waste, are not expected to impact benthic, hard bottom, or coral communities because the discharge volume would be very small and immediately diluted in the water column. Because a survey vessel could be at a location for several weeks, there is the potential for accidental releases of trash, debris, and fuel or other vessel fluids. Much of this material would float, and would therefore have no effect on bottom habitat. The effects of debris lost overboard in the U.S. Gulf of Mexico have been addressed by several authors, and the elapsed time is the most important factor determining habitat recovery (Shinn et al., 1989, 1993; Dustan et al., 1991; Shinn and Lidz 1992). These assessments have evaluated operations in variable water depths (i.e., 69-489 feet (21-149 m), over different substrates, and at variable times. The loss of debris results in minimal impacts on the benthic environment. In areas of extensive soft bottom, the debris that sinks has provided artificial hard substrate and produced epifaunal colonization and attracted fishes.

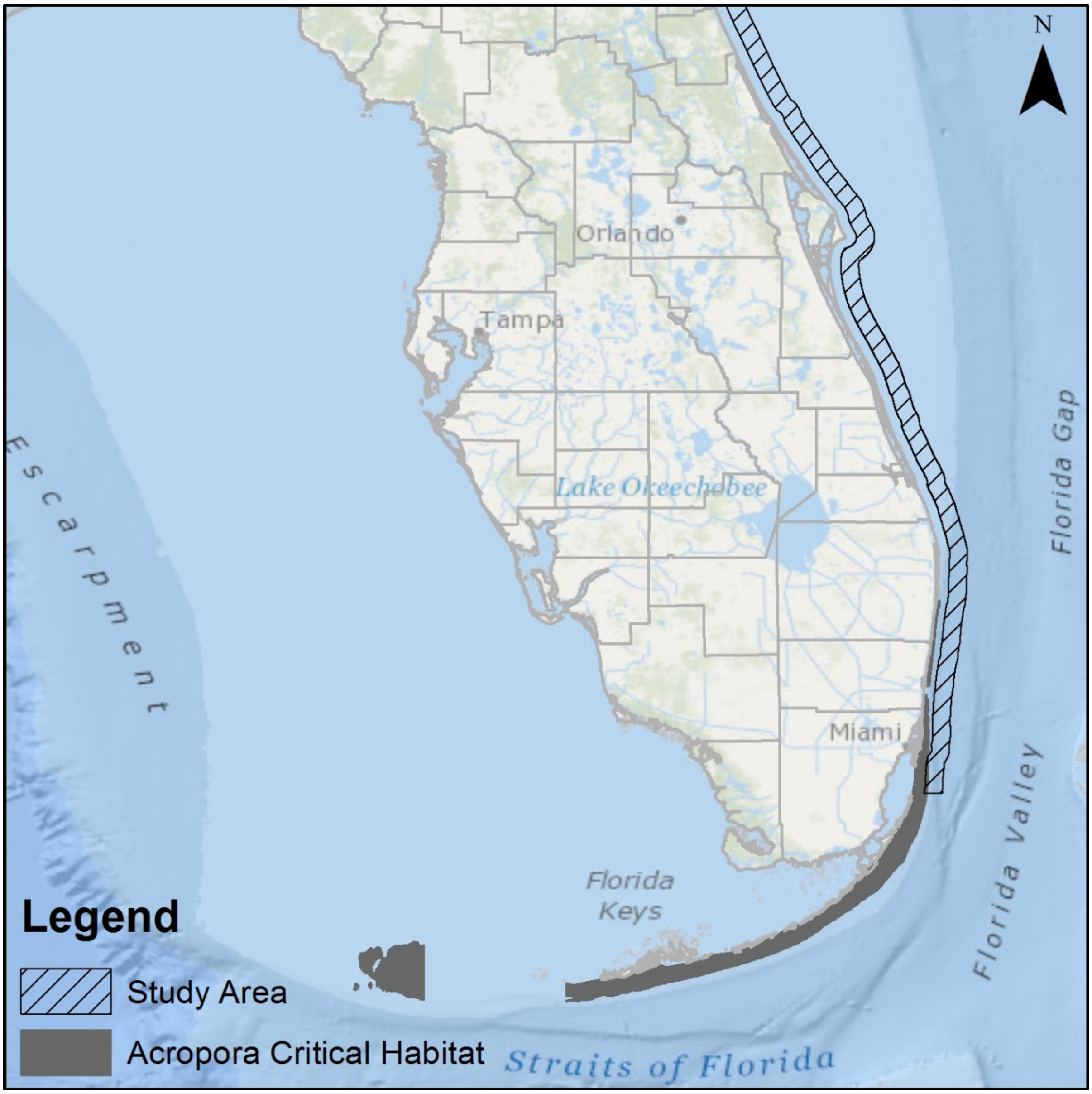


Figure 3-3. Location of Critical Habitat for Elkhorn and Staghorn Corals in Florida

Sinking marine debris could have long-term, adverse impacts on benthic resources by altering substrate composition, interfering with dissolved gas exchange between sediment pore waters, and releasing heavy metals and other toxic substances into the water. This debris can directly damage benthic habitats and organisms, and tends to be deposited in areas containing crevices, overhangs, or changes in relief (Bauer et al., 2008). However, because operators must comply with marine debris requirements and applicable regulatory requirements, the amount of trash and debris dumped offshore would be minimal because only accidental loss of trash and debris is anticipated, some of which could sink to the seafloor. Therefore, impacts from trash and debris on benthic communities would be negligible.

Under a marine pollution control plan, survey operators must be able to rapidly contain any accidental spill. Accidental leaks and spills from vessels could be comprised of less dense liquid that would float on the water surface, which would limit any impacts on benthic communities. If higher density liquids are accidentally leaked or spilled from vessels, water quality could degrade temporarily. Degraded water quality can affect not only the size and diversity of a community, but also the biomass of individuals. Biomass of macrobenthic organisms is important because it is related to the capacity of the individual to be food for predatory fish and other resource species. Petroleum hydrocarbons that remain within sediments and bottom waters could inhibit or limit some organisms, such as pericarid crustaceans or corals. Reduction of some species would potentially lead to population expansions of other tolerant or opportunistic species, such as certain mollusks and polychaetes (Steimle 1984). Contamination of benthic invertebrates could also affect higher food chain organisms. However, given the relatively small size of any anticipated spill and the loss of most spilled fuel through evaporation and dispersion, a small diesel fuel spill at the surface would be expected to have negligible effects on benthic communities.

Seafloor Disturbance

Direct mortality of benthic organisms could occur in areas of seafloor disturbance, such as during geologic sampling or anchoring. However, the disturbed areas would be small and sampling would be spaced out so that impacts on benthic communities would be limited. Collection of each sample is estimated to disturb an area of approximately 1 to 9 square feet (0.09 to 0.84 square m), although the actual area of the vibracore or grab sample extracted could be much smaller. The maximum total area disturbed by vibracore or grab sampling is expected to be about 0.01 to 0.1 acres. Additionally, it is anticipated that vessels would employ dynamic positioning, thereby greatly reducing, or eliminating, the need for anchoring. Effects on benthos from seafloor disturbance would be greatest among species with low mobility or those that are sessile, which include echinoderms. Forty percent of the work would be conducted offshore of New Jersey and New York, where abundance of organisms, including echinoderms, is relatively high.

As discussed in Section 2.2.7, BOEM will generally avoid anchoring, geological sampling, and any other seafloor-disturbing activities in the vicinity of sensitive benthic habitat and associated communities, including hard bottom, rippled scour depressions, cobbled seafloor, reef tract, and HAPCs. It is also unlikely that the surveys would affect these habitats because they are not in areas where there are sand-rich deposits. Any seafloor-disturbing activities in these areas would avoid these habitats and general bottom impacts by either 1) using a dynamically positioned vessel or live boating methodology to support geological sampling and/or 2) requiring site-specific geophysical data in advance of sampling to map and otherwise avoid benthic resources. All sensitive benthic habitats must be avoided by at least 164 feet (50 m) during vibracoring or other bottom-sampling activities and by 328 feet (100 m) if anchoring must occur. Although several hundred cores may be collected, sampling in soft-bottom areas would produce only localized and temporary impacts on benthos.

Seafloor disturbance could result in very localized and short-term sediment resuspension, some of which could extend beyond the footprint of the bottom sampling, leading to short-term, indirect effects that could impact the benthic community due to differential susceptibility of fauna to temporarily bury a limited number of adults/recruits (Miller et al., 2002) and/or temporarily prevent effective suspension feeding (Rhoads and Young 1970). Any change in the resident benthic community could have indirect impacts on higher trophic levels that depend upon benthos composition for its resource value (Kenny and Rees 1996). However, the potential for these effects would be minimal, due to the very small area of disturbance to the seafloor. Potential impacts on soft bottom benthic communities from seafloor disturbance under this alternative would not be detectable and therefore would be negligible.

Hard-bottom areas, including coral reefs, artificial reefs, and shipwrecks, would be avoided to protect these resources and also because sand resources would not be present/extractable in these areas. Therefore, no ESA-listed or unlisted corals or other hard/live bottoms are likely to be impacted and the proposed action would have no direct effect on hard bottom or associated communities.

3.5.1.2. Alternative B: Additional Operational Restrictions and Time-Area Closures

Impacts on benthic resources from implementing Alternative B would be similar to those described for Alternative A. The number of geological samples anticipated to occur under Alternative B would be the same as, those for the proposed action, and therefore the area of seafloor disturbance would be essentially the same. If multiple mobilizations to the same area are required under this alternative, it is possible that increased impacts on benthic resources could occur from accidental releases of trash, debris, and fuel or other vessel fluids. Even though there are seasonal differences in composition and productivity of benthic communities, implementation of additional time-area closures to protect fish spawning and nursery areas would not be anticipated to substantially alter impacts on benthic resources and communities, given the relatively limited number and small footprint of bottom-disturbing activities when compared to the proposed action.

3.5.1.3. Alternative C: No Action Alternative

Under the No Action Alternative, the proposed action would not occur and a comprehensive inventory of sand resources within the Atlantic OCS would not be conducted. No seafloor-disturbing activities would be conducted. Therefore, no impacts on benthic resources would occur as a result of implementing the no action alternative.

3.6. Sea Turtles

3.6.1. Affected Environment

Five sea turtle species occur in the Study Area (Table 3-5): loggerhead (*Caretta caretta*), green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), Kemp's ridley (*Lepidochelys kempii*), and leatherback (*Dermochelys coriacea*). The leatherback is classified under Family Dermochelyidae, whereas the other four are in Family Cheloniidae. Loggerhead, leatherback, and green sea turtles are more commonly found either within or adjacent to the Study Area at certain time periods (i.e., nesting season) and life stages. Less common are Kemp's ridley, and particularly hawksbill sea turtles, within the Study Area. Green, leatherback, and loggerhead sea turtles use coastal beaches adjacent to the Study Area as primary nesting sites, with the main nesting beaches in southeastern Florida. However, loggerhead sea turtles also nest along the southeastern coast as far north as Virginia.

All sea turtles are protected under Section 7 of the ESA. Because sea turtles use terrestrial and marine environments at different life stages, FWS and NMFS share jurisdiction over sea turtles under the ESA. The FWS has jurisdiction over nesting beaches, and NMFS has jurisdiction in the marine environment. The Northwest Atlantic population of the loggerhead sea turtle is currently classified as threatened. The green sea turtle is listed as threatened, except for the Florida breeding population, which is endangered. The hawksbill, Kemp's ridley, and leatherback sea turtles are listed under the ESA as endangered.

The FWS and NMFS have designated critical habitat for the green, hawksbill, and leatherback sea turtles (Table 3-5), but there is no critical habitat within or adjacent to the Study Area. On February 17, 2010, FWS and NMFS were jointly petitioned to designate critical habitat for Kemp's ridley sea turtles for nesting beaches along the Texas coast and marine habitats in the Gulf of Mexico and Atlantic Ocean. The FWS and NMFS are currently reviewing the petition. Both FWS and NMFS are proposing critical habitat for the Northwest Atlantic Ocean loggerhead sea turtle DPS within the Atlantic Ocean and the Gulf of Mexico. Specific areas proposed for designation include 36 occupied marine areas within the range of the Northwest Atlantic Ocean DPS. These areas contain one or a combination of nearshore reproductive habitat, winter area, breeding areas, and migratory corridors.

Important marine habitats for sea turtles adjacent to the Study Area include nesting beaches, estuaries and embayments, nearshore hard substrate areas, and the Gulf Stream. Exposed hard substrate in shallow, nearshore areas off eastern Florida provides important foraging and developmental habitats for cheloniid sea turtles, particularly juveniles and subadults (CSA International 2009). The Gulf Stream is a key oceanographic feature that is used by sea turtles for various purposes, such as migration (Hoffman and Fritts 1982). *Sargassum* mats that form in convergence zones associated with the Gulf Stream provide shelter and foraging habitat for hatchling and post-hatchling sea turtles (Carr and Meylan 1980; SAFMC 2002).

Adjacent to the Study Area, sea turtle nesting occurs on sandy beaches from along the Delmarva Peninsula south to Florida. The distribution and densities of sea turtle nests from individual counties adjacent to the Study Area during the 2010 nesting season are shown in Tables 3-6 and 3-7. Most sea turtle species travel through and adjacent to the Study Area, either seasonally or between nesting activities.

Table 3-5. Sea Turtles Nesting Adjacent to the Study Area

Scientific Name	Common Name	Status[1]	Occurrence	Life Stage	Primary Nesting Sites	States with Nesting Reported
Caretta caretta	Loggerhead sea turtle	T[2]	MD–FL	All	Florida beaches: Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward Counties	MD, VA, NC, SC, GA, FL
Chelonia mydas	Green sea turtle	E, T[3]	DE–FL	All	Florida beaches: Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward Counties	NC, SC, GA, FL
Eretmochelys imbricata	Hawksbill sea turtle	E	DE–FL (uncommon north of FL)	All	Mexican beaches: Yucatán Peninsula; Caribbean Beaches: Puerto Rico (Culebra, Mona, and Vieques Islands), Barbados	--
Lepidochelys kempii	Kemp's ridley sea turtle	E	DE–FL	Juveniles and Adults	Mexican beaches: Tamaulipas and Veracruz	NC, SC, FL
Dermochelys coriacea	Leatherback sea turtle	E	DE–FL	All	Florida beaches (southeast coast)	NC, SC, GA, FL

Key:

[1]. Status: E = endangered (E); T = threatened.

[2] The loggerhead sea turtle is currently classified as threatened throughout its range. In March 2010, NMFS and FWS proposed to list the Northwest Atlantic Ocean population of loggerhead sea turtles as endangered (Federal Register, 2010).

[3] The green sea turtle is threatened, except for the Florida breeding population, which is endangered (NMFS, 2011g).

Sea turtles may move seasonally into foraging habitats through migration corridors and to nesting beaches (Mansfield et al., 2009; Hawkes et al., 2011). The size of "resident" foraging habitats appears to vary by species and location. Studies suggest that resident foraging area size in the western North Atlantic decreases from north to south, possibly because of available food resources and the width of the continental shelf, which also narrows from north to south (Griffin 2002).

Estuaries, such as the Chesapeake and Delaware bays and the Long Island Sound, provide important foraging and developmental habitat for sea turtles (Musick 1988; Coles 1999; Musick and Limpus 1997). Coles (1999) explained that sea turtles use the Chesapeake Bay as feeding areas when water temperatures approach 20 degree Celsius (°C) and leave when it drops below 20 °C. The Chesapeake Bay becomes the summer home primarily to juvenile loggerhead, Kemp's ridley, and leatherback sea turtles, but hawksbill and green sea turtles could feed there as well. Loggerheads are the most abundant of the sea turtles, with between 3,000 and 10,000 individuals observed in a summer, feeding in deeper waters on benthic invertebrates such as horseshoe crabs. Kemp's ridley sea turtles are typically in the shallower waters around the edges of the Bay, foraging on blue crabs. Leatherback sea turtles are less abundant, but typically feed on the scup and jellyfish of the Bay. Samuel et al. (2005) described primarily juvenile loggerheads, Kemp's ridley, and green sea turtles that forage in the Peconic Bay Estuary system in Long Island Sound from July through October.

Table 3-6. 2010 Sea Turtle Nesting Reported for Maryland through Georgia, by County

State	County	Total Nests
Maryland	Worcester	1
Virginia	Accomack	10
	Virginia Beach	16
North Carolina	Currituck	9
	Dare	164
	Carteret	212
	Onslow	151
	New Hanover	92
	Brunswick	234
South Carolina	Horry	42
	Georgetown	276
	Charleston	2,074
	Colleton	241
	Beaufort	547
Georgia	Liberty	153
	Chatham	409
	McIntosh	472
	Glynn	203
	Camden	540

Source: seaturtle.org, 2010

Loggerhead Sea Turtle

Range and Spatial Distribution. Loggerhead sea turtles are likely to be the most common sea turtle species in the Study Area. The loggerhead is a large cheloniid sea turtle, with adults reaching up to 1.1 m (3.5 feet) in carapace length and 181 kg (400 lb) in mass. It is a circumglobal species that is found from tropical to temperate regions. In the Atlantic Ocean, the loggerhead sea turtle is reported from Newfoundland, the Caribbean Sea, the Gulf of Mexico, and along the east coast of the U.S. Loggerhead sea turtles, like other sea turtles, are highly migratory, making various seasonal and annual migrations (Godley et al., 2003). Moncada et al. (2010) reported that it is common for loggerhead sea turtles to make extended transoceanic journeys and then later return to specific nesting beaches.

Table 3-7. 2012 Sea Turtle Nesting Reported for Florida, by County

County	Total Nests
Nassau	219
Duval	193
St Johns	707
Flagler	627
Volusia	3,197
Brevard	38,315
Indian River	7,477
St Lucie	6,331
Martin	12,090
Palm Beach	25,099
Broward	3,539
Miami-Dade	515

Source: Florida Fish and Wildlife Conservation Commission 2013

Overall, the population structure of the loggerhead sea turtle (much like other sea turtle species) is complex and challenging to evaluate (Bolten and Witherington 2003). There are nine significant populations of loggerhead sea turtles (DPSs) (Conant et al., 2009). The Northwest Atlantic Ocean population segment occurs in an area bounded by 60º N latitude to the north and the equator to the south, with 40º W longitude as the eastern boundary. The NMFS has also identified four recovery units with the Northwest Atlantic DPS (NMFS and FWS, 2008) (Figure 3-4). Two of these recovery units are within the Study Area: the Northern Recovery Unit (NRU), extending from the Florida-Georgia border through southern Virginia (the northern extent of the nesting range), and the Peninsular Florida Recovery Unit (PFRU), extending south from the Georgia-Florida border through Pinellas County on the west coast of Florida, excluding the islands west of Key West, Florida. Roughly one-third of NRU turtles are distributed on the wide continental shelf off South Carolina and Georgia where they occupy year-round home ranges of approximately 77-154 square miles (200-400 square kilometers). The remaining two-thirds of the NRU occupies a seasonal range that extends as far north and east as the continental shelf edge off New Jersey during summer months and retracts southwards to a narrow area of continental shelf off North Carolina and South Carolina during winter months (Hawkes et al., 2011).

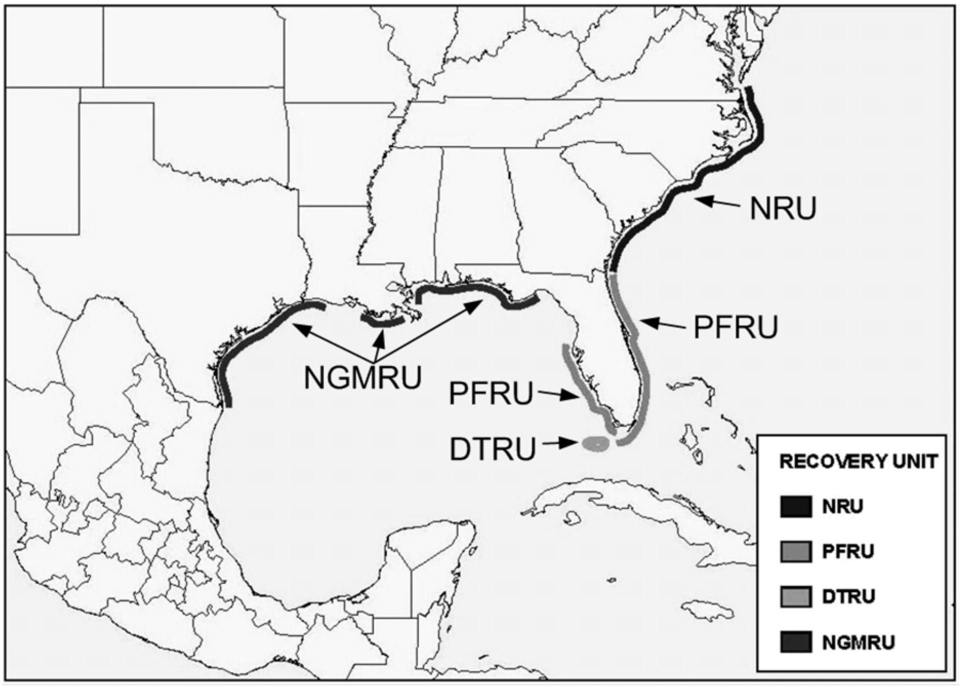


Figure 3-4. Location of the Four Recovery Units for the Loggerhead Sea Turtle in the U.S.

Note: NRU = Northern Recovery Unit, PFRU = Peninsular Florida Recovery Unit, DTRU = Dry Tortugas Recovery Unit, NGMRU = Northern Gulf of Mexico Recovery Unit. Source: NMFS and FWS 2008.

Inner shelf waters off Virginia and North Carolina provide important seasonal habitat for this species, especially waters near Cape Hatteras, North Carolina, which act as a seasonal "migratory bottleneck" (Mansfield et al., 2009). Turtles within the much larger PFRU travel outside of western Atlantic waters into the Gulf of Mexico and into waters outside of the U.S. EEZ (e.g., Mexico and Cuba) (Hawkes et al., 2011). Based on nesting information, loggerhead sea turtle nests are primarily located in four of the seven states adjacent to the Study Area: Florida (91 percent), South Carolina (6.5 percent), Georgia (1.5 percent), and North Carolina (1 percent).

Ecology and Life History. Loggerhead sea turtles use three different types of marine habitats throughout their life: terrestrial (beaches), neritic (nearshore waters), and oceanic (open ocean) (NMFS and FWS 2008). Most of our knowledge on loggerhead sea turtle biology is inferred from nesting and when they are found in coastal and nearshore waters. Loggerhead sea turtles are carnivores, feeding primarily on mollusks and crustaceans (NMFS and FWS 2008). Loggerhead sea turtle nesting is from April to September, with peak nesting occurring in June and July (Weishampel et al., 2006); females nest every 2.5-3.7 years. Age at sexual maturity is late in life, at around 35 years of age; average clutch size is between 100 and 126 eggs, and incubation is between 42 and 75 days. The mean number of clutches per laying female is 3-5.5 per breeding season, with inter-nesting intervals ranging from 12–15 days (NMFS and FWS 2008). The life span of the loggerhead sea turtle is 57 years or more.

Immediately after loggerhead sea turtle hatchlings emerge from the nest, they actively swim offshore into oceanic areas of local convergence zones and major gyre systems, often characterized by accumulations of floating *Sargassum*. The duration of this oceanic post-hatchling-juvenile stage is variable, but generally ranges between 7 and 12 years (Bolten and

Witherington 2003). Afterward, oceanic juveniles actively migrate to nearshore (neritic) developmental habitats. Some neritic juveniles make seasonal foraging migrations into temperate latitudes as far north as New York. Most juveniles are south of Cape Hatteras, North Carolina, by January (Musick and Limpus 1997). Neritic juvenile loggerhead sea turtles are likely to occupy shallow water developmental habitats (Musick and Limpus 1997).

Information about daily movement and dive behaviors of loggerheads in the open ocean is limited, but new technology has allowed researchers to study this type of behavior in the turtles' natural environment (Sobin 2008). Based on the research, Polovina et al. (2003) found that there were diurnal and species differences in dive profiles and that all the turtles spent more time at the surface and dove deeper during the day than at night. Loggerhead sea turtles spent 40 percent of their time at or near the surface and at less than 328-foot (100-m) depths; most (70 percent) of the dives were no deeper than 16.4 feet (5 m). In southwestern Florida, Sobin (2008) reported that loggerhead sea turtles spent more time near the surface in the morning than in the evening. Overall, surface and dive times are highly variable depending on geographic region, habitat, and other oceanographic factors.

Population Status. Estimating sea turtle populations is challenging given the lack of information for many of the life history parameters needed to model populations (e.g., hatchling survival rates and adult natural and anthropogenic mortality rates), but estimates are based on the number of annual nests at different locations within a region, anthropogenic threats, and mortality estimates (Conant et al., 2009). Results for nine specific areas within the Northwest Atlantic (in-water assessment) showed that there were five time series without a distinct population trend (i.e., increasing or decreasing), two with an increasing trend, and three with a decreasing trend (NMFS and FWS 2008).

The southeastern U.S. coast is among the most important areas in the world for loggerhead nesting, and the PFRU along southeastern Florida coast is the most important area (Figure 3-5). The NMFS and FWS (2008) report that about 80 percent of loggerhead nesting in this region occurs in six Florida counties: Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward, all adjacent to the Study Area. Within this region, there is a 20-mile (32.2-km) section of coastline from Melbourne Beach to Wabasso Beach that comprises the Archie Carr National Wildlife Refuge (NWR), which has been identified as the most important nesting area for loggerhead sea turtles in the western hemisphere (NMFS and FWS 2008). The Archie Carr NWR is critical to the recovery and survival of loggerhead sea turtles; it has been estimated that 25 percent of all loggerhead nesting in the U.S. occurs in the Archie Carr NWR, with nesting densities estimated at 1,000 nests per mile (625 nests per km). Other important nesting locations occur in South Carolina (6.5 percent), Georgia (1.5 percent), North Carolina (1 percent), and Virginia (less than 1 percent), but not at the same magnitude as in Florida (NMFS and FWS 2008).

Similar to most sea turtle populations, the loggerhead sea turtle is severely depleted; however, the population is probably the most stable of any sea turtle. To date, projections indicated that the Northwest Atlantic loggerhead sea turtle population was slightly declining but expected to recover in the next 50–150 years (NMFS and FWS 2008). Even so, the population is still at risk of extinction given the current continuing threats (Conant et al., 2009).

Conservation and Management. Both FWS and NMFS have proposed critical habitat for the Northwest Atlantic Ocean loggerhead sea turtle DPS within the Atlantic Ocean and the Gulf of Mexico. Specific areas proposed for designation include 36 occupied marine areas within the range of the Northwest Atlantic Ocean DPS. These areas contain one or a combination of nearshore reproductive habitat, winter area, breeding areas, and migratory corridors.

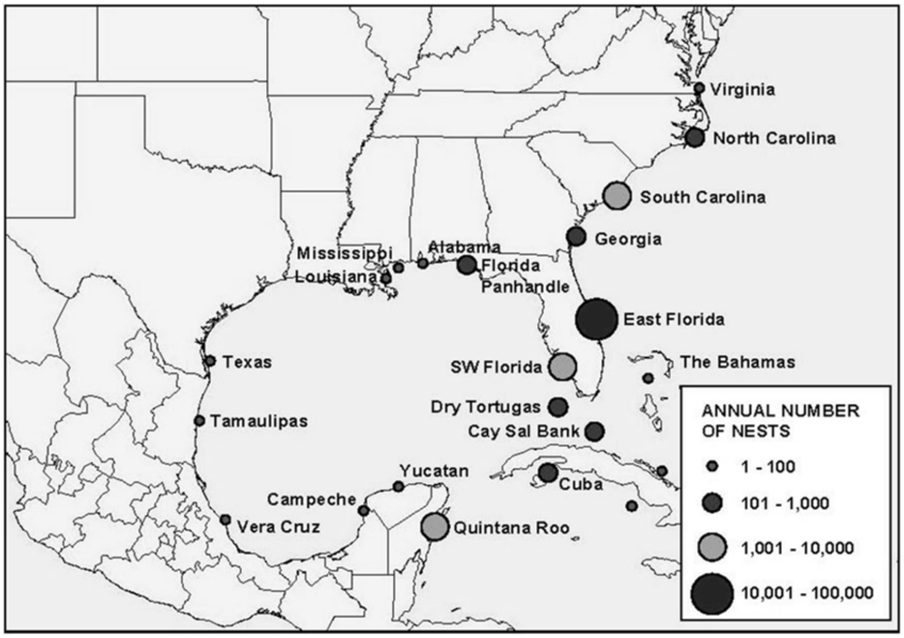


Figure 3-5. 2001-2008 Estimated Annual Number of Loggerhead Nests in the Southeastern U.S., Bahamas, Cuba, and Mexico.

Source: NMFS and FWS 2008.

Green Sea Turtle

Range and Spatial Distribution. The green sea turtle is the largest cheloniid sea turtle; adults can reach 3 feet (0.91 m) in carapace length and range between 300 and 350 lbs (136 and 159 kg) in mass. The green sea turtle is a circumglobal species found in the Mediterranean Sea and the Pacific, Indian, and Atlantic Oceans (NMFS and FWS 2007a). The green sea turtle can be found in tropical and subtropical waters between 30° N and 30° S latitude, and, to a lesser extent, in temperate waters (NMFS and FWS 2007a). Satellite tagging data indicate that, similar to other sea turtles, green sea turtles display highly migratory behavior, making vast seasonal coastal and annual transoceanic migrations (Godley et al., 2003, 2008, 2010). In the western North Atlantic, green sea turtles can be found on various coastal beaches during the nesting season and at other times feeding or swimming along nearshore or offshore waters from Florida to Massachusetts (NMFS and FWS 2007a). Green sea turtles are vulnerable to cold temperatures, so they are found only during the summer months in many locations within the Study Area (Foley et al., 2007). Based on satellite tagging research by Hart and Fujisaki (2010), green sea turtles display daily and seasonal movement patterns that are associated with foraging strategies. The researchers indicated that locations with optimal habitats (e.g., sources of marine algae) are likely locations where small juvenile green sea turtles may be found. Green sea turtles are also reported to use not only the coastal waters of North Carolina as summer foraging habitat, but the waters of Virginia as well (Mansfield et al., 2009). Further south, green sea turtles have been reported to use the Indian River Lagoon (Florida) and areas south of the Study Area (Florida Bay and the Florida Keys) as feeding areas. Green sea turtles, however, appear to occupy smaller home ranges than loggerhead sea turtles (Seminoff et al., 2002; Makowski et al., 2006; Broderick et al., 2007). Important nesting areas for green sea turtles adjacent to the Study Area include southeastern Florida beaches, with most green sea turtles nesting in Brevard County (NMFS and FWS 2007a).

Ecology and Life History. In the southeastern U.S., nesting generally occurs from June-September; females nest at 2- to 4-year intervals. Similar to other sea turtles, age at sexual maturity is not reached until late in life at around 20–50 years of age; clutch size varies from 75-200 eggs, and incubation is between 20 and 50 days. Female green sea turtles usually deposit two or three clutches per breeding season, with inter-nesting intervals ranging from 12-14 days (NMFS and FWS 2007a).

Hatchling green sea turtles swim offshore to areas of convergence zones characterized with driftlines and patches of *Sargassum*. Neritic developmental habitats in the western North Atlantic range from the Long Island Sound to southern Florida and the tropics. These habitats include shallow nearshore hard substrate, embayments, and other inshore habitats (e.g., Indian River Lagoon, Florida). Juvenile green sea turtles occupying developmental habitats north of Florida must migrate south in autumn (Musick and Limpus 1997). Therefore, neritic juvenile green sea turtles may occur within nearshore and inshore habitats.

Green sea turtle distribution and diet is well documented. The NMFS and FWS (2007a) status review highlights that the Florida east coast (Indian River Lagoon and the waters off Brevard County (within the Study Area) through Broward County (south of the Study Area)) is a prime foraging area for green sea turtles. However, because green sea turtle diet consists of seagrasses and macroalgae, it is possible that green sea turtles use other sites within the Study Area (Virginia-Florida) where macroalgae is found.

Hazel et al. (2009) documented various daily diving behaviors of green sea turtles in nearshore foraging habitats in Australia, and found that the majority of the turtles spent most of time (89–100 percent) at depths (< 16.4 feet (5 m)) near the surface. They also found that dives were shorter and shallower during the day than at night, suggesting that green sea turtles rest at night and forage during the day. Hazel et al. (2009) also indicated that this phenomenon was consistent with the requirement to surface more often during increased activity (e.g., daytime foraging). In addition, Hazel et al. (2009) found that green sea turtle dives became longer as water temperatures decreased. Despite the ability for sea turtles to dive to deep depths, Hazel et al. (2009) postulated that green sea turtles chose not to dive to deeper depths at night given the distance (1.9 or 3.7 miles (3 or 6 km)) from shallow (foraging areas) to deeper waters.

Population Status. The green sea turtle population is considered severely depleted in comparison to its estimated historical levels (NMFS and FWS 2007a). Currently, there is no reliable green sea turtle population estimate, but inferences have been attempted using age-based survivability models and nesting data (Bjorndal et al., 2003). Nesting data indicate that between 200 and 1,100 females nest annually on continental U.S. beaches (adjacent to the Study Area). The recent 5-year status review (NMFS and FWS 2007a) reported that the total mean annual green sea turtle nesting abundance was around 5,600 nests (Florida east coast) during 2000 through 2006. Overall, the number of green sea turtle nests in Florida has increased over the past 18 years (NMFS and FWS 2007a).

Conservation and Management. No critical habitat has been designated for green sea turtles within or adjacent to the Study Area.

Hawksbill Sea Turtle

Range and Spatial Distribution. The hawksbill sea turtle is a medium-size cheloniid sea turtle. Adults can reach to 3.5 feet (1.1 m) in carapace length and 180 lb (82 kg) in mass (NMFS and FWS 2007b). The hawksbill sea turtle is a circumglobal species found in the Pacific, Indian, and Atlantic Oceans between latitudes 30° N and 30° S (NMFS and FWS 2007b). Hawksbill sea turtles are highly migratory, with satellite tagging data demonstrating that these sea turtles display short and long migrations from nesting to foraging grounds (NMFS and FWS 2007b; Blumenthal et al., 2009). In the western North Atlantic, hawksbill sea turtles can be found from Florida to Massachusetts, but are rarely reported north of Florida. In comparison to the other sea turtles potentially found within the region, the hawksbill sea turtle has a restricted distribution and range given that its habitat (foraging) preference is coral reefs, which are found only near coastal areas along southeastern Florida. Limited information on hawksbill sea turtle home ranges suggests they are smaller than for other sea turtle species (Witt et al., 2010). Although it is a rare occurrence, NMFS and FWS (1993) report that hawksbill nesting has been reported not only in southern Florida counties (Miami Dade, Broward, Palm Beach, and Martin) but also in Volusia County, which is adjacent to the Study Area (Table 3-5). Juvenile hawksbill sea turtles have been reported to use offshore floating mats of *Sargassum* as habitat, so it is possible that hawksbill sea turtles are found in the offshore areas of the Study Area that are associated with the Gulf Stream (NMFS and FWS 1993); the Gulf Stream often transports large patches of *Sargassum* as it moves from south to north. In addition to offshore and reef habitats, hawksbill sea turtles are also known to use mangrove-fringed bays, estuaries (Carr 1952), and Caribbean seagrass habitats (Bjorndal and Bolten, 1988, 2010).

Ecology and Life History. The nesting season varies with locality, but in most locations, nesting occurs sometime between April and November (NMFS and FWS 1993). Researchers also discovered that nesting interval ranged from 2–6 years with a mean of 2.5 years. Overall, the average 6-month nesting season for the hawksbill sea turtle is longer than for other sea turtles (NMFS and FWS 1993). Female hawksbill sea turtles usually deposit from 3–5 clutches per breeding season (~14 days) (Beggs et al., 2007; NMFS and FWS 2007b). Age at sexual maturity is between 20 and 40 years; average clutch size is around 135 eggs, and incubation is around 60 days.

Hatchling hawksbill sea turtles emerge from the nest and actively swim offshore at night to areas of water mass convergence. Hawksbill post-hatchlings in the laboratory appear to be attracted to patches of floating *Sargassum*, which they use as protective cover (Musick and Limpus 1997). Data suggest that juvenile (or post-hatchling) hawksbills move into neritic developmental habitats such as shallow coral reefs and mangrove estuaries at a smaller size than either loggerhead or green sea turtles (Witzell 1983). Because of their preference for these habitats, neritic juvenile hawksbill sea turtles may occur only within the southernmost areas of the Study Area.

Adult hawksbill sea turtles specialize on a diet of sponges and feed very selectively on specific species of demosponges (Bjorndal, 1997). They may also consume a variety of other food items such as algae and other benthic invertebrates (Márquez 1990). Hawksbill sea turtles primarily nest on Mexican and Caribbean beaches; some nesting has been reported in South Florida and the Florida Keys, but this is rare (NMFS and FWS 1993).

There is some information about the diving behavior of hawksbill sea turtles. In Milman Island, Australia, Bell and Parmenter (2008) recorded the diving behavior of nine female hawksbill sea turtles. Results from the study showed that the nine hawksbill sea turtles primarily spent their time near the surface but did make occasional deeper dives. The maximum depth recorded was 70.5 feet (21.5 m), and the researchers did not find any significant difference between day and night dive behaviors. On average, the dive time and surface interval for the nine sea turtles were 31.2 and 1.6 min, respectively. On the reefs of Mona Island, Puerto Rico, van Dam and Diez (1997) reported the diving patterns of five juvenile hawksbill sea turtles. Results showed that mean dive behavior associated with foraging ranged from 26–33 feet (8 to 10 m), dive durations ranged from 19 to 26 minutes, and surface intervals ranged from 37 to 64 seconds. Night dives ranged from 23 to 33 feet (7 to 10 m), dive durations ranged from 35 to 47 minutes, and surface intervals ranged from 36 to 60 seconds (van Dam and Diez 1997).

Population Status. The hawksbill sea turtle population is severely depleted and continues to be threatened (Bjorndal, 1999). Although there is no reliable hawksbill sea turtle population estimate, conclusions have been made from nesting data. There are no nesting estimates for hawksbill sea turtles adjacent to the Study Area, but the recent 5-year status review reported that the number of hawksbill sea turtles nesting in the western North Atlantic has decreased over the past 20 years (NMFS and FWS 2007b), but populations are much larger than in other regions (e.g., Indo-Pacific Ocean) where populations are declining. Despite showing some signs of recovery, the hawksbill sea turtle population has not reached an adequate level that warrants ESA-delisting or reclassification (NMFS and FWS 2007b).

Conservation and Management. No critical habitat for the hawksbill sea turtle exists in the Study Area.

Kemp's Ridley Sea Turtle

Range and Spatial Distribution. The Kemp's ridley is the smallest sea turtle; adults reach only 30 inches (76 cm) in carapace length and range from 80–100 lbs (36–45 kg) in mass. The Kemp's ridley sea turtle is generally found in the Gulf of Mexico and is occasionally sighted along the east coast from Florida to New England (NMFS et al., 2011). Overall, it may be the least abundant sea turtle in the region.

Foraging areas along the Atlantic coast include various embayments and estuarine systems from Florida to New York. Coles (1999) reported that Kemp's ridley sea turtles were frequently sighted in the Chesapeake Bay during summer months over a continuous 18-year sea turtle stranding survey and indicated that Kemp's ridleys ranked second in the number of strandings per year in the MAB. Coles (1999) also indicated that the MAB is an important foraging area for juvenile Kemp's ridley sea turtles during spring through fall. Satellite tracking data document seasonal migration along the inner shelf of the eastern U.S. from New England to Florida. Wintering habitats for Kemp's ridley sea turtles in the northwestern Atlantic include shelf habitats off Florida and waters south of Cape Hatteras, North Carolina (Gitschlag 1996).

There is some evidence of Kemp's ridley sea turtles nesting on beaches along the south Atlantic coast, but this is considered rare (NMFS et al., 2011). Johnson et al. (1999) reported that Kemp's ridley sea turtles nest on the beaches of North Carolina, South Carolina, and Florida (Ponce Inlet and New Smyrna Beach, Volusia County); all of these locales are adjacent to the Study area. Johnson et al. (1999) also reported Kemp's ridley sea turtles nesting in Palm Beach County, Florida.

Similar to other sea turtles, Kemp's ridley sea turtles display some seasonal and coastal migratory behavior; satellite tagging data indicate that Kemp's ridley sea turtles transit between nearshore and offshore waters (within 50 miles (28 km)) from spring/summer to fall/winter, which coincides with seasonal water temperature changes (NMFS et al., 2011). The home ranges of Kemp's ridley sea turtles may be similar to those of loggerhead sea turtles (Shaver et al., 2005).

Ecology and Life History. The mean clutch is 2.5 per breeding season (14–28 days), average clutch size is around 100 eggs, and incubation is between 45 and 58 days; females nest at 2-year intervals (NMFS et al., 2011). Age at sexual maturity for wild Kemp's ridleys has been reported to be between 10 and 16 years.

Neritic developmental habitats in the Study Area include shallow coastal areas in the western North Atlantic as far north as Long Island Sound. The Chesapeake Bay is an important developmental habitat for this species (Musick and Limpus 1997). Neritic juvenile Kemp's ridleys undergo seasonal migrations within the Study Area.

The Kemp's ridley sea turtle is a carnivore throughout its life cycle (Márquez, 1990). Adult and subadult Kemp's ridley sea turtles are benthic feeders that primarily feed on crabs. Other preferred food items include shrimps, mollusks, sea urchins, and fishes (opportunistically) (NMFS et al., 2011).

Available information about Kemp's ridley sea turtles is limited, but there is some information about their diving behavior. In the Gulf of Mexico, Schmid et al. (2002) reported a surface interval between 1 and 88 seconds and a mean submergence duration of 8.4 minutes. Overall, these researchers did not find any differences between day and night surface activities but did find a diel difference in some years (e.g., 1994 and 1995). The data also showed that the mean submergence interval during the night was longer than during the day (Schmid et al., 2002).

Population Status. The Kemp's ridley sea turtle population is severely depleted, and it is considered the most endangered sea turtle (FWS 1999). Kemp's ridley sea turtles were once abundant, especially in the Gulf of Mexico. Today, the population is stressed and there are no reliable Kemp's ridley sea turtle population estimates. Using various assumptions, the current population estimate of Kemp's ridley sea turtles is approximately 738 females, but the number of nesting Kemp's ridley sea turtles continues to improve. NMFS et al. (2011) reported that the number of nests per season in Rancho Nuevo, Mexico, recently exceeded 20,000 and stated that the nesting population is growing exponentially.

Conservation and Management. Critical habitat has not been designated, but the agencies were petitioned on February 17, 2010, under the ESA to designate Kemp's ridley critical habitat (NMFS 2013b), and this is being evaluated.

Leatherback Sea Turtle

Range and Spatial Distribution. The leatherback sea turtle is the largest sea turtle and the largest reptile, with adults reaching up to 6 feet (1.8 m) in carapace length and 2,000 lbs (907 kg) in mass. They are easily distinguished from all other sea turtle species by their large spindle-shaped, leathery, and unscaled carapaces that possess a series of parallel dorsal ridges, or keels (Márquez, 1990). Leatherback sea turtles are found throughout the Study Area, depending on the season. In Virginia, Coles (1999) reported from sea turtle stranding data that leatherback sea turtles were frequently sighted and stranded in the Chesapeake Bay during 1979 through 1997. Off South Carolina, leatherback sea turtles are primarily found from April through June when cannonball jellyfish (*Stomolophus meleagris*) are abundant, and again in October and November (SCDNR 2005).

Along the U.S. east coast, the principal nesting beaches for leatherback sea turtles are in Florida. According to SCDNR (2005), leatherback sea turtles have also been documented to nest in Georgia, South Carolina (four leatherback nests since 1996), North Carolina, and possibly in Maryland.

Satellite tagging data demonstrate that leatherback sea turtles display wide-ranging coastal and transoceanic movements (Hays et al., 2006) and have the most wide-ranging distribution of any sea turtle. Because leatherback sea turtles appear to adapt quickly to local environmental conditions, they do not display any restricted distributional and movement behaviors (Hays et al., 2006; NMFS and FWS 2007c). James et al. (2005a, b) described only few high-use areas for Atlantic leatherback sea turtles compared with the total area traveled through, suggesting a low fidelity to any particular area. Eckert (2006) reported that leatherback sea turtles tagged in Trinidad were later reported off Newfoundland (Flemish Cap), Canada, and subsequently in Mauritanian waters. Genetic techniques have been used to distinguish five groups or populations in the western North Atlantic Ocean: Florida, Northern Caribbean, Western Caribbean, Southern Caribbean (includes northern Brazil), and Southern Brazil (NMFS and FWS 2007c). Genetic studies support the natal homing hypothesis, which has been reported for other sea turtles (Godley et al., 2010). Leatherback sea turtles tend to use specific beach sites within their respective regions for nesting.

Ecology and Life History. Unlike other sea turtles, leatherback sea turtles can begin nesting as early as February or March, with peak nesting in July; females nest at 2- or 3-year intervals. In Atlantic OCS waters and within the Study Area, the leatherback sea turtle is reported to nest mainly on Florida beaches. Age at sexual maturity has been reported to be much younger than for other sea turtles, at around 6–10 years. The average clutch size is around 100 eggs, and incubation is between 60 and 65 days; females deposit between five and seven nests per breeding season, with inter-nesting intervals ranging from approximately 8–12 days (NMFS and FWS 2007c).

Like other sea turtle species, hatchling leatherback sea turtles leave the nest and swim actively offshore. Post-hatchling and oceanic juvenile leatherbacks are more active than other sea turtle species (Wyneken and Salmon 1992). These oceanic juveniles virtually disappear for 4 years (Musick and Limpus 1997). Their requirements for gelatinous prey suggest that they may search for areas of major upwelling. Juvenile (as well as adult) leatherbacks recruit seasonally to temperate and boreal coastal habitats to feed on concentrations of jellyfish (Lutcavage and Lutz 1986). In the western North Atlantic, juveniles appear in these habitats at a body length of 43–47 inches (110–120 cm) (Musick and Limpus 1997). It is likely that post-hatchling and oceanic juvenile leatherback sea turtles may be present within offshore and coastal waters of the Study Area.

Leatherback sea turtles have a wide-ranging distribution and apparently are able to adapt and tolerate cold water temperatures; most sea turtles sighted in the Chesapeake Bay were in waters between 25 and 29 °C (Coles 1999). Coles (1999) indicated that sea turtle distribution may not be random but associated with specific water temperature ranges. Adult leatherback sea turtles have been reported to migrate from equatorial to temperate waters to forage, which is unique for sea turtles (NMFS and FWS 2007c). Leatherback sea turtles primarily feed on pelagic gelatinous invertebrates such as scyphomedusae (jellyfish) and pelagic tunicates (NMFS and FWS 1992; Bjorndal, 1997), and seasonal movements appear to be correlated with jellyfish seasonal abundance (SCDNR 2005).

Using tagging data from nine sea turtles (181–431 days), Hays et al. (2006) recorded seasonal movements from the Caribbean to the northeastern coast of the U.S. during the summer and from the north to the south during the fall. With these seasonal movements, the researchers found that as the individuals moved from southern to northern latitudes, the dives were became progressively shallower and shorter. In addition, Hays et al. (2006) documented that leatherback sea turtles displayed a diel dive pattern, with more diving and shallower diving at night than during the day for the individuals located between 18° and 30° N. Mean dive duration ranged from 3–5 to 30 minutes, and mean dive depth ranged from surface waters to almost 820 feet (250 m). The overall swimming speed ranged from 1.5–51 miles (2.5-82.5 km) per day; most leatherback sea turtles swam between 20 and 26 miles (32.5 and 42.5 km) per day. Hays et al. (2006) concluded that leatherback sea turtles do not display highly migratory behavior (i.e., swim from southern to northern waters) just to forage at specific "hotspots," but instead continuously feed as they travel. However, the researchers noted that leatherback sea turtles did remain in specific areas for short durations to feed, and their daily diving patterns were correlated with prey abundance.

Population Status. The leatherback sea turtle population is depleted but more stable than when compared to other sea turtles (NMFS and FWS 2007c). The most recent population estimate for leatherback sea turtles in the Atlantic is smaller than the estimates for 1980 (between 34,000 and 94,000 compared to 115,000 individuals) – but apparently stable (NMFS and FWS 2007c; Spotila et al., 1996). Leatherback sea turtles are highly migratory (Shillinger et al., 2008) and migrate further than any other reptile (NMFS and FWS 2007c). Recent survey data clearly show that the nesting numbers have dramatically increased, from 98 nests in 1988 to around 850 nests in the early 2000s (NMFS and FWS 2007c). Using the number of nests as a population index, the estimated annual growth rate for leatherback sea turtles is around 1.17 (NMFS and FWS 2007c).

Conservation and Management. Critical habitat was initially designated for the leatherback sea turtle in 1979 but does not occur within the Study Area (Federal Register 1979).

Summary of Sea Turtle Hearing Capabilities

Investigations suggest that sea turtle auditory sensitivity is limited to low-frequency bandwidths. The role of underwater low-frequency hearing in sea turtles is unclear. Sea turtles may use acoustic signals from their environment as guideposts during migration and as cues to identify their natal beaches (Lenhardt et al. 1985). Sea turtles are thought to be low-frequency hearing specialists, typically hearing frequencies from 10 to 2,000 Hertz (Hz), with a range of maximum sensitivity between 100 and 800 Hz (Bartol and Ketten 2006; Bartol et al. 1999; Lenhardt 2002; Lenhardt 1994; Ridgway et al. 1969). Greatest sensitivities are 300 to 400 Hz for the green sea turtle (Ridgway et al. 1969) and around 250 Hz or below for juvenile loggerheads (Bartol et al. 1999). Bartol et al. (1999) reported that the range of effective hearing for juvenile loggerhead sea turtles is from at least 250 to 750 Hz using the auditory brainstem response technique. Juvenile and sub-adult green sea turtles detect sounds from 100 to 500 Hz underwater, with maximum sensitivity at 200 and 400 Hz (Bartol and Ketten 2006). Auditory brainstem response recordings on green sea turtles showed peak response at 300 Hz (Yudhana et al., 2010). Juvenile Kemp's ridley sea turtles were found to detect underwater sounds from 100 to 500 Hz, with a maximum sensitivity between 100 and 200 Hz (Bartol and Ketten 2006). Leatherback sea turtle hatchlings are able to detect sounds underwater and in air, responding to stimuli between 50 and 1200 Hz in water and 50 and 1600 Hz in air with maximum sensitivity between 100 and 400 Hz in water (84 dB re: 1 μPa-rms at 300 Hz) and 50 and 400 Hz in air (62 dB re: 20 μPa-rms at 300 Hz) (Piniak et al., 2012b). Hearing sensitivity in both media declined considerably above 400 Hz. These represent the first measurements of leatherback sea turtle hearing sensitivity.

Much of the research on the hearing capacity of sea turtles is limited to gross morphological dissections (Wever 1978; Lenhardt et al., 1985). Based on the functional morphology of the ear, it appears that sea turtles receive sound through the standard vertebrate tympanic middle ear path. The sea turtle ear appears to be a poor receptor for aerial sounds but is well adapted to detect underwater sound. Organized bundles of coherent fatty tissues under the tympanum act as a low-impedance channel for underwater sound. Furthermore, the retention of air in the middle ear of these sea turtles suggests that they are able to detect sound pressure (Ketten 2008).

Electrophysiological studies on hearing have been conducted on juvenile green sea turtles (Ridgway et al., 1969; Bartol and Ketten 2006), juvenile Kemp's ridley sea turtles (Bartol and Ketten 2006), and juvenile loggerhead sea turtles (Bartol et al., 1999; Lavender et al., 2011, 2012). Electrophysiological responses, specifically auditory-evoked potentials (AEPs), are the most widely accepted technique for measuring hearing in situations in which normal behavioral testing is impractical. Most AEP research has concentrated on detectable neural electrical responses occurring within the first 10 milliseconds following presentation of a click or brief tone, which has been termed the auditory brainstem response.

Ridgway et al. (1969) measured AEPs of green sea turtles using both aerial and vibrational stimuli. Green sea turtles detect a limited frequency range (200–700 Hz) with best sensitivity at the low tone region of about 400 Hz. Though this investigation examined two separate modes of sound reception (i.e., air and bone conduction), sensitivity curves were relatively similar, suggesting that the inner ear is the main structure for determining frequency sensitivity. To measure electrophysiological responses to sound stimuli, Bartol et al. (1999) collected auditory brainstem responses from juvenile loggerhead sea turtles. Thresholds were recorded for both tonal and click stimuli. Best sensitivity was found in the low frequency region of 250–1,000 Hz. The decline in sensitivity was rapid above 1,000 Hz, and the most sensitive threshold tested was at 250 Hz. More recently, Bartol and Ketten (2006) collected underwater auditory brainstem responses from hatchling and juvenile loggerhead and juvenile green sea turtles using speakers suspended in air while the sea turtle's tympanum remained submerged. All sea turtles tested responded to sounds in the low frequency range, from at least 100 Hz (lowest frequency tested) to no greater than 900 Hz. The smallest sea turtles tested, hatchling loggerheads, had the greatest range of hearing (100–900 Hz), while the larger juveniles responded to a much narrower range (100–400 Hz). Hearing sensitivity of green sea turtles also varied with size; smaller greens had a broader range of hearing (100–800 Hz) than that detected in larger subjects (100-500 Hz). Using underwater speakers as a sound source, Lavender et al. (2011, 2012) measured underwater AEPs in loggerhead sea turtles ranging from yearlings to subadults and detected responses to frequencies between 50 and 1,000 Hz. Piniak et al. (2012a) recorded both in-air and in-water AEP responses from juvenile green sea turtles. The sea turtle AEP signal signature was similar to that seen in fish, with a frequency doubling response observed at 400 Hz. As observed in other studies, juvenile green sea turtles responded to stimuli between 50 and 1,600 Hz in water and 50 and 800 Hz in air. Ranges of maximum sensitivity were between 50 and 400 Hz in water and 300 and 400 Hz in air. In both media, sensitivity decreased sharply for frequencies above 400 Hz. These studies show that sea turtles are particularly sensitive to low-frequency sounds and so are able to hear much of the low-frequency and high-intensity anthropogenic noise in the ocean such as vessel traffic and offshore oil and gas exploration activities.

Few studies have examined the role acoustic cues play in the ecology of sea turtles (Mrosovsky 1972; Samuel et al., 2005; Nunny et al., 2008). Sea turtles may use sound for navigation, locating prey, avoiding predators, and environmental awareness (Piniak et al., 2012a). There is evidence that sea turtles may also use sound to communicate, but the few vocalizations described for sea turtles are restricted to the "grunts" of nesting females (Mrosovsky 1972). These sounds are low-frequency and relatively loud, thus leading to speculation that nesting females use sounds to communicate with conspecifics (Mrosovsky 1972). Very little is known about the extent to which sea turtles use their auditory environment. The acoustic environment for sea turtles changes with each ontogenetic habitat shift. In the inshore environment where juvenile and adult sea turtles generally reside, the ambient environment is noisier than the open ocean environment of the hatchlings; this inshore environment is dominated by low frequency sound (Hawkins and Myrberg 1983) and, in highly trafficked areas, virtually constant low-frequency noises from shipping and recreational boating (Hildebrand 2009).

3.6.2. Environmental Consequences

3.6.2.1. Alternative A: Proposed Action

This section discusses potential impacts associated with Alternative A on sea turtles. Based upon the description of the proposed action, four IPFs from G&G activities that may affect sea turtles have been identified: 1) active acoustic and vessel noise, 2) vessel presence/traffic, 3) vessel waste and discharges (including marine debris), and 4) seafloor disturbance.

Noise from Active Sound Sources and Vessel Operations

Although sea turtles are thought to detect low-frequency sound, with an expected hearing range with a peak sensitivity of 200 to 700 Hz (Samuel et al., 2005), the potential effects of sound exposure on sea turtle biology and behavior remain largely unknown (Samuel et al., 2005). Without the implementation of monitoring and mitigation measures, active acoustic sound sources could have a range of effects on sea turtles. These could include physical injury, hearing threshold shift, auditory masking, and behavioral responses. Hearing threshold shifts, auditory masking, and behavioral responses that could possibly occur absent mitigation are discussed in detail below.

Hearing Threshold Shift: Although unexpected, auditory impacts such as permanent (PTS) or temporary threshold shift (TTS) could potentially occur in situations where sea turtles are exposed to very loud sound sources when within hearing range and in very close proximity. However, criteria have not been developed to delineate threshold shifts for these effects in sea turtles mainly because of the few data that exist on sea turtles' hearing. PTS results in the permanent though variable loss of hearing through the loss of sensory hair cells (Clark 1991). TTS is a temporary and recoverable damage to hearing structures (sensory hair cells) and can vary in intensity and duration. For individuals experiencing TTS, normal hearing abilities would return over time; however, animals may lack the ability to detect prey and predators and assess their environment during the recovery period. Few studies have looked at hair cell damage in reptiles, and studies do not indicate precisely if sea turtles are able to regenerate injured sensory hair cells (Warchol 2011).

Auditory Masking: Noise may have the potential to mask relevant sounds in the environment. Masking sounds can interfere with the acquisition of prey or mates, the avoidance of predators, and, in the case of sea turtles, the identification of an appropriate nesting site (Nunny et al., 2008). These maskers could have diverse origins, ranging from natural to anthropogenic sounds (Hildebrand 2009). Because sea turtles appear to be low-frequency specialists, the potential masking noises would fall mainly within the range of 50-1,000 Hz. There are no quantitative data demonstrating masking effects for sea turtles. Behavioral changes that may occur from masking sounds may have ecological consequences for sea turtles, although there are no quantitative data demonstrating these effects.

Behavioral Responses: Limited data exist on noise levels that may induce behavioral changes in sea turtles. There is no equivalent literature evaluating behavioral effects from exposure to sources with lower source levels and comparatively higher frequencies. Although airguns are not proposed for us in this effort, sea turtle avoidance reactions to them (such as erratic swimming behavior) have been observed at levels between 166 and 179 dB re 1 μPa (Moein et al., 1995; McCauley et al., 2000); however, both of these studies were done in a caged environment, so the extent of behavioral changes could not be monitored. In experiments attempting to use airguns to repel sea turtles from dredging operations, Moein et al. (1995) observed a habituation effect to airguns; the animals stopped responding to the signal after three presentations. From these results, it was not clear whether this lack of behavioral response was a result of behavioral habituation, or physical effects from temporary or permanent threshold shifts in hearing.

Becuase sea turtles are primarily most sensitive to sound below 1,000 Hz, acoustic signals from proposed electromechanical sources other than the boomer and chirp are not likely to be detectable to them. Hearing threshold shifts are not expected to occur, given the nature of the sound sources.

Mitigations: However, in recognition of the potential for possible behavioral effects (such as auditory masking or elicited avoidance behavior) BOEM would apply the mitigation outlined in the Geophysical Survey and Nighttime Geophysical Surveys and Passive Acoustic Monitoring Protocols (Section 2.2.7). The minimum number of geophysical sources per survey would be used to obtain the necessary geophysical data. Only chirp sub-bottom profiler and boomer would be operated at frequencies below 180 kHz, within the hearing sensitivity range of sea turtles. Source levels for sub-bottom profilers and boomers would not exceed 220 dB re 1 μPa and would be operated at the lowest power setting possible and narrowest beamwidth and highest frequency possible to fulfill data needs, while effectively reducing exposure and received levels on sea turtles. Further, an acoustic exclusion zone would be monitored during G&G surveys using any boomer or sub-bottom profiler sound source(s). The acoustic exclusion zone will be a 328-foot (100-m) radius zone around the sound source. Consistent with recent sound source verification studies on these active sources, threshold radii to 160 dB re 1 μPa are expected to be less than 328 feet (100 m) because of the beam pattern characteristics and downward directivity. For geophysical surveys using sound sources operating at frequencies below 180 kHz, operations will be monitored by a trained PSO. During nighttime operations or when operating during reduced visibility, observers would monitor the waters around the acoustic exclusion zone using enhanced vision equipment and night-vision equipment. G&G sound sources operating at frequencies below 180 kHz may be approved during periods of reduced visibility or at night, provided the nighttime survey protocol requirements are applied. Additionally, during nighttime surveys, the frequency of chirp and boomer sources would be modulated to operate outside the upper limit of hearing range of the species likely to be present in the survey area (e.g., loggerhead: < 1 kHz; leatherback: < 2kHz). During all survey activity, the chirp towfish would be towed as close to the bottom as possible to further reduce the zone of ensonification. The boomer, which is surface towed, has an operating frequency range of 200 Hz–16 kHz and so may be audible to sea turtles. The boomer has comparable beam pattern, short pulse lengths (120, 150, or 180 microseconds) and a lower source level, with a 180-dB radius of less than 16 feet (5 m). The use of boomers would be limited to circumstances where penetration from chirp seismic sources would be insufficient to map or delineate near-surface geologic units.

Bottom Sampling: Proposed activities under Alternative A would also include bottom sampling. Only vibracorers and grab samplers would be used to sample near-surface sediments during geological surveys. The vibratory mechanism on the vibracorer would be the primary source of underwater sound during geological sampling operations in addition to broadband noise from the vessel. Both would be within the hearing range of sea turtles. The vibratory mechanism on the vibracorer would be operated at the sample location for 5 to 15 minutes. Monitoring of an acoustic exclusion of 328 feet (100 m), consistent with the geophysical protocol, would be implemented. The same start-up and shutdown requirements, consistent with the geophysical protocol, would be implemented when sea turtles are observed approaching or within the acoustic exclusion zone.

The exposure of sea turtles to sound would largely be avoided, but for possible exposure at lower received levels, and that exposure would be temporary and localized and based on the audibility of the source to sea turtles (which is a function of both hearing ability and distance between the source and the turtle(s)), in addition to the short duration of the G&G surveys. Any behavioral response, potentially including avoidance, changes in dive patterns or course, or changes in foraging behavior, would be very brief and limited to the area of ensonification. Additionally, there is not expected to be any increase in energy expenditure that has any detectable effect on the physiology of any individuals or any future effect on growth, reproduction, or general health. Sound generated from the G&G surveys will primarily take place at least three miles offshore, and would therefore have negligible impacts on nesting or nearshore foraging sea turtles.

Vessel Noise: Survey vessels and engine noise could also disturb sea turtles or contribute to auditory masking absent mitigation. Vessel noise is a combination of narrowband (tonal) and broadband sound (Richardson et al., 1995). Tones typically dominate up to about 50 Hz, whereas broadband sounds may extend to 100 kHz, and this varies by vessel size, configuration, and speed. The dominant source of noise from vessels is from the propeller operation, including cavitation, singing and propulsion, and the intensity of this noise is largely related to ship size and speed. Vessel and equipment noise from the proposed G&G vessels, including survey and support vessels associated with activities described in the proposed action, would produce low levels of noise. Broadband source levels for most small ships (a category that would include seismic survey vessels and possible support vessels) are anticipated to be in the range of 170-180 dB re 1 μPa at 1 m, and source levels for smaller boats (a category that would include the types of survey vessels used for the proposed action) are in the range of 150-170 dB re 1 μPa at 1 m (Richardson et al., 1995). The speed restrictions and slow survey speed would further reduce these noise levels. Active acoustic noise sources, such as the electromechanical sources described in this document, and vessel and equipment noise from the proposed action, would contribute incrementally to overall ambient noise levels within the Study Area.

The most likely effects of vessel and equipment noise on sea turtles would include behavioral changes and possibly auditory masking. Vessel and equipment noise is transitory and generally does not propagate at great distances from the vessel, and the source levels are too low to cause death or injuries such as auditory threshold shifts. Based on existing studies on the role of hearing in sea turtle ecology, it is unclear whether masking would realistically have any effect on sea turtles. Behavioral responses to vessels have been observed but are difficult to attribute exclusively to noise rather than to visual or other cues. It is conservative to assume that noise associated with survey vessels may elicit behavioral changes in individual sea turtles near these vessels. These behavioral changes may include evasive maneuvers such as diving or changes in swimming direction and/or speed. This evasive behavior is not expected to adversely affect these individuals or the population. The use of the G&G survey protocols, including mandatory use of observers and exclusion zones, would provide protection to sea turtles that may be present in the Study Area. Vessel noise associated with the proposed activities would have negligible impacts on sea turtles.

Vessel Presence/Traffic

Without the implementation of monitoring or mitigation measures, G&G survey vessels could strike and injure or kill sea turtles. Propeller and collision injuries to sea turtles arising from their interactions with boats and ships are common. From 1997–2005, 14.9 percent of all stranded loggerhead sea turtles in the U.S. Atlantic Ocean and Gulf of Mexico were documented as having sustained some type of propeller or collision injuries. This study did not indicate what proportion of these injuries was post- or ante-mortem (NMFS and FWS 2008). The incidence of propeller wounds reported in sea turtles rose from approximately 10 percent in the late 1980s to a record high of 20.5 percent in 2004. Documented propeller wounds have the highest frequency of occurrence in southeastern Florida (i.e., Palm Beach through Miami-Dade Counties); during some years, as many as 60 percent of the loggerhead strandings found in these areas had propeller wounds (NMFS and FWS 2008). Green sea turtle recovery off the U.S. west coast has been hampered by vessel collisions, especially when sea turtles are struck by an engaged propeller (NMFS and FWS 1998a). In contrast, vessel collisions are not listed as a current threat to leatherback sea turtle recovery (NMFS and FWS, 1992 1998b). It is likely that these reported injuries to sea turtles were largely caused by collisions with high-speed recreational powerboats because of the high volumes of these vessels operating in waters off southeastern Florida and in other areas of the U.S.

Under the proposed action, all authorizations for shipboard surveys would include guidance for vessel strike avoidance. Guidance protocols are discussed in Section 2.2.7. With these mitigation measures in place, G&G survey vessels or towed equipment are unlikely to strike sea turtles. G&G survey vessels, which account for most of the project-related vessel traffic, survey at a speed of approximately 4.5 knots (8.3 km/hr). In addition, waters surrounding survey vessels would be monitored by for the presence of sea turtles. During transit to and from shore bases, G&G survey vessels are expected to travel at somewhat greater speeds, but still under speed restrictions and in compliance with observer requirements. Daylight operations would be conducted to the extent possible to avoid any additive strike risk during nighttime. During nighttime operations observers would monitor the waters around the acoustic exclusion zone using enhanced vision equipment and night-vision equipment. Similarly, the lighting scheme aboard the vessel would be reduced to the extent possible to minimize any attraction of swimming sea turtles to the vessel.

Sea turtles spend at least 20 to 30 percent of their time at the surface for respiration, basking, feeding, orientation, and mating (Lutcavage et al., 1997). Because sea turtles spend most of their lives submerged and therefore cannot be seen by a visual monitor at all times, collisions would be possible. Any project-related vessel strike with a sea turtle could result in the death or injury of the sea turtle. However, this risk of vessel strikes on sea turtles would be expected to be minimal and vessel traffic related impacts would be negligible because of: (1) vessel strike avoidance requirements; (2) the typical slow speed of survey vessels; and (3) the use of monitors or PSOs to scan the sea surface around seismic survey vessels.

Vessel Waste and Accidental Discharges

Liquid Waste Discharges: Very short-term and localized deterioration in water quality may occur during survey operations following discharge of sanitary and domestic wastes, bilge water, and cooling water. Waste would be either treated onboard the vessel using an approved marine sanitation device or stored aboard to be pumped out later onshore, depending upon vessel size. All vessel operations would comply with the regulatory requirements of the USCG and USEPA's Vessel General Permit. These requirements should minimize any toxicity or other exposure-related effects.

Accidental Spills: Other hazardous materials routinely onboard survey vessels include diesel fuel, hydraulic fluid, and lubricants. Although accidental spills are unexpected, all operations would be conducted under a marine pollution control plan to account for this remote possibility. If a spill were to occur, sea turtles could be affected by an accidental diesel fuel spill during G&G activities. Effects of spilled oil on sea turtles are discussed by Geraci and St. Aubin (1987), Lutcavage et al. (1995, 1997), and Milton et al. (2003). Oil, including refined diesel fuel, may affect sea turtles through various pathways including direct contact, inhalation of the fuel and its volatile components, and ingestion (directly or indirectly through the consumption of fouled prey species) (Geraci and St. Aubin, 1987). Several aspects of sea turtle biology and behavior place them at risk, including lack of avoidance behavior, indiscriminate feeding in convergence zones, and inhalation of large volumes of air before dives (Milton et al., 2003). Studies have shown that direct exposure of sensitive tissues (e.g., eyes, nares, other mucous membranes) and soft tissues to diesel fuel or volatile hydrocarbons may produce irritation and inflammation. Diesel fuel can adhere to sea turtle skin or shells. Sea turtles surfacing within or near a diesel release would be expected to inhale petroleum vapors, causing respiratory stress. Ingested diesel fuel, particularly the lighter fractions, can be acutely toxic to sea turtles.

A small, accidental diesel fuel spill from a G&G survey vessel would be expected to disperse quickly in the open ocean; small diesel spills usually evaporate and disperse within a day or less, even in cold water (NOAA 2006). It is assumed that the spilled fuel would rapidly spread to a layer of varying thickness and break up into narrow bands or windrows parallel to the wind direction. The rate at which the oil spreads would be determined by the prevailing conditions (e.g., temperature, water currents, tidal streams, wind speeds). The fuel spill is not likely to result in the death or life-threatening injury of individual sea turtles or hatchlings, or the long-term displacement of adult sea turtles from preferred feeding, breeding, or nesting habitats or migratory routes. It is unlikely that a small diesel fuel spill in the ocean would reach sea turtle nests, which are usually positioned above the high tide line. If a small spill were to occur, potential impacts on sea turtles are expected to range from negligible (if the fuel does not contact individual sea turtles) to minor (if individual sea turtles encounter the dispersed windrows of the surface slick).

Marine Debris: Lost and discarded marine debris, particularly those items made of synthetic materials, is a major form of marine pollution (Laist 1997). Marine debris poses two types of negative impacts on sea turtles: (1) entanglement, and (2) ingestion. NMFS and FWS (2008) note that loggerhead sea turtles have been found entangled in a wide variety of materials, including steel and monofilament line, synthetic and natural rope, plastic onion sacks, and discarded plastic netting. From 1997-2005, 1.6 percent of stranded loggerheads found on Atlantic and Gulf of Mexico beaches were entangled in fishing gear.

The G&G survey operations could generate trash made of paper, plastic, wood, glass, and metal. Most of this trash is associated with galley and offshore food service operations. The discharge of trash and debris is prohibited (33 CFR 151.51–77) unless it is passed through a comminutor (a machine that breaks up solids) and can pass through a 25 millimeter mesh screen. All other trash and debris must be returned to shore for proper disposal with municipal and solid waste. Some personal items, such as hardhats and personal flotation devices, are occasionally accidentally lost overboard. However, USCG and USEPA regulations require operators to become proactive in avoiding accidental loss of solid waste items by developing waste management plans, posting informational placards, manifesting trash sent to shore, and using special precautions such as covering outside trash bins to prevent accidental loss of solid waste. In addition, all operations would be conducted under guidance for marine debris awareness. Taking into account the USCG and USEPA regulations and marine debris guidance, it is unlikely that significant amounts of trash and debris from the proposed G&G activities would be released into the marine environment, which appreciably reduces the likelihood of sea turtles encountering marine debris from the proposed activity. Debris entanglement and ingestion impacts on sea turtles are expected to be negligible.

Seafloor Disturbance

Sediment sampling would occur in select locations. Due to the small size of the vibracores and associated platforms, the area of seabed to be disturbed during individual sampling events is estimated to range from 1 to 9 square feet (0.3 to 2.7 square m). The total area of seafloor disturbed by bottom sampling and shallow coring activities would be a very small portion of the total Study Area and constitute a limited portion of potentially available sea turtle foraging and resting habitat. Sensitive benthic habitat areas, including coral reef and hard bottom areas located offshore Florida, would not be the target of sampling, and would otherwise be avoided by an exclusion zone. The direct and indirect effects of project-related geological activities within the Study Area are expected to be negligible.

3.6.2.2. Alternative B: Additional Operational Restrictions and Time-Area Closures

The IPFs from routine events that may impact sea turtles would be the same as discussed in Alternative A, including: (1) active and vessel noise, 2) vessel presence/traffic, 3) vessel waste and discharges (including marine debris) and 4) seafloor disturbance. The potential impacts on each of the sea turtle species are largely similar as to the impacts discussed under Alternative A. Under this alternative, the same suite of G&G activities would occur with the implementation of the same mitigation suite as Alternative A, but additional mitigation requirements and restrictions on G&G operations would be employed.

Specifically, geological surveys would occur only after geophysical surveys have been conducted and analyzed. Additionally, no bottom anchoring would be permitted during geological surveys, except in the case of an emergency. This alternative could require two mobilizations to an area if it is determined that additional (site-specific) investigation is warranted which would result in increased vessel traffic and overall acoustic noise. The sequential G & G surveys may lead to additional marine noise exposure and a greater chance for vessel collisions because of the increased number of vessel trips to occur than outlined in Alternative A.

Additional restrictions would be applied to further minimize potential effects to loggerhead sea turtles during nesting season (May 1 to October 31) offshore of southeastern Florida; effects to be minimized include possible behavioral responses, interruption of nesting, and interruption of foraging behavior. Nighttime surveys, when visual observations are not as effective, would not be allowed in that area so that all risk associated with underwater noise and vessel strike would be avoided.

Lastly, this alternative would incorporate additional time-area closures to specifically avoid G&G surveys at sensitive times of year in spawning and nursery HAPCs in the Study Area, including in sensitive cape-associated shoals, ephemeral hard-bottom areas, or other important habitat (Appendix A, Table A-12). Although the exact survey areas are undefined at this time, these time-area closures could result in a reduction in the likelihood of noise-related effects depending on location, time of year, and characteristic behavior.

3.6.2.3. Alternative C: No Action Alternative

Under Alternative C, the no action alternative, the proposed action would not occur, and there would be no potential impacts. This would mean that a comprehensive and systematic inventory of sand resources along the Atlantic OCS would not be conducted. Additional borrow areas for coastal restoration and resiliency would not be delineated. This may lead to delays in coastal restoration from future storms and/or erosion. This may also lead to loss of critical shoreline habitat for sea turtle nesting. The no action alternative would not meet the objectives of the Disaster Relief Appropriations Act, and BOEM would forfeit the funds.

3.7. Marine and Coastal Birds and Bats

3.7.1. Affected Environment

There are four avian species listed under the ESA that are either within or in close proximity to the Study Area (piping plover, roseate tern, Bermuda petrel, and Kirtland's warbler), one species proposed for listing (red knot), and one species under review (black-capped petrel) after a positive 90-day finding to a petition requesting ESA listing.

In addition to protected bird species, there are three taxonomic and ecological avian groups of concern that are found along the Atlantic coast and in the shallow marine environment of the Study Area, including seabirds, waterfowl, and shorebirds. Seabirds are those species that live in the marine environment and feed at sea (Schreiber and Burger 2002).

Seabirds found in the Study Area include members from five taxonomic orders, as follows: Charadriiformes (skuas, jaegers, gulls, terns, skimmers, and alcids); Gaviiformes (loons); Pelicaniformes (pelicans, frigatebirds, gannets, boobies, tropicbirds, and cormorants); Podicepiformes (grebes); and Procellariiformes (albatrosses, petrels, storm petrels, fulmars, and shearwaters).

Certain waterfowl (Order Anseriformes) feed and rest within coastal and offshore waters outside of their breeding seasons. They can form large flocks and are often observed in large rafts on the sea surface.

Shorebirds use coastal environments for nesting and feeding. They are included within the Order Charadriiformes (along with gulls and terns). The shorebird group consists of four families and includes sandpipers, plovers, and stilts.

These species receive Federal protection under the Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712), which states, "Unless and except as permitted by regulations … it shall be unlawful at any time, by any means, or in any manner to pursue, hunt, take, capture, kill … possess, offer for sale, sell … purchase … ship, export, import … transport or cause to be transported … any migratory bird, any part, nest, or eggs of any such bird, or any product … composed in whole or in part, of any such bird or any part, nest, or egg thereof …."

A discussion of ESA-listed (or species under consideration for ESA protection) and non-listed bird species is provided below, followed by a discussion of a bat species proposed for ESA listing that could occur within the Study Area.

3.7.1.1. Threatened and Endangered Species

Piping Plover

Distribution. The piping plover (*Charadrius melodus*) is a small, migratory shorebird that breeds on beaches from Newfoundland to North Carolina (and occasionally in South Carolina) and winters along the Atlantic coast from North Carolina south, along the Gulf Coast, and in the Caribbean (FWS 1996; Elliot- Smith and Haig 2004). Piping plovers that breed on the Atlantic coast belong to the subspecies *C. melodus melodus* (FWS 2009). The Atlantic coast population is classified as threatened, whereas other piping plover populations inhabiting the Northern Great Plains and Great Lakes watersheds are endangered (FWS 2011a). The Great Lakes piping plover population is the smallest, and its wintering population is distributed along the Atlantic and Gulf of Mexico coastlines (Stucker and Cuthbert 2006).

Critical Habitat. The FWS first designated critical habitat for the wintering population of piping plovers in 142 areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas on July 10, 2001 (Federal Register 2001). Critical habitat areas were subsequently revised in North Carolina in 2008 (Federal Register 2008b) and in Texas in 2009 (Federal Register 2009d). Thirty-three percent of these designated critical habitat areas are known to be used by Great Lakes piping plovers (Stucker and Cuthbert 2006). No critical habitat exists for the wintering population of piping plover within the Study Area.

Life History. Piping plovers largely inhabit coastal sandy beaches and mudflats. They use open, sandy beaches close to the primary dune of barrier islands for breeding, preferring sparsely vegetated open sand, gravel, or cobble for a nest site. They feed on marine worms, fly larvae, beetles, insects, crustaceans, mollusks, and other small invertebrates. They forage along the wrack zone, or line, where dead or dying seaweed, marsh grass, and other debris is left on the upper beach by the high tide (FWS 2011a). They do not forage offshore. These birds may cross the Study Area during migration in the spring and fall (by late August for birds leaving

Massachusetts) (Strauss 1990 in Elliot-Smith and Haig 2004; Mac Ivor 1990 in Elliot-Smith and Haig 2004).

Status. A key threat to the threatened Atlantic coast population is habitat loss from shoreline development (FWS 1996). Piping plovers are also very sensitive to human activities; disturbances from anthropogenic activities can cause the parents to abandon their nests. Since the listing of this species under the ESA in 1986, the Atlantic coast piping plover population has increased 234 percent (FWS 2009). Although increased abundance has reduced near-term vulnerability to extinction, piping plovers remain sparsely distributed across their Atlantic coast breeding range, and populations are highly vulnerable to even small declines in survival rates (FWS 2009).

Roseate Tern

Distribution. The roseate tern (*Sterna dougallii*) is a worldwide species that is divided into five subspecies. The Atlantic subspecies (*S. dougallii dougallii*) breeds in two discrete areas in the western hemisphere (FWS 1998). The northeastern population, which is endangered, breeds from New York north to Maine and into adjacent areas of Canada. However, historically this population bred as far south as Virginia, and this state is shown as the southern extent by the FWS (FWS 2011d). Northeastern roseate terns are thought to migrate through the eastern Caribbean and along the northern coast of South America and to winter mainly on the eastern coast of Brazil (FWS 2010a). A second population breeds on islands around the Caribbean Sea from the Florida Keys to the Lesser Antilles. This population, which is listed as threatened, also occurs along the U.S. southeastern coast, where there are occasional breeding records from North Carolina, South Carolina, and Georgia (FWS 2011b).

Life History. The roseate tern is a medium-sized tern that is primarily pelagic along seacoasts, bays, and estuaries, going to land only to nest and roost (Sibley 2000). They forage offshore and roost in flocks typically near tidal inlets in late July to mid-September. Along the Atlantic coast, they nest on islands on sandy beaches, open bare ground, and grassy areas, typically near areas with cover or shelter (NatureServe, InfoNatura 2010).

Roseate terns forage mainly by plunge-diving and contact-dipping or surface dipping over shallow sandbars, reefs, or schools of predatory fish. They are adapted for fast flight and relatively deep diving and often submerge completely when diving for fish (FWS 2011b).

Status. Reasons for the initial listing of the roseate tern included the concentration of the population into a small number of breeding sites and to a lesser extent, declines in population (FWS 1998). The most important factor in breeding colony loss was predation by herring gulls and/or great black-backed gulls. No critical habitat has been designated for the roseate tern.

Bermuda Petrel

Distribution. The endangered Bermuda petrel, or cahow (*Pterodroma cahow*), breeds on five small islands off the southeastern coast of Bermuda from October–June (Warham 1990; Onley and Scofield 2007). When not at their nesting sites, Bermuda petrels forage primarily over deep waters (greater than 200 m) of the continental slope and seaward with no reports from inshore or Atlantic coast terrestrial environments (Brinkley 2012). They are wide-ranging, and there have been confirmed sightings off Georgia, North Carolina, Virginia, and Long Island, New York (Brinkley 2012). From 2009 through 2012, twelve Bermuda petrels were tracked with Lotek data-loggers, which provided evidence that petrels range farther from Bermuda than expected, even into the waters off northeastern Canada (Madeiros 2009; Madeiros undated.)

Life History. Bermuda petrels feed by snatching food by "dipping" or scavenging dead or dying prey floating on or near the sea surface (Warham 1990).

Status. Exploitation of nesting Bermuda petrels by early colonists and introduced predators decimated their numbers. They were initially listed by FWS as endangered in 1970 (FWS 2011c). Successful conservation efforts have increased the population, from 18 nesting pairs in 1960 to 101 breeding pairs in the 2011-2012 breeding season (Madeiros undated), but it remains listed as endangered.

Kirtland's Warbler

Distribution. The endangered Kirtland's warbler (*Dendroica kirtlandi*) has a very limited distribution; it nests in summer in a few areas in Michigan, Wisconsin, and Canada, and winters in the Bahamas. This small bird migrates from Bermuda in April and May, making the trip in about 16 days, and averaging distances of about 144.5 km/day (Ewert et al., 2012). They return to Bermuda in the August-October timeframe (FWS 2012). Both spring and fall migrations are thought to follow a relatively narrow band through southern Michigan, Ohio, West Virginia, western Virginia, and finally North and South Carolina (Mayfield 1992 in FWS 2012). This species would be in the coastal areas of the Carolinas for a narrow window in spring and fall. It would travel over a small section of the Study Area while migrating twice a year.

Life History. The Kirtland's warbler has a very specific nesting requirement, preferring jack-pine trees of a specific size for its nest. It forages on the ground and in trees for insects.

Status. The Kirtland's warbler has been listed as endangered since 1967 (Federal Register 1967). Threats include small population numbers, very specific habitat requirements for nesting, limited geographic distribution on nesting and wintering grounds, and cowbird parasitism. With conservation efforts, its population has increased to 1,828 singing males in 2011 (MDNR unpublished data in FWS 2012) from 432 singing males when the first survey was conducted (Mayfield 1953 in FWS 2012).

3.7.1.2. Species Proposed for ESA-Listing

Red Knot

Distribution. The red knot (*Calidris canutus rufa*) is a medium-sized shorebird that migrates in large flocks along distances between breeding grounds in the mid- and high-arctic areas and wintering grounds in the Caribbean, northern Brazil, and southern South America (Harrington 2001; Morrison et al., 2001a; FWS 2010b; Normandeau Associates, Inc. 2011). They also winter in the U.S. from North Carolina to Texas. They migrate northward through the contiguous U.S. in April-June and southward in July-November. They are only likely to be in the Study Area during their migratory periods. Delaware Bay is the most important spring migration stopover in the eastern U.S. because it is the final stop where most birds can refuel in preparation for their nonstop leg to the Arctic (Clark and Niles 2000; Harrington 2001; NatureServe, InfoNatura 2010; FWS 2010b). Approximately 90 percent of the entire population of the red knot can be present in Delaware Bay in a single day (FWS 2010b). In addition to the large flocks traditionally found in Delaware Bay, flocks of up to 6,000 red knots have been observed from Georgia to Virginia in recent years (FWS 2010b).

Life History. Along the Mid-Atlantic and southeastern coasts, red knots forage along sandy beaches, tidal mudflats, salt marshes, and peat banks (FWS 2010b). In Delaware Bay, they feed primarily on horseshoe crab eggs, and the timing of their arrival within the bay typically coincides with the annual peak of the horseshoe crab spawning period (FWS 2010b).

Status. The red knot was proposed for ESA-listing as threatened on September 30, 2013 (Federal Register 2013a). Surveys at wintering areas and at Delaware Bay during spring migration have indicated a substantial decline in the red knot population (Morrison et al., 2001a; FWS 2010b, 2010c). The decrease in horseshoe crabs, a key food resource, has been implicated as contributing to this decline. Horseshoe crabs are harvested primarily for use as bait and secondarily to support a biomedical industry (Morrison et al., 2004; FWS 2010b, 2010c). The primary identified threat factors described in the proposed listing include loss of habitat due to sea level rise, shoreline stabilization, and Arctic warming; reduced food availability; increased frequency and severity of mis-matches in the timing of the birds' annual migratory cycle; and potential increases of predation in the red knots' breeding ground (Federal Register 2013a).

3.7.1.3. Species under Status Review for ESA Listing

Black-Capped Petrel

Distribution. The black-capped petrel (*Pterodrona hasitata*) nests in the Caribbean, with known populations in Haiti and the Dominican Republic. Even during the breeding season, this seabird is highly pelagic, with birds recorded off the North Carolina coast. These birds can be found off the coast of the northeastern United States south to northeastern Brazil. In the summer months, the black-capped petrels frequent the western edge of the Gulf Stream (Farnsworth 2010).

Life History. There is some evidence that these birds tend to feed at night and at dawn in areas of localized upwelling (Simons et al., 2006). They feed on the water surface or by dipping into the water (Haney 1987). They often rest on the water surface in groups (Goetz et al., 2012).

Status. The black-capped petrel's status is under review for ESA-listing; the FWS published a positive 90-day finding on June 21, 2012. A conservation action plan developed for this species (Goetz et al., 2012) identified a number of threats to the species. The most imminent is the loss of nesting habitat. Other listed threats included changes in prey resources, collisions at sea, oil development, fishery by-catch, climate change, and mercury contamination.

3.7.1.4. Non-Listed Marine and Coastal Birds

There are a number of marine and coastal birds, protected under the Migratory Bird Treaty Act, that can be found in coastal and offshore environments, including both resident and migratory species. Resident species are present throughout the year, migratory species may be present only during breeding and wintering seasons, or they may only migrate through the Study Area. This analysis will focus on three groups: seabirds, waterfowl, and shorebirds, which compose 18 taxonomic families.

Seabirds

Five taxonomic orders of seabirds (broadly defined as those species that spend a large portion of their lives on or over water), including 13 families, are found in both offshore and coastal waters of the Study Area during their annual cycle. Seabirds generally feed on localized concentrations of prey in single- or mixed-species aggregations. Modes of prey acquisition include picking from or diving to the sea surface, plunging below the sea surface, and diving from the sea surface to depths of several meters (Shealer 2002). Species that dive below the sea surface may be exposed to underwater noise. Seabird families that occur within the Study Area that regularly dive below the sea surface include Procellariidae, Pelecanoididae, Sulidae, Phalacrocoracidae, Laridae, and Alcidae. Michel et al. (2013) indicated that gulls, loons, northern gannets, and scoters have been frequently observed over or in the vicinity of offshore shoals, especially during winter. Overwintering birds concentrate in areas that provide suitable foraging habitat with preferred prey and water depths.

Waterfowl

Waterfowl that occur within coastal and inshore waters of the Study Area include members of two subfamilies: Aythyinae (diving ducks) and Merginae (sea ducks) (Sibley 2000). Diving ducks include the canvasback, redhead, tufted duck, ring-necked duck, and scaup. They are gregarious and are mainly found on fresh water or estuaries, though species such as the greater scaup become marine during the winter. Diving ducks feed on aquatic vegetation, mollusks, and crustaceans. Sea ducks that could occur within the Study Area include eiders, scoters, mergansers, goldeneyes, buffleheads, scaups, long-tailed ducks, and harlequin ducks. Most sea duck species are essentially marine outside of their breeding season. Depending on the species, they feed on fishes, mollusks, and small invertebrates (Sibley 2000). Similar to diving seabirds, sea ducks and some diving ducks could be vulnerable to underwater noise produced during survey activities, especially those that may be affiliated with shoal ecosystems (Michel et al. 2013). Some dive to great depths—for example, the long-tailed duck can dive as deep as 60 meters to forage. It can also spend considerable time underwater—as much as three to four times underwater as above the water (Robertson and Savard 2002).

Shorebirds

The term shorebird applies to a large group of birds including sandpipers, plovers, oystercatchers, avocets, and stilts. Thirty-five representatives from four shorebird families are present in coastal areas of the Atlantic during their annual cycle (O'Connell et al., 2011). All four families are in one taxonomic order, Charadriiformes. The total number of shorebirds present varies by latitude and time of year. Recent trend analyses of shorebird populations indicate that many species are declining (Morrison et al., 2001b, 2006). The Atlantic coast beaches and bays have high quality environments that are essential to shorebirds as habitat and also provide critical stopover areas during migration (Brown et al., 2001). They may cross the Study Area during spring and fall migrations.

3.7.1.5. Bats

There are 47 species of bats living in the United States, with 20 species found in the U.S. states bordering the Atlantic (BCI, 2013.) In temperate regions, bats migrate or hibernate during the winter. Most species hibernate, but several species migrate long distances, traveling from as far north as Canada to the southern United States (BCI, 2013). Concerns about the conservation of bat species has been heightened in recent years due to massive die-offs associated with white-nose syndrome (WNS) disease.

Threatened and Endangered Species

The Northern Long-Eared Bat

Distribution. The northern long-eared bat can be found in much of the eastern and north-central United States and all the Canadian providences west to the southern Yukon. Along the Atlantic coast, that includes all the coastal states from Maine to Florida (Federal Register 2013b). However, its distribution is patchy in most of its range, with greatest abundance historically in the east (Caceres and Barclay 2000).

More than 780 hibernacula have been identified throughout the U.S., although some contain only a few individuals (Whitaker and Hamilton 1998 in Federal Register 2013b). Northern long-eared bats generally overwinter in hibernacula that include caves and abandoned mines. During the summer they roost singly or in colonies in live trees or snags. While not a long-distance migrator, movements between summer habitats and winter hibernacula may be on the order of 35–55 miles (Nagorsen and Bringham 1993; Griffin 1945).

Life History. It is believed that mature forests are an important habitat for foraging northern long-eared bats (Caceres and Pybus 1997, but they can also forage over forest clearings and water and along roads (Van Zyll de Jong 1985 in Federal Register 2013b). The most common prey items are moths, beetles, and spiders (Feldhamer et al., 2009). Food is caught in-flight or on surfaces.

Information regarding the presence of bats in the offshore environment is limited. Although bats have been confirmed to occur offshore, with some species using the offshore environment to migrate or forage, little is known about the species-specific patterns or the numbers relative to offshore (Pelletier et al., 2013). Visual observations have recorded migratory and non-migratory bats hunting over water (Ahlen et al., 2007). Ahlen et al. (2009) found the majority of migrating bats flew low over water. Surveys have, in a few cases, identified the northern long-eared bat species on islands offshore from the coasts of Canada, Maine, and Massachusetts (Broders et al., 2003; Zimmerman 1998 in Pelletier et al., 2013; Buresch 1999 in Pelletier et al., 2013). One of the most comprehensive studies off the east coast using acoustical monitoring grouped all *Myotis* species because of difficulties discerning individual species' calls. But the study did conclude that bats were active as far as 13 nmi beyond the seaward limit of the states' boundaries. Also, both migratory and non-migratory bats could be found offshore (Pelletier et al., 2013).

Status. The northern long-eared bat (*Myotis septentrionalsis*) is a member of the Vespertilionidae family in the order Chiptera. It has been proposed for listing throughout its range (Federal Register 2013b). Due to the WNS disease, the northern long-eared bat has experienced a deep decline in the northeastern part of its range (Federal Register 2013b). Although some bat species populations stabilized at drastically reduced levels, 14 populations of northern long-eared bats became extinct within 2 years of the disease's onset (Langwig et al., 2012). During 2013 hibernacula surveys at 34 sites in Pennsylvania, researchers found a 99 percent decline in population (from 637 to 5 bats) (Turner, 2013, unpublished data in Federal Register 2013b). Although the disease has not reached all parts of its entire range, it continues to spread. WNS has already had a substantial effect on the species in the core of its range within a short time; the disease is considered to be the predominant threat to bats rangewide (Federal Register 2013b).

3.7.2. Environmental Consequences

3.7.2.1. Alternative A: The Proposed Action

Noise from Active Sound Sources and Vessel Operations

The primary potential for impacts on marine and coastal birds from the use of the proposed electromechanical sources is to seabirds and waterfowl that dive below the water surface and would, therefore, be exposed to underwater noise (Turnpenny and Nedwell 1994). Generally, birds have a relatively restricted hearing range in air, from a few hundred hertz to about 10 kHz (Dooling and Popper 2000). There is very limited data regarding the hearing range of bird species for underwater noise. One study examining hearing in a cormorant species, a kind of seabird, did conclude that its hearing sensitivity in water is higher than would have been expected for a purely in-air adapted ear and that it was likely that cormorants can actively use their hearing underwater (Johansen et al., 2013).

Vessel noise is one of the main contributors to overall noise in the ocean (National Research Council, 2003; Jasny et al., 2005). The G&G survey vessels would locally increase noise levels in both air and underwater. The noise generated by individual vessels, engine noise, propeller cavitation and proposed geophysical survey equipment (e.g., sub-bottom profilers) would fall within the airborne hearing range of birds, whereas noise generated by other types of survey equipment (e.g., side-scan sonar, depth sounders operating above 200 kHz) would be outside of their airborne hearing range and is likely to be inaudible to birds underwater. Sediment sampling would be conducted using a vibracore, which produces a short-duration broadband noise with peak frequency less than 1 kHz. Source levels are generally expected to be less than 180–190 dB re 1 µPa @ 1 m depending on the intensity of the vibrations, barrel material, and nature of sediment penetration (Reiser et al., 2011). If birds can hear within the same range for underwater noise as their airborne hearing range, the survey activities and sediment sampling using a vibracore have the potential to disturb diving seabirds and waterfowl.

Diving seabirds and waterfowl such as members of the families Alcidae, Gaviidae, Phaethontidae, Phalacrocoracidae, Sulidae, Hydrobatidae, Procellariidae, Podicipediformes, and Anatidae could be susceptible to active acoustic sounds generated from surveys, especially those species that would dive, rather than fly, away from a vessel (e.g., grebes, loons, alcids, and some diving ducks). Those species that plunge-dive face the greatest risk of exposure since the relevant sound sources are directed downward and are highly attenuated near the surface. These same sources are also towed near the seafloor; both the deployment and transmission characteristics diminish the risk to bird species, other than plunge-diving species. However, impacts would be minimized because (1) the level of vessel activity per survey event is not a significant increase in the background vessel noise level, (2) the vessels move at slow speeds, minimizing source levels, and (3) noise levels dissipate quickly with distance from the vessel. Based on these measures and the directionality of the sound generated from lower-frequency equipment used for geophysical surveys, it is expected that there would be no mortality or life-threatening injury, and there would be limited disruption of behavioral patterns or other effects on diving seabirds or waterfowl from active acoustic sound sources, resulting in a negligible impact. Among the species that are ESA-listed, proposed for listing, or under status review, piping plover and red knot are unlikely to be in the area targeted for study. Roseate terns are comparatively more likely to be exposed to underwater sound, because they forage offshore and feed by plunge-diving, often submerging completely when diving for fish. However, their exposure would be somewhat limited by the exclusion of Nantucket Sound and Cape Cod Bay from the Study Area and, depending on timing, time-area closures designed to reduce potential noise- and strike-related impacts on North Atlantic right whales. The Bermuda petrel is also known to occur in the Atlantic offshore environment, but it feeds by snatching prey from the sea surface and is most likely to feed in areas of waters deeper than are found in the Study Area. The black-capped petrel concentrates its feeding in the western edge of the Gulf Stream, which is outside of the Study Area. It is uncertain how much time the northern long-eared bat spends offshore; there is some evidence of occurrence on islands. But there is no evidence that it feeds by diving so it would not be exposed to underwater sound. Both the northern long-eared bat and the black-capped petrel feed at night; the plan is to minimize surveys at night. The Kirtland's warbler would only transit through the Study Area while migrating and would not be exposed to underwater sound.

Seabirds and waterfowl that dive below the water surface include members of the Alcidae, Gaviidae, Phaethontidae, Phalacrocoracidae, Sulidae, Hydrobatidae, Procellariidae, Podicipediformes, and Anatidae families. Some seabirds and waterfowl, including members of the families Laridae, Rhyncopidae, Pelicanidae, Fregatidae, and Anatidae, either rest on the water surface or shallow-dive for short durations. Most of the seabirds and waterfowl that would be resting on the water surface in the area surrounding the G&G vessel would be dispersed, and therefore, they would not be exposed to underwater noise. However, those birds that dive could be exposed to underwater noise.

Some seabirds and waterfowl, including members of the families Laridae, Rhyncopidae, Pelicanidae, and Fregatidae, as well as the endangered Bermuda petrel and the black-capped petrel, either rest on the water surface, skim the water surface, or shallow-dive for short durations. Because of these behaviors, members of these families are not expected to be exposed to underwater vessel noise generated from G&G survey vessels, or the exposure would be for such a short time that it would result in little disruption of behavioral patterns or other non-injurious effects. For non-diving birds, the impacts of vessel noise and traffic on these seabirds and waterfowl (including both petrels) from vessel and equipment noise would be negligible. For shorebird species, including piping plover and red knot, it is expected that underwater noise would produce negligible impacts because of the distance offshore and rapid attenuation of underwater noise from survey vessels prior to reaching shore/beach habitat.

In-air noise and vessel presence could disturb and displace both diving and non-diving birds temporarily. Marine and coastal birds require specialized habitat requirements for feeding (Kushland et al., 2002). Survey vessel and equipment noise could cause pelagic bird species, including members of the families Laridae, Stercorariidae, Alcidae, Pelicanidae, Phaethontidae, Sulidae, Fregatidae, Hydrobatidae, Hydrobatidae, and Procellariidae, to relocate to alternative areas. These alternative areas may not provide food sources or habitat requirements similar to that of the original (preferred) habitat, and could result in additional energetic requirements expended by the birds and diminished foraging opportunity. However, it is expected that the area of disturbance would be limited relative to most species foraging areas and the impacts on pelagic birds from disturbance associated with vessels would be negligible.

Vessel Presence/Traffic

Most survey activities have the potential to disturb marine and coastal birds from vessel traffic and the associated vessel operation noise (as discussed under *Noise from Active Sound Sources and Vessel Operations*). The effects of disturbance by vessels would be negligible since both petrels are more likely to forage farther offshore than the Study Area. The piping plover and red knot would likely be in the Study Area only for a short period during migration. The Kirtland's warbler would be in the offshore environment only twice a year during migration and would not be feeding or resting on the water and would not be disturbed. The roseate tern could be disturbed, but the geographic limits on the surveys would reduce its exposure (i.e., the exclusion of Nantucket Sound from the Study Area and, depending on timing, time-area closures designed to reduce potential noise- and strike-related impacts on North Atlantic right whales). Bats, including the northern long-eared bat, should have limited exposure since geophysical surveys would occur to the maximum extent possible during daylight hours. The impacts of vessel traffic are expected to be negligible for at-risk species.

Lighted boats could attract bats and birds at night. This could disrupt behaviors like migration and feeding. To avoid impacts, geophysical surveys would occur to the maximum extent practicable in daylight hours. If nighttime geophysical surveys are required, the lighting effects would be decreased through reduction, shielding, lowering, and appropriate placement of lights to the minimum standard required by the USCG and the Occupational Safety and Health Administration to avoid attracting or disturbing birds and bats. The effects on birds and bats, including at-risk species, are expected to be negligible.

Vessels could disturb breeding birds if a vessel approached too closely to a breeding colony. The G&G surveys would not occur close enough to land to affect marine and coastal bird breeding colonies during survey activities. However, survey vessels could transit from a shorebase to offshore and return daily. The expectation is that these transits would occur from established ports, which have established transiting routes for vessel traffic. Because of this existing vessel traffic, it is not anticipated that marine and coastal birds would roost in adjacent areas, or if they did roost nearby, the addition of G&G survey vessels would not significantly increase the existing vessel traffic. Therefore, the impacts of vessel traffic and presence on nesting or roosting marine and coastal birds would be negligible.

Vessel Waste and Accidental Discharges

Trash and Debris: Surveying activities can generate trash; most trash is associated with galley and offshore food service operations. Plastic, in particular, poses a potential hazard to most marine life, including seabirds through entanglement or ingestion (Laist 1987). Plastic accumulation in seabirds has been correlated with the body burden of polychlorinated biphenyls, which can cause lowered steroid hormone levels and result in delayed ovulation and other reproductive problems (Pierce et al., 2004). To minimize loss of wastes to the marine environment, BOEM requires operators to develop a marine pollution control plan for all G&G survey activities performed as part of the proposed action. The marine pollution control plan must address the marine debris awareness requirement.

Survey vessels performing work within the U.S. jurisdictional waters are expected to comply with Federal regulations, which implement MARPOL 73/78. All vessel operations must be compliant with USCG regulations and the U.S. Environmental Protection Agency's Vessel General Permit, as applicable. BOEM, USCG, and USEPA, as necessary, will be notified of a noncompliant discharges and remedial actions taken. Reports of the incident and resultant actions will be provided to BOEM. The amount of trash and debris dumped offshore would be minimal, as only accidental loss of trash and debris is anticipated. Therefore, impacts from trash and debris on marine and coastal birds would be negligible.

Accidental Spills: Although unexpected, an accidental event could result in release of fuel or diesel from a survey vessel; the size of the spill would be depend on the fuel tanks of the vessels used, but are expected to be limited to small- and medium-sized vessels. Spills occurring at the ocean surface would disperse and weather. Volatile components would evaporate. Fuel and diesel used for operation of survey vessels is light and would float on the water surface. There is the potential for a small proportion of the heavier fuel components to adhere to particulate matter and sink. An accidental spill could occur offshore or nearshore, and the marine and coastal bird species affected and the type of effect would differ depending on the location of the spill (Wiese and Jones, 2001; Castege et al., 2007). If an accident occurred in nearshore waters, shorebirds, including piping plover and red knot; waterfowl; and coastal seabirds, including the roseate tern and members of the Laridae, Rhyncopidae, Gaviidae, Pelicanidae, Phalacrocoracidae, Fregatidae, and Podicipedidae families, could be impacted. Direct impacts could include physical oiling of individuals. In general, the effects of oil spills on coastal and marine birds include: the potential for tissue and organ damage from oil ingested during feeding and grooming and from inhaled oil; loss of buoyancy; inability to thermoregulate; stress that could result in interference with food detection and predator avoidance; disruption of migration; and respiration issues. The degree of these potential effects depends on the nature and duration of exposure.

Because of the relatively small spill size, clean-up requirements, and rapid weathering of residual fuel, the area and duration of impact would be limited. To avoid spills and to minimize their effects a number of mitigation requirements are included in this proposal. These include requirements that sufficient spill response equipment and supplies shall be available onboard (or readily mobilized with a secondary vessel) to contain and recover the maximum scenario spill keyed to the proposed operations and disclosed in the marine pollution control plan. In addition, vessel fueling would only occur in-port at a docking facility; no at-sea cross-vessel fueling would be permitted.

If an accidental fuel spill did occur within nearshore waters, impacts on shorebirds, waterfowl, and seabird species would range from negligible to minor depending on timing, size, and location of the spill. Since the populations of piping plover, roseate tern, and red knot are already in peril, if an accidental fuel spill affected any of these species or their food supply, there could be minor to moderate impacts on these species. The petrels would unlikely be affected since they nest in the Caribbean and forage further offshore. The Kirtland's warbler would not be in contact with the water on its migratory flights so it would not be impacted. Bats, including the northern long-tailed bat, would also not be impacted.

If the accidental event occurred in offshore waters, fuel and diesel would float on the water surface. There is a small potential for oceanic and pelagic seabirds to be directly and indirectly affected by spilled diesel fuel during resting or foraging. Both petrels can rest on the water in groups, putting them at greater risk of exposure. Impacts would be similar to those described above.

Impacts on oceanic and pelagic birds from a spill incident involving survey vessels within offshore waters would range from negligible to minor. If an accidental fuel spill affected the Bermuda petrel or the black-capped petrel, there could be a minor to moderate impact on those species. However, they generally forage further away from the coast. The piping plover, red knot, Kirtland's warbler, and northern long-eared bat are unlikely to be in contact with offshore water, so no impact would be expected. Roseate terns could be affected; however, their exposure would be somewhat limited by the exclusion of Nantucket Sound from the Study Area and, depending on timing, time-area closures designed to reduce potential noise- and strike-related impacts on North Atlantic right whales. Impacts on the roseate tern could range from negligible to minor.

3.7.2.2. Alternative B: Additional Operational Restrictions and Time-Area Closures

Impacts on coastal and marine birds and bats from implementing Alternative B: Most of the disturbance factors would be very similar to those from Alternative A. If multiple mobilizations to the same area are required under this alternative, it is possible that increased impacts on avian resources could occur from increased disturbance and accidental releases of trash, debris, and fuel or other vessel fluids. Additional restrictions on nighttime activity off Florida would further decrease impacts of lighting on birds and bats. Source frequency restrictions to protect loggerhead turtles could also decrease noise in the audible range of birds. Similarly, seasonally based time-area closures in HAPCs important for spawning and nursery functions, especially cape-associated shoals, would incidentally reduce noise and vessel-related disturbances to resting, foraging, diving, or migrating birds. However, the overall intensity of effects would not be substantially different from Alternative A, given the short-term duration of G&G operations, avoidance behavior likely to be demonstrated by most species, and the relatively small numbers expected to be present in those offshore areas (Michel et al., 2013).

3.7.2.3. Alternative C: No Action Alternative

Under the no action alternative, the proposed action would not occur and a comprehensive inventory of sand resources within the Atlantic OCS would not be conducted. There would be no disturbances to avian resources. Therefore, no impacts on birds or bats would occur as a result of implementing the no action alternative.

3.8. Historic/Pre-Contact Resources

The NHPA (16 U.S.C. 470 et seq.) established a national program to preserve the country's historical and cultural resources. Section 106 of the NHPA requires Federal agencies to take into account the effects of their undertakings (actions) on historic properties. Regulations for implementing the Section 106 process are provided in 36 CFR 800. Both state and Federal guidelines for cultural resources recognize that historic properties, including buildings, structures, objects, districts, archaeological sites, and cultural landscapes, can be historically significant.

Historic properties (i.e., archaeological resources) on the OCS include historic shipwrecks, sunken aircraft, and pre-contact archaeological sites that have become inundated as a result of the 394-foot (120-m) rise in global sea level since the maximum extent during the last Ice Age (approximately 19,000 years ago). The OCS is not federally owned land, and the Federal Government has not claimed direct ownership of historic properties on the OCS; therefore, BOEM only has the authority to ensure that their funded and permitted actions do not adversely affect significant historic properties. Beyond avoidance of adverse impacts, BOEM does not have the legal authority to manage the historic properties on the OCS.

3.8.1. Affected Environment

Submerged cultural resources within the Study Area primarily include shipwrecks that date from early exploration and settlement of North America by Europeans (16th and 17th centuries) through World War II and the Cold War period. Submerged pre-contact sites dating between 30,000 and 3,000 years before present could also exist within the Study Area, depending on regional landform variation and the coastal processes associated with sea level rise.

Because of the rich maritime history and potential for submerged pre-contact resources in the Study Area, all activities that disturb the seafloor have potential to impact previously recorded and unrecorded cultural resources. The potential for impacts on cultural resources resulting from G&G surveys would be associated with sediment sampling activities and anchoring. By implementing the mitigation measures noted in Section 2.2.7 and those noted in the "Finding of No Historic Properties Affected" document (Appendix B), BOEM can ensure that physical impacts on cultural resources identified during geophysical surveys can be avoided. If, during the course of G&G activity, it is determined that a potential shipwreck or pre-contact site has been located, the operator would immediately halt operations and take the necessary steps to ensure that the site is not disturbed further. BOEM must also be notified within 24 hours of the discovery.

3.8.1.1. Historic Shipwrecks

While European voyagers have been exploring the North Atlantic seaboard since A.D. 1000, it was not until the 16th century that expeditions reached the Mid-Atlantic and South Atlantic regions. Shipwrecks within the Study Area date from the 16th century until modern times; it is highly unlikely that earlier shipwrecks could be located due to preservation factors and the limited number of early pre-16th century voyages.

A recent study by TRC Environmental Corporation (TRC 2012) concluded that there may be up to 9,150 wrecks within the Federal portion of the Atlantic OCS. The distribution of these wrecks appears to be closely correlated to major ports and associated vessel traffic; especially where navigational hazards exist in the vicinity of port approaches. Of those 9,150 wrecks, further geo-spatial analysis revealed that approximately 1,488 shipwrecks may potentially be found in the Study Area. Table 3-8 provides a breakdown on the potential number of historic shipwrecks within the Study Area.

Table 3-8. Distribution of Potential Shipwrecks in the Study Area

Planning Areas	Nearest State	Number of Wrecks	Number of Wrecks per Planning Area	Number of Wrecks in the Study Area
North Atlantic	ME	137	3,185	826
	NH	10		
	MA	762		
	RI	140		
	CT	13		
	NY	371		
	NJ	1,752		
Mid-Atlantic	DE	310	4,252	348
	MD	630		
	VA	1,701		
	NC	1,611		
South Atlantic/Straits of Florida	SC	435	1,713	314
	GA	160		
	FL	1,118		
Totals			**9,150**	**1,488**

Source: Modified from TRC 2012

3.8.1.2. Pre-contact Resources

Offshore archaeological resources that may exist within the proposed Study Area may also include submerged pre-contact sites or relict landforms that have a potential to contain these sites. None of these sites have been previously identified within the proposed Study Area; however, the area is within a region of the OCS that was formerly exposed above sea level and available to human occupation during the last ice age. Because of this, the entirety of the proposed Study Area is within an area considered to have the potential for the presence of submerged pre-contact archaeological sites (TRC 2012).

If these sites endured the coastal processes associated with sea level rise in an undisturbed form, they could exist below the sand layers, particularly geological facies dating to the Holocene and Pleistocene epochs. Since the purpose of the proposed project would be to characterize sand resources on the Atlantic OCS, it is unlikely that these layers would be disturbed during geological sampling. The potential for impacts on pre-contact cultural resources resulting from G&G surveys can be avoided by implementing the mitigations noted in Section 2.2.7 and those noted in the attached Finding of No Historic Properties Affected.

3.8.2. Environmental Consequences

3.8.2.1. Alternative A: Proposed Action

Because of the rich maritime history and potential for submerged pre-contact resources in the Study Area, all activities that disturb the seafloor have potential to impact previously unrecorded cultural resources. Potential impacts on cultural resources resulting from G&G surveys would likely be associated with geological sampling and anchoring. Bottom sampling, coring activities, anchor placement, and anchor dragging across the seafloor have the potential to adversely affect both historic and pre-contact archaeological resources

Because of the rarity of these nonrenewable submerged cultural resources and the high potential for information loss and damage, impacts on submerged archaeological resources can be potentially significant. However, the potential for impacts on pre-contact cultural resources resulting from G&G surveys can be avoided by implementing the mitigations in Section 2.2.7 and the Finding of No Historic Properties Affected. Adherence to these mitigation measures ensures that historic and pre-contact submerged cultural resources would not be affected. Areas identified with potential historic shipwreck or pre-contact archaeological resources should be assigned an avoidance zone for all activities. If, during the course of G&G activities, it is determined that a potential shipwreck or pre-contact site has been located, the operator must immediately halt operations and take the necessary steps to ensure that the site is not disturbed further. BOEM must also be notified within 24 hours of the discovery. If protective measures are followed, no adverse impacts would occur on submerged cultural resources or archaeological resources from seafloor disturbance associated with G&G actions.

3.8.2.1. Alternative B: Additional Operational Restrictions and Time-Area Closures

Impacts would be similar to, but slightly greater than, those discussed under Alternative A. Impacts would be slightly greater than Alternative A due to the potential for multiple surveys occurring in one location, which could increase the possibility of anchoring or other seafloor-disturbing activities that could impact submerged cultural resources. However, mitigation measures would be implemented to reduce the potential for impacts to occur, as discussed above and in Section 2.2.7.

3.8.2.2. Alternative C: No Action Alternative

Under the no action alternative, no G&G activities would be conducted, and therefore, no impacts on historic/pre-contact resources would occur.

3.9. Recreation

3.9.1. Affected Environment

A mixture of public, private, and residential beaches from Maine to southern Florida are adjacent to the Study Area. The scenic and aesthetic values of these diverse coastal areas play an important role in attracting visitors, providing a rich recreational and tourist experience, and driving the economies of coastal communities. Offshore recreational activities consist of game and sport fishing, charter boat fishing, sport diving, water skiing, swimming, dolphin and whale watching, sailing, and power cruising. Fishing activities are discussed below in Section 3.10, *Recreational and Commercial Fishing*.

3.9.2. Environmental Consequences

3.9.2.1. Alternative A: Proposed Action

Effects on recreation due to the proposed action could result from slight, temporary changes in the viewshed and a negligible increase in vessel traffic. A small number of small vessels operating offshore could have a limited and short-lived impact on the viewshed. Lights from survey vessels operating at night could be visible, especially from locations such as elevated viewpoints along the coastline. Vessel traffic would use established approach channels and traffic lanes to the extent possible, and would not travel close to the shoreline except when leaving and entering a port during mobilization, demobilization, and refueling. Existing port facilities and shorebases would be used to support vessel operations, including refueling. Any adverse impact on offshore recreation from the additional vessels associated with the proposed action is unlikely.

3.9.2.2. Alternative B: Additional Operational Restrictions and Time-Area Closures

Implementing Alternative B could result in additional impacts on recreation when compared with Alternative A. The additional impacts would primarily be due to the potential for increased vessel traffic, which could introduce additional viewshed impacts, especially if nighttime surveying were to occur and lighting was required.

3.9.2.3. Alternative C: No Action Alternative

Under the no action alternative, the proposed G&G survey activities within the Study Area would not occur. No impacts on recreation would be anticipated.

3.10. Recreational and Commercial Fishing

3.10.1. Affected Environment

The Study Area is used for both recreational and commercial fishing. Along the Atlantic coastal states, recreational and commercial fishing are significant drivers of the marine economies and are also important for their contributions to coastal communities (NMFS 2012; NMFS 2013b).

As shown in Table 3-9, there are approximately 30 million recreational anglers along the east coast. Of those, only about 6 percent take trips offshore 2 to 300 nmi.

Table 3-9. Economic Factors Related to Recreational Angling along the East Coast

Economic Factor	East Coast States
Number of recreational anglers (millions)	30.087
Average percent of anglers living outside the state	42
Average percent of fishing trips between 3 and 200 nmi	6
Total jobs supported by recreational fishing	103,648

Source: Modified from Navy 2013

Recreational anglers fish for recreationally permitted species via personal vessels, party boats, and/or chartered vessels. The top recreational fish species caught in different geographies are provided on an annual basis by NMFS Office of Science and Technology (NMFS 2013b; NOAA 2013c). Of the United States' key recreational species or species groups, herring, Atlantic croaker and spotted seatrout were caught most often by recreational anglers in 2011 (NMFS 2013a). The most commonly caught non-bait species for Atlantic states were summer flounder, bluefish, Atlantic croaker, black sea bass, and scup. The species most commonly caught on Atlantic coast trips that fished primarily in federally managed waters were black sea bass, Atlantic cod, summer flounder, dolphinfish, and bluefish.

Major commercial fisheries are supported by New England and the mid-Atlantic ports. Commercial fisheries are concentrated seaward to 200 nmi and are managed either by NMFS or by each state's natural resources or wildlife department. The NMFS has determined that 16 percent of the federally managed U.S. marine fish stocks studied are subject to overfishing and that the rate of removal of these stocks is too high. In addition to federally managed fish, the agency also determined that 23 percent of U.S. marine fish stocks studied are overfished, indicating that the population is too low or below a prescribed threshold to sustain the Nation's fisheries (NMFS 2010b). Commercial species often have Federal and state quotas to manage landings, seasonal closures, and gear restrictions to reduce overfishing. The number of pounds of fish caught in the United States by commercial fishing efforts has been decreasing since the mid-1990s, although the total value of fish caught has increased (NOAA 2013d). Top commercial fish in the Study Area include American lobster, sea scallop, blue crab, white shrimp, and menhaden (NMFS 2013b; NOAA 2013d). Commercial anglers use mobile and fixed gear (trawls, dredges, longlines, pots and traps, weirs, purse seines, and gill nets) to catch fish.

3.10.2. Environmental Consequences

3.10.2.1. Alternative A: Proposed Action

Potential multiple use effects on recreational and commercial fishing include short-term displacement of fishing activities and potential damage to fishing equipment. Any physical disturbance in the ocean or on the ocean floor, such as deployment of the vibracoring rig, use of a towed system, or anchoring could inadvertently damage submerged fishing equipment and gear. Areas in which commercial and recreational fishermen would be temporarily excluded from are relatively small in relation to the overall fishing grounds. G&G surveys would generally occur landward of fishing grounds, therefore impacts on fishing due to required changes to navigation necessary to reach fishing areas would be minimal. BOEM would require survey vessels to report AIS location data real-time, be flagged and use required lighting schemes during survey activities, communicate with observed fisheries vessels, and avoid fishing gear by a minimum distance. These measures would substantially reduce the potential for space-use conflicts. Any effect on fishing would be further minimized to negligible levels with advance public notification through the use of Notices to Mariners.

3.10.2.1. Alternative B: Additional Operational Restrictions and Time-Area Closures

Impacts on recreational and commercial fishing would be similar to, but slightly greater than, those discussed for Alternative A. Implementing Alternative B could result in additional vessel traffic to conduct sequential survey work, which could temporarily exclude fisherman from specific areas that could be fished. However, these impacts would be short-term and negligible.

3.10.2.2. Alternative C: No Action Alternative

Under the no action alternative, the proposed action would not occur. There would be no impacts on recreational and commercial fishing.

3.11. Marine Transportation

3.11.1. Affected Environment

The coastal zone and inner shelf offshore the U.S. east coast is heavily traveled by marine vessels, including commercial shipping traffic transiting to and from major coastal ports. Recreational boaters are regularly found in the same area. Vessel traffic in the vicinity of the Study Area is supported by a complex network of navigation features, including shipping lanes, traffic separation schemes, and navigational aids. Deepwater commercial ports along the coast adjacent to the Study Area include Boston, Massachusetts; New York/ Newark, New York/New Jersey; Norfolk, Virginia; Wilmington, North Carolina; Charleston, South Carolina; Savannah, Georgia; Brunswick, Georgia; and Jacksonville, Florida. In addition, Delaware Bay provides access to Delaware River ports and terminals in the Wilmington, Delaware, and Philadelphia, Pennsylvania, areas and to the Port of Baltimore via the Chesapeake and Delaware Canal. Chesapeake Bay provides access to the Port of Baltimore and numerous smaller ports in Maryland and Virginia. Large commercial vessels (cargo ships, tankers, and container ships) use these ports to access overland rail and road routes to transport goods throughout the U.S. More than 54,000 vessel transits (involving commercial vessels of at least 150 gross registered tons) occur at U.S. east coast ports per year, a significant proportion of which either use Atlantic coast ports or traverse waters of the Study Area during inbound or outbound transit. Figure 3-6 shows vessel traffic density, principal ports, and the Study Area. Vessels operating in the vicinity of these ports, navigation routes, and the general Study Area could include cargo ships such as tankers, bulk carries, and tug and barge units; passenger ferries; naval vessels; government research, enforcement, and search and rescue vessels; pilot boats; and fishing and recreational crafts.

3.11.2. Environmental Consequences

3.11.2.1. Alternative A: Proposed Action

It is highly likely that commercial and recreational vessels would be encountered during proposed G&G surveys and mobilization/demobilization trips. The limited number of comparatively small and highly maneuverable survey vessels that would be used during G&G surveys would not substantially increase vessel traffic density when compared to existing vessel traffic in existing traffic patterns. Survey operations would occur primarily outside the principal transportation corridors. Vessel flagging and lighting, as well as mandatory broadcast of vessel position using AIS data would allow survey vessels to minimize navigational conflicts with other vessels operating in the same vicinity (see Section 2.2.7 for a description on mitigation measures). Any effect on vessel traffic outside of established waterways and airways, including potential delays from rerouting, would be further minimized to negligible levels due to advance public notification through the use of Notices to Mariners.

3.11.2.2. Alternative B: Additional Operational Restrictions and Time-Area Closures

Implementing Alternative B would result in impacts similar to, but slightly greater than, those described under Alternative A for marine transportation. Alternative B could require sequential, additional mobilizations and vessel traffic, which would result in increased impacts on marine transportation. However, impacts would be short-term and negligible, and further reduced through mitigation measures and protocols discussed previously.

3.11.2.3. Alternative C: No Action Alternative

Under the no action alternative, the proposed action would not be implemented and no G&G survey work for sand resource identification would occur. No impacts on marine transportation would be expected.

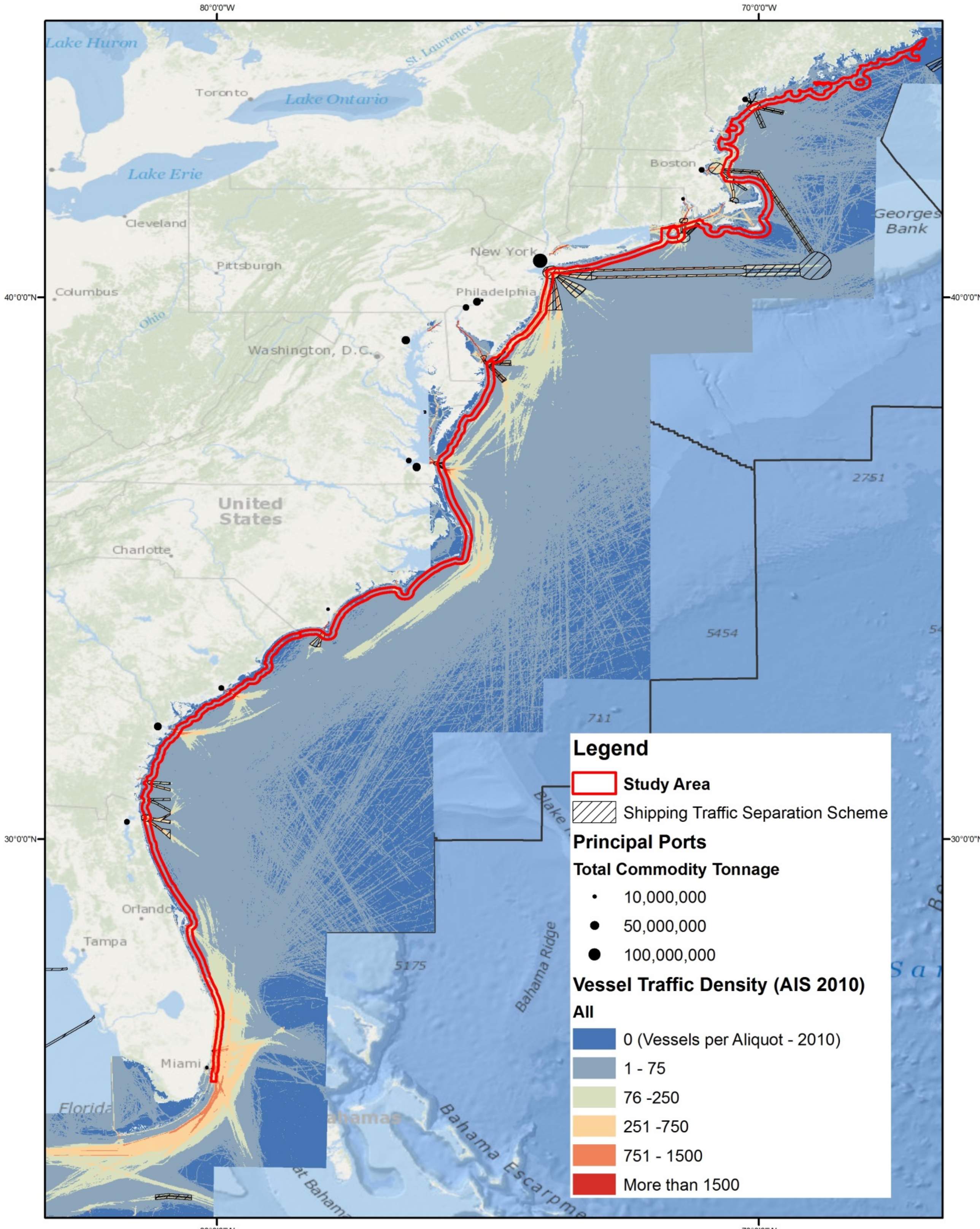


Figure 3-6. Vessel Traffic Density, Port Location, and Shipping Traffic Separation Scheme

3.12. Military and Civilian Space Program Uses

3.12.1. Affected Environment

Military activities can include various air-to-air, air-to-surface, and surface-to-surface naval fleet, submarine, and antisubmarine training exercises. The U.S. Air Force, Navy, Marine Corps, and Special Operations Forces conduct various testing and training missions in military operating areas that partially overlap with the Study Area (Navy 2013). Figure 3-7 shows the major military and other restricted use areas along the Atlantic coast. A comprehensive summary and analysis of current and expected future U.S. Navy operations within and adjacent to the Study Area can be found in several recent Navy EISs (e.g., *Atlantic Fleet Training and Testing (AFTT) EIS/OEIS* (Navy 2013)). The U.S. Navy, U.S. Coastal Guard, Air Force, and Air National Guard also conduct search and rescue missions and training on the Atlantic coast.

Additionally, the National Aeronautics and Space Administration has designated downrange danger zones by identifying patterns for recent debris cones from rocket tests that represent hazards for surface activities after such tests. There are also restricted areas for rocket testing, satellite launches, and other range mission activities. National Aeronautics and Space Administration -restricted areas within the Study Area include areas offshore the Goddard Space Flight Center's Wallops Island Flight Facility in Virginia, and offshore of the Kennedy Space Center at Cape Canaveral, Florida.

3.12.1. Environmental Consequences

3.12.1.1. Alternative A: Proposed Action

Direct impacts on military and civilian space program activities could occur as a result of the incremental increase in vessel traffic from G&G survey vessels, but the effect should be minor and short-term, given the limited footprint and duration of the survey activity.

3.12.1.2. Alternative B: Additional Operational Restrictions and Time-Area Closures

Under Alternative B, additional vessel traffic could be required, which would introduce impacts that would generally be similar to, but slightly greater than, those discussed under Alternative A. Depending on actual survey areas and proposed survey timing, time-area closures, designed for the protection of HAPCs especially in the vicinity of shoal complexes in the South Atlantic, may also reduce the number and frequency of space conflicts with military and space program exercises where such activities are prominent.

3.12.1.3. Alternative C: No Action Alternative

Under Alternative C, the proposed action would not be implemented and G&G survey work to comprehensively identify additional OCS sand resources would not occur. No impacts on military and civilian space program uses would be anticipated.

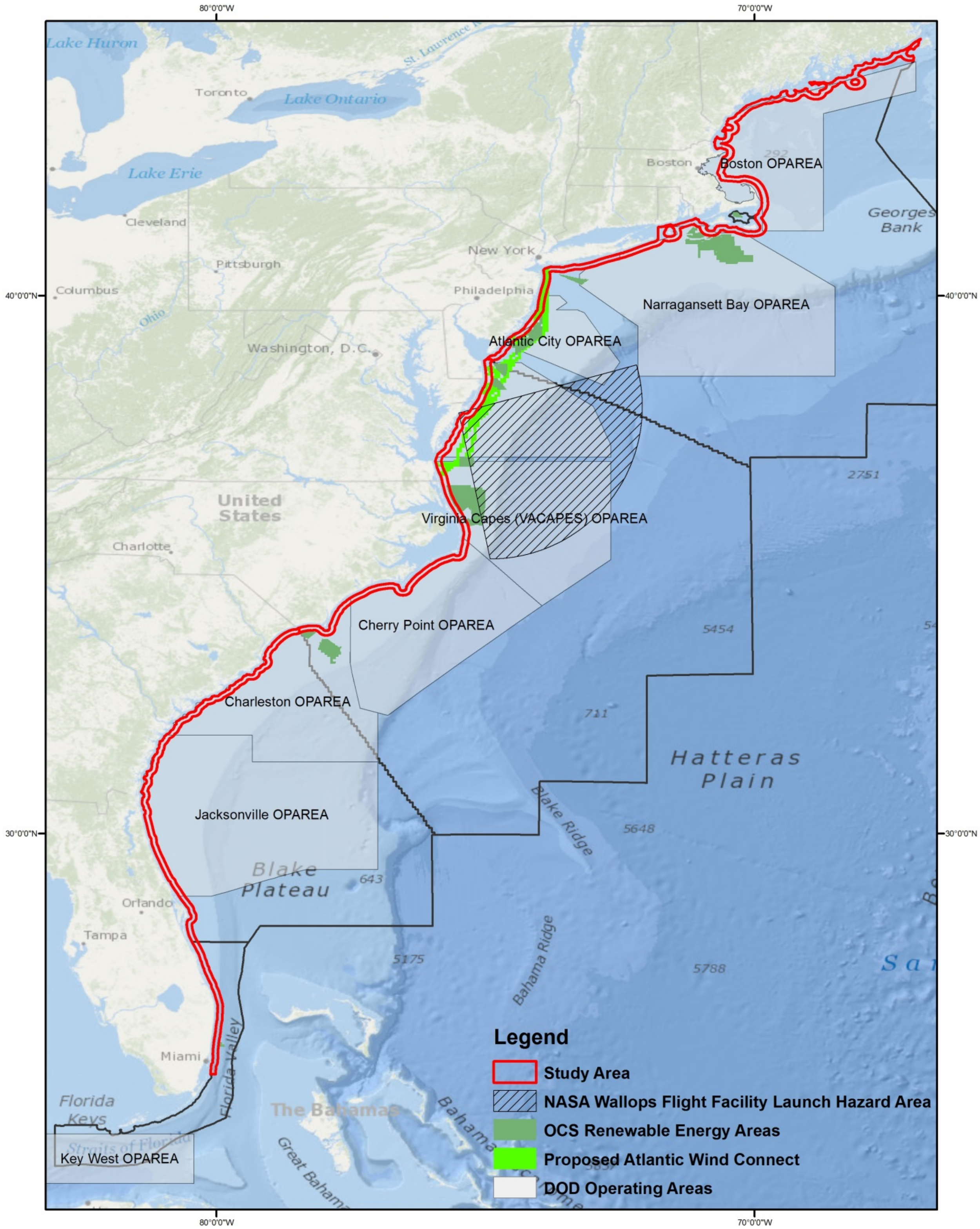


Figure 3-7. Military and other Restricted Use Areas within or Adjacent to the Study Area

4. Cumulative Effects

The Council on Environmental Quality regulations for implementing NEPA define cumulative effects as "the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative effects may result from the accumulation of similar effects or from the synergistic interaction of different effects.

4.1. Reasonably Foreseeable Future Actions within the Study Area

The spatial boundaries for the cumulative effects analysis include both the Study Area and adjacent nearshore and coastal areas where shorebases can be found. The temporal boundary is limited to 2014 to 2017, beyond which there would be no residual effect from the proposed G&G activities. The past, present, and reasonably foreseeable future actions that could contribute to cumulative effects include the following:

1. oil and gas G&G exploration
2. renewable energy site assessment
3. dredging of marine minerals
4. commercial and recreational fishing
5. military range complexes and civilian space program use
6. boating, shipping, and marine transportation
7. dredged material disposal
8. new cable infrastructure installation

Given the substantive overlap between cumulative actions and multiple uses in the Study Area, this section refers to the descriptions of other uses in the multiple use section to describe many of the cumulative actions. Two broader sources of cumulative impacts, climate change and cumulative noise in the ocean, also were identified. From these sources of cumulative impacts, reasonably foreseeable IPFs include the following:

1. underwater noise from sonar, explosives, and other active acoustic sound sources
2. vessel traffic and associated noise
3. discharges and accidental releases of trash, marine debris, and a risk of fuel spills from vessels
4. seafloor disturbance, turbidity, and benthic habitat alterations (due to placement of a well template on the seafloor, jetting of the well, anchoring of drilling rigs, or dredging)
5. direct physical impacts and incidental taking of protected species (e.g., by hopper dredges, trawling)
6. direct taking of fish and shellfish resources, including targeted species and bycatch.

The proposed G&G activities could incrementally affect underwater noise; vessel traffic and noise; discharges and accidental releases; and seafloor disturbance.

4.1.1. Oil and Gas Exploration

There are currently no active oil and gas leases or oil and gas exploration, development, or production activities on the Atlantic OCS, and leasing is not proposed for the 2012–2017 5-Year Program (BOEM 2012b). Oil and gas exploration and development activities that could occur before 2017 would be limited to the G&G activities occurring prior to an OCS lease sale. Proposed survey activities in the shallow inner shelf are limited, but survey vessels supporting G&G activities in deepwater would also use Atlantic coastal ports for mobilization and demobilization. Impacts from proposed oil and gas exploration have been evaluated in the *Atlantic Geological and Geophysical (G&G) Activities Draft Programmatic Environmental Impact Statement (PEIS)* (BOEM 2012a).

4.1.2. Renewable Energy Site Assessment

Offshore wind facilities are currently the most likely type of renewable energy development in Federal and adjacent state waters. The maximum distance from shore for a wind facility is generally defined at the outward limit of its economic viability, currently about 25 nmi (46 km) from shore or 131 foot (40 m) water depth (see Figure 3-7 for proposed OCS renewable energy and Atlantic Wind Connect project locations). BOEM has received only one plan for a pilot hydrokinetic facility on the OCS offshore southeastern Florida. Within the 2014–2017 time period considered, limited site characterization and site assessment activities, which could include G&G surveys, biological sampling, and meteorological testing, would be conducted for Wind Energy Areas, Interim Policy Areas offshore Delaware, New Jersey, or Florida, or other competitive lease sale areas (BOEM 2013a). The level and timing of actual wind facility construction would occur after the 2014–2017 time period. Impacts from site assessment and meteorological testing have been evaluated in several recent NEPA documents (BOEM 2012c, d, e; BOEM 2013b).

4.1.3. Marine Minerals Use

Since 1995, BOEM has issued more than 20 negotiated agreements along the Mid- and South Atlantic Planning Areas authorizing the use of OCS sand resources from borrow areas offshore of Maryland, Virginia, South Carolina, and Florida for recreational beach, storm, and hurricane damage protection, and infrastructure protection projects (see: http://www.boem.gov/Non-Energy-Minerals/Marine-Mineral-Projects.aspx).

BOEM anticipates that OCS sand resources will continue to be used for beach restoration and shoreline protection projects within the time frame considered. The general area where dredging would likely occur is in water depths between 33 and 98 feet (10 and 30 m) offshore New Jersey south to Florida. The proposed activity scenario is based on an examination of past trends in OCS G&G and leasing activity and anticipated OCS leasing requests, as well as projections of other possible uses as existing borrow areas are nearing depletion. Based on past usage, a few existing borrow areas, such as Sandbridge Shoal (offshore Virginia), Little River and Cane South borrow areas (offshore Myrtle Beach, South Carolina), and the Canaveral Shoals and

Jacksonville borrow areas (offshore Florida), are likely to be reused, perhaps accounting for 40-50 percent of future projects over the 2014–2017 time period. Additional dredging in OCS borrow areas is expected to support beach restoration and storm recovery efforts along areas that were affected by Hurricane Sandy, including central New Jersey, the Delmarva Peninsula, and North Carolina. Impacts of sand and gravel mining along the Atlantic coast have been evaluated in numerous studies (e.g., Louis Berger Group, Inc. 1999; Michel et al.; 2013).

4.1.4. Commercial and Recreational Fishing

The type and scope of commercial and recreational fishing are summarized in Section 3.10. Although there are inter-annual and seasonal variations in both commercial and recreational fishing, as well as geographic differences among states, there are no major short-term, temporal trends in the level of these activities (NMFS 2012). Over the 2014-2017 time period analyzed, it is assumed that these activities will continue at the present level.

4.1.5. Marine Transportation

The type and scope of marine transportation, including shipping traffic, are summarized in Section 3.11. Over the 2014-2017 time period analyzed, it is assumed that shipping and marine transportation activities will increase slightly above the present level, due in part to the expansion of the Panama Canal, which is expected to be completed in 2014 (Canal de Panamá, 2012).

4.1.6. Military Range Complexes and Civilian Space Program Use

The type and scope of military and space operations are summarized in Section 3.12. Over the 2014-2017 time period analyzed, it is assumed that military and civilian space program uses of the Study Area could increase slightly above the present level due to these ongoing and planned programs (Navy 2013).

4.1.7. Dredged Material Disposal

There are 13 designated dredged material disposal sites on the Atlantic OCS ranging from Dam Neck, Virginia, to Canaveral Harbor, Florida. The disposal sites are used only for the disposal of dredged material from the maintenance dredging of commercial ports. Typically, sites are permitted for continuing use, and the activity level varies depending on the dredging requirements for particular ports. Over the 2014-2017 time period analyzed, it is assumed that usage of dredged material disposal sites would continue at about the present level.

4.1.8. New Cable Infrastructure

With the continued need for additional bandwidth to provide reliable high-speed connectivity, it is possible that additional cables and infrastructure could be constructed in the Study Area within the timeframe analyzed in this EA (2014–2017).

4.2. Climate Change

Warming of the earth's climate system is occurring, and most of the observed increases in global average temperatures since the mid-20th century are due to the observed increase in anthropogenic greenhouse gas concentrations (IPCC 2007; U.S. Global Change Research Program, 2009). The U.S. Global Change Research Program (2009) has summarized regional climate changes for the southeastern U.S. (including most of the states in the Study Area). Since 1970, average annual temperature has risen approximately 2° F (1.1° C) and the number of freezing days has declined by four to seven days per year. Average autumn precipitation has increased 30 percent since 1901. There has been an increase in heavy downpours in many parts of the region, while the percentage of the region experiencing moderate to severe drought increased over the past three decades. The area of moderate to severe spring and summer drought has increased by 12 percent and 14 percent, respectively, since the mid-1970s. Continuing changes in precipitation could affect the water quality and marine ecology by altering the quantity and quality of runoff into estuaries.

Reasonably foreseeable marine environmental changes that could result from climate change over the next century include altered migratory routes and timing for marine mammals and migratory birds; changes in shoreline configuration that could adversely affect sea turtle, shorebird, and seabird nesting beaches that could require increased levels of beach restoration activity and increased use of OCS sand resources; changes in estuaries and coastal habitats due to interactive effects of climate change, development, and pollution; and impacts on calcification in plankton, corals, crustaceans, and other marine organisms due to ocean acidification (The Royal Society 2005).

Over the next two decades, the Intergovernmental Panel on Climate Change (2007) projected a warming of about 0.2 °C per decade. During the three-year time period of this EA (2014-2017), environmental changes in the Study Area due to climate change are likely to be small, incremental, and difficult to discern from effects of other natural and anthropogenic factors.

4.3. Cumulative Noise in the Ocean

Various activities and processes, both natural and anthropogenic, combine to form the sound profile within the ocean, generally referred to as ambient (background) ocean noise (Richardson et al., 1995; Hildebrand 2009). Most ambient noise is broadband (composed of a spectrum of numerous frequencies without a differentiating pitch) and encompasses virtually the entire frequency spectrum. For purposes of understanding the sources and characteristics of ocean ambient noise, it can be divided into three frequency bands: low (10-500 Hz), medium (500 Hz-25 kHz) and high (greater than 25 kHz) (Hildebrand 2009). Shipping noise is the main contributor to ambient ocean noise in the low-frequency band (NRC 2003a; Hildebrand 2009). Noise in the low-frequency band has a broad maximum around 10–80 Hz, with a steep negative slope above 80 Hz. According to ambient noise spectra presented by Hildebrand (2009), spectrum levels of ambient noise from shipping are 60-90 dB re 1 μPa^2 Hz^{-1}. Sea surface agitation correlated with wind and sea state is the major contribution to ambient noise in the medium frequency band. In the high-frequency band, "thermal noise" caused by the random motion of water molecules is the primary source (Hildebrand 2009). Ambient noise sources, especially noise from wave and tidal action, can cause coastal environments to have particularly high ambient noise levels.

4.4. Cumulative Impacts by Impact-Producing Factors

Cumulative impacts discussed below are organized by IPFs for each of the resource areas. In an effort to reduce redundancy and streamline the content, the discussion has been organized based on the impact activity rather than separated by resource area. The IPFs analyzed are: (1) underwater noise, (2) vessel traffic, (3) discharge and accidental releases, and (4) seafloor disturbance.

4.4.1. Underwater Noise

Most ambient underwater noise is broadband, encompassing virtually the entire frequency spectrum. Vessel traffic is recognized as a major contributor to anthropogenic ocean noise, primarily in the low-frequency bands between 5 and 500 Hz. Naturally occurring noise such as spray and bubbles from breaking waves is also a major contributor to ambient noise, primarily in the 500-100,000 Hz range. Noise-related impacts associated with the cumulative activities scenario are expected to range from negligible to moderate in the Study Area; localized, short-term, minor noise impacts might be realized in association with specific military activities (e.g., sonars), sand dredging, commercial trawling and dredging, air gun surveys, and shipping traffic; however, applicable mitigation measures (e.g., observation and clearance of safety zones) should minimize noise impacts from these acoustic sources to the extent possible. In this context, active acoustic noise sources and vessel and equipment noise from the proposed action would contribute to overall ambient noise levels within the Study Area. Noise from proposed G&G operations would occur on a transient and intermittent basis within the first years of the period analyzed (2014–2017), which is comparatively short-lived in context of the cumulative scenario. Underwater noise associated with the proposed action would exceed ambient levels but be similar to or less than the existing underwater noise levels expected under the cumulative scenario from vessel and equipment noise, sonar, and other active sound sources.

The use of G&G survey protocols during the proposed survey activities would provide needed protection to marine mammals and sea turtles that could be present within the acoustic exclusion zone so that the incremental contribution of the proposed action to cumulative effects would be negligible to minor. No mortalities of listed or otherwise protected marine mammals or sea turtles are expected.

Marine mammals and sea turtles may respond to the low levels of chirp, boomer, vibracore, or vessel noise outside of the exclusion zone and alter their behavior temporarily. However, the potential for behavior modification is not dissimilar from what is typical and expected under the cumulative scenario. Consequently, the impacts associated with the proposed action would result in a negligible incremental increase in potential effects on marine mammals, sea turtles, fish, and seabirds under the cumulative scenario.

4.4.2. Vessel Traffic

Vessel traffic under the cumulative impacts scenario would originate from many activities, including oil and gas exploration, marine minerals use, renewable energy development, commercial and recreational fishing, military range complexes and civilian space program use, shipping and marine transportation, and dredged material disposal. Shipping and marine transportation and commercial and recreational fishing represent the most significant sources of large vessel traffic, with traffic heavily concentrated in the vicinity of U.S. east coast ports. Additional vessel traffic from G&G operations under the proposed action would not represent a significant increase to existing vessel traffic from cumulative operations within the Study Area. The vessel size used for the proposed G&G surveys would be comparatively smaller in contrast to most shipping, military, and commercial fisheries vessels. Moreover, the survey vessels would be operating at slower speeds than most other vessels, which would tend to reduce impacts

Some birds engage in ship-following as a foraging strategy, especially with commercial or recreational fishing vessels. In addition, in an open environment like the ocean, objects are easy to detect and birds locate vessels easily from long distances and approach to investigate. However, the proposed action would have only a negligible incremental impact on marine and coastal birds from additional vessel presence and traffic under the cumulative scenario. Only a very small incremental increase to the cumulative risk of marine mammal or sea turtle strike could be attributed to the proposed action. BOEM plans to mitigate that risk by implementing speed restrictions, vessel strike avoidance requirements, and observer requirements so that incremental effect would be negligible.

4.4.3. Discharges and Accidental Releases

The cumulative scenario considers a significant volume of overall vessel traffic and, consequently, vessel discharges, particularly around ports along the U.S. eastern seaboard. All vessel movements are associated with a risk of collision or grounding with a subsequent loss of fuel into offshore or nearshore waters. The release of vessel discharges, trash, and debris into offshore waters could occur from some of the activities identified in the cumulative impacts scenario. Vessel operators, crew, and personnel present on offshore structures are expected to comply with the requirements of Federal regulations, which have implemented the requirements of MARPOL 73/78, including Annex V. Compliance with these regulations greatly limits discharges and debris in the marine environment. G&G surveys conducted under the proposed action would potentially add a very small amount of discharge and accidently released trash and debris into offshore waters.

The incremental impacts on marine mammals, sea turtles, and fish arising from an accidental fuel spill in context of the cumulative scenario is negligible to minor, depending on a series of factors, including whether spilled diesel fuel directly contacts individual animals, the quantity of fuel encountered, local sea state and the direction and intensity of local surface currents, the degree of weathering to which the fuel has been exposed, and duration of contact.

Under the cumulative activities scenario, effects from vessel discharges and or accidental spills on bird species would differ depending on the location and timing of the spill. If the accident occurred in nearshore waters, waterfowl, coastal seabirds, and shorebirds including piping plover, roseate tern, and red knot could be impacted. Impacts could include physical oiling of individuals. The effects of oil spills on coastal and marine birds include the potential of tissue and organ damage from oil ingested during feeding and grooming from inhaled oil, and stress that could result in interference with food detection, predator avoidance, homing of migratory species, and respiration issues. Indirect effects of a spill under the cumulative scenario could include oiling of nesting and foraging habitats and displacement to secondary locations (Clark 1984). It is anticipated that the spill would be relatively small and the resulting area of impact would be relatively small; however the type and severity of the impact on marine and coastal birds would differ depending on the location and timing of the spill. Dispersal, weathering, and evaporation would reduce the amount of fuel remaining on the sea surface. The incremental impacts on sea birds arising from an accidental fuel spill from the proposed action in context of the cumulative scenario are negligible to minor, but depend on a series of factors, including whether spilled diesel fuel directly contacts individual animals, the quantity of fuel encountered, local sea state and the direction and intensity of local surface currents, the degree of weathering to which the fuel has been exposed, and duration of contact.

4.4.4. Seafloor Disturbance

Seafloor disturbance can damage or alter hard or soft demersal habitats important to fisheries resources and, in some cases, designated EFH. Additionally, any seafloor disturbance (e.g., anchors, nodes, cables, sensors, bottom-founded monitoring buoys) has the potential to disturb benthic habitat and communities and submerged cultural resources, when present. Seafloor disturbance expected from cumulative scenario would be caused by bottom sampling, anchoring,sand dredging and dredged material disposal, commercial fishing trawling and dredging, pipeline or cable installation, and emplacement of structures (e.g., meteorological buoys). The extent of the seafloor disturbance caused by seafloor-disturbing fisheries within the Study Area has not been quantified, but is thought to be extensive. In addition, military range complexes and civilian space program use could involve placement of buoys or other equipment that could potentially disturb the seafloor. Cumulative impacts on benthic habitat and resident fishes should be managed in consideration of all cumulative actions from commercial fisheries through bottom-founded military exercises and dredging. For this reason, fish habitat is managed under regional FMPs (see Section 3.4.1.4). Comprehensive mitigation programs must be developed and impacts on these resources avoided to the extent possible in context of cumulative actions. BOEM's proposed seafloor-disturbing activities would not occur in areas that constitute the most sensitive habitat so that these areas remain protected, and because OCS sand resources are not likely to be present in those locations. Moreover, BOEM would require strict clearance and avoidance requirements to ensure that sensitive bottom habitats are not otherwise affected. The incremental impact of the proposed action on fish and benthic resources from seafloor disturbance in context of the cumulative activities scenario would be negligible.

Submerged cultural resources may be impacted by activities related to any of the cumulative activities that involve seafloor-disturbing operations. Because of the rarity of submerged cultural resources and the high potential for information loss and damage, cumulative impacts on submerged archaeological resources are potentially significant, especially in consideration of all cumulative actions. Areas identified with potential historic shipwrecks or prehistoric archaeological resources should be assigned an avoidance zone for most cumulative activities, including any proposed dredging and naval exercises. However, certain requirements do not protect the resources from all activities that may occur, including commercial and recreational fishing. BOEM's proposed seafloor-disturbing activities would be subject to clearance and avoidance requirements to ensure that historic and prehistoric submerged cultural resources are not affected. The incremental impact of the proposed action on archaeological resources from seafloor disturbance in context of the cumulative activities scenario would be negligible.

5. Consultation and Coordination

5.1. Development of the Proposed Action

BOEM coordinated with several Federal and state agencies and other concerned parties to develop the proposed action and alternatives in this EA. Key agencies and organizations were contacted, including the NMFS and FWS.

5.2. Coastal Zone Management Act

The CZMA (16 U.S.C. 1451 et seq.) was enacted by Congress to protect the coastal environment from increasing demands associated with commercial, industrial, recreational, and residential uses, including Federal and state offshore energy development. Section 307 of the CZMA enables coastal states develop coastal management programs to manage and balance competing uses of the coastal zone.

Federal agencies must follow the Federal consistency provisions delineated in 15 CFR 930. If an activity would have direct, indirect, or cumulative effects, the activity is subject to Federal consistency. Federal agency activities must be "consistent to the maximum extent practicable" with relevant enforceable policies of a state's federally approved coastal management programs (15 CFR 930 subpart C). In accordance with these requirements, BOEM prepared Consistency Determinations for 14 affected states describing potential impacts on their coastal zones from implementing the proposed action. Appendix C includes letters of concurrence from state coastal management programs.

5.3. Endangered Species Act

BOEM initiated an informal consultation with NMFS and FWS pursuant to Section 7 of the ESA and implementing regulations (50 CFR 402). BOEM determined that the proposed action is not likely to adversely affect listed species and their critical habitats. The Draft EA was used to support informal Section 7 consultations in lieu of preparing a separate Biological Assessment. NMFS and FWS concurred with BOEM's determination (Appendix C).

5.4. Magnuson-Stevens Fishery Conservation and Management Act

BOEM determined that the proposed action may affect EFH, defined as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity" under Section 305 of the Magnuson-Stevens Fishery Conservation and Management. BOEM initiated consultation with the NMFS regarding potential effects on EFH in accordance with 50 CFR 600. The Draft EA was used to facilitate the consultation in lieu of preparing a separate EFH Assessment. NMFS did not provide additional Conservation Recommendations (Appendix C).

5.5. National Historic Preservation Act

In accordance with the NHPA (16 U.S.C. 470), Federal agencies are required to consider the effect of their undertakings on historic properties. The implementing regulations for Section 106 of the NHPA (36 CFR 800) establish the requirements for and steps of the consultation process. BOEM requested an expedited consultation process, pursuant to 36 CFR 800.4(g), and prepared a Finding of No Historic Properties Affected document (Appendix B). The Finding explains the undertaking in more detail with regard to historic properties and provides the bureau's rationale for choosing the area of potential affect, the archaeological identification efforts that will be conducted prior to any bottom disturbance, and the mitigation measures that will be in place to ensure that historic properties are not affected during bottom-disturbing activities. Letters and a copy of the Finding were sent to the Advisory Council on Historic Properties, fourteen State Historic Preservation Officers (SHPOs), twenty-seven federally recognized Tribes (see Table 5-1), and one state-recognized Tribe (Lenape Indian Tribe of Delaware) requesting comments and concurrence with the determination.

Table 5-1. Federally Recognized Tribes determined by BOEM to have Connections to the Study Area

Absentee Shawnee Tribe of Oklahoma	Houlton Band of Maliseet Indians	Onondaga Nation	Shinnecock Indian Nation
Aroostook Band of Micmacs	Mashantucket Pequot Tribe of Connecticut	Passamaquoddy Tribe - Indian Township	Stockbridge-Munsee Community of Mohican Indians
Catawba Indian Nation	Mashpee Wampanoag Tribe	Passamaquoddy Tribe - Pleasant Point	Tonawanda Band of Seneca Indians
Cayuga Nation; Cherokee Nation	Miccosukee Tribe	Penobscot Nation	Tuscarora Nation
The Delaware Tribe of Indians	Mohegan Indian Tribe of Connecticut	Saint Regis Mohawk Tribe	United Keetoowah Band of Cherokee Indians in Oklahoma
Eastern Band of Cherokee Indians	Narragansett Indian Tribe	Seminole Tribe of Florida	Wampanoag Tribe of Gay Head (Aquinnah)
The Eastern Shawnee Tribe of Oklahoma	The Oneida Indian Nation	Seneca Nation of New York	

To satisfy the public participation requirement of the Section 106 process (36 CFR 800.2(d)(2)), BOEM posted the Finding to its website and provided contact information for commenting on the proposed undertaking. BOEM notified potentially interested parties using a contact list that the bureau maintains for similar projects in the Atlantic coastal region. No public comments, other than from State agencies, were received.

BOEM received concurrence with the Finding determination from twelve SHPOs. Representatives of three federally recognized Tribes have expressed interest in the undertaking: Mashantucket Pequot Tribe, Penobscot Nation, and the Stockbridge-Munsee Community of Mohican Indians. The Penobscot Nation has replied with a 'No Objection' determination, and the Stockbridge-Munsee Community of Mohican Indians stated that the project is within its ancestral territory, but that no known cultural properties are in the Study Area. The Mashantucket Pequot Tribe has requested that BOEM provide copies of the reconnaissance-level and site-specific surveys, a copy of the specific avoidance measures that will be implemented to avoid effects to historic properties, and a copy of the comments from the Connecticut SHPO. BOEM has reached out to the Mashantucket Pequot Tribe to determine the geographical extent of its interest, but has yet to receive a response. The Connecticut SHPO was one of the two states that did not respond. BOEM will continue to reach out to the Mashantucket Pequot Tribe and will ensure that the Tribe is contacted prior to any survey activities discussed in this undertaking that might have an impact on their ancestral lands of interest.

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Appendices

Appendix A

Fish and Essential Fish Habitat Tables
(For Section 3.4)

List of Tables

Table A-1

Fish Species and Species Groups in the Study Area with Demersal and Pelagic Habitats Managed by the South Atlantic Fishery Management Council, Mid-Atlantic Fishery Management Council, New England Fishery Management Council, and/or Highly Migratory Species Office of the National Marine Fisheries Service

Species or Species Groups	SAFMC	MAFMC	NEFMC	NMFS
Demersal				
Coral, coral reefs, and live/hard bottom	■	--	--	--
Spiny lobster (*Panulirus argus*)	■	--	--	--
Snapper-grouper complex (73 species)	■	--	--	--
Tilefish (*Lopholatilus chamaeleonticeps*)	■	■	--	--
Black sea bass (*Centropristis striata*)	■	■	--	--
Scup (*Stenotomus chrysops*)	■	■	--	--
Surfclam (*Spisula solidissima*)	--	■	--	--
Ocean quahog (*Arctica islandica*)	--	■	--	--
Sea scallop (*Placopecten magellanicus*)	--	--	■	--
Calico scallop (*Argopecten gibbus*)	--	--	--	--
Golden crab (*Chaceon fenneri*)	■	--	--	--
Red crab (*Chaceon quinquedens*)	--	--	■	--
Shrimps (Penaeidae and Sicyonidae)	■	--	--	--
Monkfish (*Lophius americanus*)	--	■	--	--
Spiny dogfish (*Squalus acanthias*)	--	■	■	--
Offshore hake (*Merluccius albidus*)	--	■	■	--
Silver hake (*Merluccius bilinearis*)	--	--	■	--
Red hake (*Urophycis chuss*)	--	--	■	--
Witch flounder (*Glyptocephalus cynoglossus*)	--	--	■	--
Summer flounder (*Paralichthys dentatus*)	--	--	■	--
Windowpane flounder (*Scophthalmus aquosus*)	--	--	■	--
Pelagic				
Sargassum	■	--	--	--
Long-finned squid (*Loligo pealei*)	--	■	--	--
Short-finned squid (*Illix illecebrosus*)	--	■	--	--
Cobia (*Rachycentron canadum*)	■	--	--	--
King mackerel (*Scomberomorus cavalla*)	■	--	--	--
Spanish mackerel (*Scomberomorus maculatus*)	■	--	--	--
Little tunny (*Euthynnus alletteratus*)	■	--	--	--
Bluefish (*Pomatomus saltatrix*)	--	■	--	--
Atlantic mackerel (*Scomber scombrus*)	--	■	--	--
Butterfish (*Peprilus triacanthus*)	--	■	--	--
Atlantic herring (*Clupea harengus*)	--	--	■	--
Small coastal sharks (5 species)	--	--	--	■
Large coastal sharks (17 species)	--	--	--	■
Pelagic sharks (6 species)	--	--	--	--
Wahoo (*Acanthocybium solandri*)	■	--	--	--
Dolphin (*Coryphaena hippurus*)	■	--	--	--
Tunas and billfishes (Scombridae, Istiophoridae, Xiphiidae)	--	--	--	■

Abbreviations: MAFMC = Mid-Atlantic Fishery Management Council; NEFMC = New England Fishery Management Council; NMFS = Highly Migratory Species Office of the National Marine Fisheries Service; SAFMC = South Atlantic Fishery Management Council.

Table A-2

Benthic, Demersal and Pelagic Essential Fish Habitats by Fishery Management Plan and Fishery Management Council

Fishery Management Plan	**Habitat Type**					
New England FMC	Coral and Coral Reefs	Live/Hard Bottoms	*Sargassum*	Artificial/manmade Reefs	Water column	Demersal/Benthic
Northeast Multispecies					X	X
Atlantic Sea Scallops						X
Monkfish					X	X
Atlantic Herring					X	
Small Mesh Multispecies					X	X
Dogfish					X	X
Skates						X
Atlantic Salmon					X	
Mid-Atlantic FMC	Coral and Coral Reefs	Live/Hard Bottoms	*Sargassum*	Artificial/manmade Reefs	Water column	Demersal/Benthic
Summer Flounder, Scup, and Black Sea Bass		X		X	X	X
Atlantic Mackerel, Squid, and Butterfish					X	
Atlantic Surf Clam and Ocean Quahog					X	X
Atlantic Bluefish					X	X
Tilefish						X
Spiny Dogfish					X	X
Monkfish						X
South Atlantic FMC	Coral and Coral Reefs	Live/Hard Bottoms	*Sargassum*	Artificial/manmade Reefs	Water column	Demersal/Benthic
Coastal Migratory Pelagic Resources					X	
Coral, Coral Reefs, and Live/Hard	X	X				

Appendix A - Fish and Essential Fish Habitat TablesTable A-2 continued: Benthic, Demersal and Pelagic Essential Fish Habitats by Fishery Management Plan and Fishery Management Council

Bottom Habitats						
Dolphin and Wahoo			X		X	
Pelagic Sargassum			X		X	
Snapper-Grouper		X				
Shrimp					X	X
Golden Crab					X	X
Spiny Lobster		X			X	X
Atlantic Highly Migratory Species	Coral and Coral Reefs	Live/Hard Bottoms	*Sargassum*	Artificial/manmade Reefs	Water column	Demersal/Benthic
Tuna			X		X	
Sharks					X	
Swordfish			X		X	
Billfish			X		X	

Table A-3
Highly Migratory Species and Species Lifestage within the Study Area
(*Identified using NMFS HMS GIS data*)

Species	**Lifestage**
Albacore Tuna	J,A (Mid Atlantic)
Angel Shark	J,A (Mid / South Atlantic)
Atlantic Sharpnose Shark	N,J,A (Mid / South Atlantic)
Basking Shark	J,A (New England / Mid Atlantic)
Bigeye Thresher Shark	All (South Atlantic)
Bigeye Tuna	J, A (Mid – offshore NC / South Atlantic – offshore SE FL)
Bignose Shark	J, A (South Atlantic)
Blacknose Shark	N,J,A (South Atlantic)
Blacktip Shark	N,J,A (South Atlantic)
Blue Marlin	J, A (South Atlantic – offshore SE FL)
Blue Shark	N, J (New England / Mid Atlantic); A (South Atlantic)
Bluefin Tuna	J,A (New England / Mid Atlantic); E,L,J,A,**S** (South Atlantic)
Bonnethead Shark	N,J,A (South Atlantic)
Bull Shark	N,J,A (South Atlantic)
Caribbean Reef Shark	All (South Atlantic – offshore SE FL)
Common Thresher Shark	All (New England / Mid / South Atlantic)
Dusky Shark	N,J,A (Mid and South Atlantic)
Finetooth Shark	N,J,A (South Atlantic)
Great Hammerhead	All (Mid / South Atlantic)
Lemon Shark	N,J,A (South Atlantic)
Longbill Spearfish	J,A (Mid and South Atlantic)
Longfin Mako Shark	All (South Atlantic – offshore SE FL)
Night Shark	All (South Atlantic – offshore SE FL)
Nurse Shark	J,A (South Atlantic)
Oceanic Whitetip Shark	All (South Atlantic – offshore SE FL)
Porbeagle Shark	All (New England / Mid Atlantic)
Roundscale Spearfish	J,A (South Atlantic – offshore SE FL)
Sailfish	J,A,S (South Atlantic)
Sandtiger Shark	N,J,A (Mid and South Atlantic)
Sandbar Shark	N,J,A (Mid and South Atlantic)
Scalloped Hammerhead	N,J,A (Mid and South Atlantic)
Shortfin Mako	All (Mid and South Atlantic)
Silky Shark	All (Mid and South Atlantic)
Skipjack Tuna	J,A (Mid and South Atlantic); **S** (South Atlantic – offshore SE FL)
Smooth Dogfish	All (New England – offshore Cape Cod/ Mid / South Atlantic)
Spinner Shark	N,J,A (Mid and South Atlantic)
Swordfish	J, A (Mid – offshore NC and South Atlantic – offshore SE FL); L (South Atlantic – offshore SE FL)
Tiger Shark	N,J,A (Mid and South Atlantic)
White Marlin	J,A (South Atlantic – offshore SE FL)
White Shark	All (New England / Mid / South Atlantic)
Yellowfin Tuna	A (Mid Atlantic – offshore NC); J, **S** (Mid Atlantic)

N = Neonate; J = Juvenile; A = Adult; L = Larvae; E = Eggs; S = Spawning

Table A-4

New England Fishery Management Plan Species with Essential Fish Habitat in the Study Area
(Identified using NMFS NERO GIS data compared with Study Area)

Species	**Lifestage**
Atlantic Cod	All
Atlantic Halibut	All
Atlantic Herring	All
Atlantic Plaice	All
Atlantic Salmon	A
Barndoor Skate	A
Clearnose Skate	J,A
Dogfish	All
Haddock	All
Little Skate	J,A
Monkfish	All
Ocean Pout	All
Pollock	All
Red Hake	All
Redfish	All
Sea Scallop	All
Silver Hake	All
Smooth Skate	J,A
Thorny Skate	J,A
White Hake	All
Window Pane Flounder	All
Winter Flounder	All
Winter Skate	J,A
Witch Flounder	All
Yellowtail Flounder	All

N = Neonate; J = Juvenile; A = Adult; L = Larvae; E = Eggs; S = Spawning

Table A-5

Hard Bottom Associated Species with Essential Fish Habitat in the Study Area (South Atlantic)

Species	Eggs and Larvae	Juveniles	Adults
Spiny lobster (*Panulirus argus*)	Surface waters of the SAB and Gulf Stream	Not in the Study Area	Live/hard bottom and artificial reefs with medium- to high-profile outcroppings from nearshore to at least 100-m water depths from Cape Hatteras, NC, to Cape Canaveral, FL
Black sea bass (*Centropristis striata*)	Surface waters of the Study Area from May-October	Demersal soft and hard bottom habitats of the shelf where water temperatures are greater than 6 °C and salinity greater than 18 ppt	Demersal soft and hard bottom habitats of the shelf where water temperatures are greater than 6 °C and salinity greater than 18 ppt
Warsaw grouper (*Epinephelus nigritus*)	Surface waters of the SAB and Gulf Stream including pelagic *Sargassum*	Live/hard bottom and artificial reefs with medium to high profile outcroppings from inner shelf to at least 200-m water depths	Live/hard bottom and artificial reefs with medium to high profile outcroppings from 50- to at least 200-m water depths. Spawning occurs in the same area
Snowy grouper (*Epinephelus niveatus*)	Surface waters of the SAB and Gulf Stream including pelagic *Sargassum*	Live/hard bottom and artificial reefs with medium to high profile outcroppings from inner shelf to at least 200-m water depths	Live/hard bottom and artificial reefs with medium to high profile outcroppings from 50- to at least 200-m water depths. Spawning occurs in the same area
Gag grouper (*Mycteroperca microlepis*)	Surface waters of the SAB and Gulf Stream including pelagic *Sargassum*	Not in the Study Area	Live/hard bottom and artificial reefs with medium to high profile outcroppings from nearshore to at least 100-m water depths from Cape Hatteras, NC, to Cape Canaveral, FL. Spawning occurs in winter months in 30-100 m depths
Scamp (*Mycteroperca phenax*)	Surface waters of the SAB and Gulf Stream including pelagic *Sargassum*	Hard bottom areas on the shelf to the shelf edge from Cape Hatteras, NC, to Cape Canaveral, FL	Hard bottom areas from Cape Hatteras, NC, to Cape Canaveral, FL
Wreckfish (*Polyprion americanus*)	Gulf Stream waters including pelagic *Sargassum*	Not enough information	Live/hard bottom and artificial reefs with medium to high profile outcroppings in 800-1,200-m water depths
Gray snapper (*Lutjanus griseus*)	Surface waters of the SAB and Gulf Stream	Hard bottom and soft bottom areas on the shelf from Cape Hatteras, NC, to Cape Canaveral, FL	Hard bottom areas from Cape Hatteras, NC, to Cape Canaveral, FL

Table A-5 continued: Hard Bottom Associated Species with Essential Fish Habitat in the Study Area (South Atlantic)

Species	Eggs and Larvae	Juveniles	Adults
Red snapper (*Lutjanus campechanus*)	Surface waters of the SAB and Gulf Stream	Not in the Study Area	Hard bottom areas from Cape Hatteras, NC, to Cape Canaveral, FL
Lane snapper (*Lutjanus synagris*)	Surface waters of the SAB and Gulf Stream	Not in the Study Area	Hard bottom areas from Cape Hatteras, NC, to Cape Canaveral, FL
Vermilion snapper (*Rhomboplites aurorubens*)	Surface waters of the SAB and Gulf Stream	Hard bottom areas on the shelf to the shelf edge from Cape Hatteras, NC, to Cape Canaveral, FL	Hard bottom areas from Cape Hatteras, NC, to Cape Canaveral, FL
Scup (*Stenotomus chrysops*)	Not in the Study Area	Not in the Study Area	Demersal waters of the continental shelf off the middle Atlantic south to Cape Hatteras, NC
Blueline tilefish (*Caulolatilus microps*)	Gulf Stream waters including pelagic *Sargassum*	Not enough information	Soft or rough bottom in water depths between 100 and 400 m
Tilefish (*Lopholatilus chamaeleonticeps*)	Water column on the outer continental shelf throughout the Study Area boundary in temperatures between 7.5 and 17.5 °C	Semi-lithified clay substrate on the outer continental shelf throughout the Study Area in bottom water temperatures which range from 9-14 °C. SE FL HAPC.	Semi-lithified clay substrate on the outer continental shelf throughout the Study Area in bottom water temperatures ranging from 9-14 °C. SE FL HAPC.

Sources: SAFMC 1998; MAFMC, 1998a, 2008a.

Table A-6

Representative Soft Bottom Species and Life Stages with Essential Fish Habitat in the Study Area

Species	Eggs and Larvae	Juveniles	Adults
Surfclam (*Spisula solidissima*)	Not enough information	In substrate, to a depth of 3 feet below the water/sediment surface throughout the MAB from the shoreline out to 70 m	In substrate, to a depth of 3 feet below the water/sediment surface throughout the MAB from the shoreline out to 70 m
Ocean quahog (*Arctica islandica*)	Not enough information	In substrate, to a depth of 3 feet below the water/sediment surface throughout the MAB in water depths from 10-244 m	In substrate, to a depth of 3 feet below the water/sediment surface throughout the MAB from the shoreline out to 10-244 m
Sea scallop (*Placopecten magellanicus*)	Bottom habitats in the Gulf of Maine south to the VA-NC border; Eggs are heavier than seawater and remain on the seafloor until they develop into the first free-swimming larval stage. Generally, eggs are thought to occur where water temperatures are below 17 °C. Larvae occur in pelagic waters and bottom habitats with a substrate of gravelly sand, shell fragments, and pebbles, or on various red algae, hydroids, amphipod tubes, and bryozoans north of the VA-NC border where sea surface temperatures are below 18 °C and salinities are between 16.9 and 30 ppt	Bottom habitats with a substrate of cobble, shells, and silt in the Gulf of Maine south to the VA-NC border where water temperatures are below 15 °C and water depths range from 18-110 m	Bottom habitats with a substrate of cobble, shells, coarse/gravelly sand, and sand in the Gulf of Maine south to the VA-NC border where water temperatures are below 21 °C, water depths range from 18 to 110 m, and salinities are above 16.5 ppt. Spawning occurs from May through October, with peaks in May and June
Calico scallop (*Argopecten gibbus*)	Not enough information	Unconsolidated sediments including hard sand bottoms, sand and shell hash, quartz sand, smooth sand-shell-gravel, and sand and dead shell in 13-94 m, with concentrations occurring off Cape Canaveral, FL (Stuart to St. Augustine) and sporadically off Cape Lookout, NC, in 19-31 m, and offshore of the SC/GA border in 37-45 m	Unconsolidated sediments including hard sand bottoms, sand and shell hash, quartz sand, smooth sand-shell-gravel, and sand and dead shell in 13-94 m, with concentrations occurring off Cape Canaveral, FL (Stuart to St. Augustine), and sporadically off Cape Lookout, NC, in 19-31 m, and offshore of the SC/GA border in 37-45 m

Table A-6 continued: Representative Soft Bottom Species and Life Stages with Essential Fish Habitat Identified within Study Area

Species	Eggs and Larvae	Juveniles	Adults
Rock shrimp (*Syconia* spp.)	Eggs and larvae in high salinity coastal waters of the SAB	Terrigenous and biogenic sand bottom habitats from 18-182 m in depth with highest concentrations occurring between 34 and 55 m in all areas from NC to Cape Canaveral, FL	Terrigenous and biogenic sand bottom habitats from 18-182 m in depth with highest concentrations occurring between 34 and 55 m. areas from NC to Cape Canaveral, FL. Spawning occurs in the same area
Brown shrimp (*Farfantepenaeus aztecus*)	Eggs and larvae in high salinity coastal waters of the SAB	Not in the Study Area (primarily in inshore waters)	Nearshore SAB shelf with medium to fine grained sediment. Spawning occurs offshore
Pink shrimp (*Farfantepenaeus duorarum*)	Eggs and larvae in high salinity coastal waters of the SAB	Not in the Study Area (primarily in inshore waters)	Coarse and particularly calcareous bottom sediments in SAB from mid- to outer shelf depths. Spawning occurs offshore
White shrimp (*Litopenaeus setiferus*)	Eggs and larvae in high salinity coastal waters of the SAB	Not in the Study Area (primarily in inshore waters)	Nearshore SAB shelf with medium to fine grained sediment
Monkfish (*Lophius americanus*)	Gulf of Maine south to Cape Hatteras, NC, with water temperatures below 15 °C and depths from 15-1,000 m for eggs and 25-1,000 m for larvae; egg veils and larvae are most often observed from March to September	Gulf of Maine to MAB shelf areas with water temperatures below 13 °C, depths from 25 to 200 m, and a salinity range from 29.9 to 36.7 ppt	Bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud along the MAB shelf north to the Gulf of Maine
Offshore hake (*Merluccius albidus*)	Shelf from Gulf of Maine to Cape Hatteras, NC where water temperatures less than 20 °C and water depths less than 1,250 m all year at depths from 110-270 m (eggs) and 70-130 m (larvae)	Bottom habitats along from the Gulf of Maine south to Cape Hatteras, NC, generally where water temperatures are below 12 °C and depths range from 170-350 m	Bottom habitats along the study area south to Cape Hatteras, NC, where water temperatures are below 12 °C and depths range from 150-380 m. Spawning occurs throughout the year at depths from 330-550 m
Silver hake (*Merluccius bilinearis*)	Surface waters of the Gulf of Maine south to Cape Hatteras where sea surface temperatures are below 20 °C and water depths are 50-130 m; larvae are observed all year, with peaks from July through September	Bottom habitats of all substrate types in the study area south to Cape Hatteras, NC, where water temperatures are below 21 °C, water depths 20-270 m, and salinities are greater than 20 ppt	Bottom habitats of all substrate types in the study area south to Cape Hatteras, NC, where water temperatures are below 22 °C and depths between 30 and 325 m. Spawning occurs in the same area where water temperatures are below 13 °C

Table A-6 continued: Representative Soft Bottom Species and Life Stages with Essential Fish Habitat Identified within Study Area

Species	Eggs and Larvae	Juveniles	Adults
Red hake (*Urophycis chuss*)	Gulf of Maine south to Cape Hatteras, NC, where sea surface temperatures are below 10 °C along the inner shelf (eggs) or 19 °C in water depths less than 200 m (larvae), in a salinity greater than 0.5 ppt; May through November (eggs) to December (larvae), with peaks in June and July (eggs) and September -October (larvae)	Bottom habitats with a substrate of shell fragments in the Gulf of Maine south to Cape Hatteras, NC, where water temperatures are below 16 °C, depths are less than 100 m, and salinity ranges from 31-33 ppt	Bottom habitats in depressions with a substrate of sand and mud in the Gulf of Maine south to Cape Hatteras, NC, where water temperatures are below 12 °C, water depths range from 10-130 m, and salinity ranges from 33-34 ppt. Spawning occurs in water depths less than 100 m and salinity less than 25 ppt from May-November, with peaks in June and July
Witch flounder (*Glyptocephalus cynoglossus*)	Surface waters to 250 m on the from the Gulf of Maine south to Cape Hatteras, NC, where sea surface temperatures are below 13 °C over deep water with high salinities; larvae are most often observed from March through November, with peaks in May-July	Bottom habitats with a fine-grained substrate along the from the Gulf of Maine south to Cape Hatteras, NC, where witch water temperatures are below 13 °C, depths range from 50-450 m, and salinity ranges from 34-36 ppt	Bottom habitats with a fine-grained substrate along from the Gulf of Maine continental shelf south to Chesapeake Bay, where water temperatures are below 13 °C, depths range from 25-300 m, and salinity ranges from 32-36 ppt. Spawning occurs from March through November, with peaks in May-August
Summer flounder (*Paralichthys dentatus*)	Surface waters of the MAB shelf south to Cape Canaveral, FL; in water depths from shore to 98 m (eggs) and from 10-70 m (larvae)	Demersal waters of the MAB shelf south to Cape Canaveral, FL, to water depths of 152 m	Demersal waters of the MAB shelf south to Cape Canaveral, FL, to water depths of 152 m. Spawning occurs between October and May
Windowpane (*Scophthalmus aquosus*)	Pelagic waters from the Gulf of Maine south to Cape Hatteras, NC where sea surface temperatures are less than 20 °C and water depths less than 70 m; eggs and larvae are often observed from February-November with peaks in May and October	Bottom habitats with a substrate of mud or fine-grained sand from the Gulf of Maine south to Cape Hatteras, NC, where water temperatures are below 25 °C, depths range from 1-100 m, and salinities range between 5.5 and 36 ppt	Bottom habitats with a substrate of mud or fine-grained sand from the Gulf of Maine south to the VA-NC border where water temperatures are below 26.8 °C, depths range from 1-75 m, and salinities range between 5.5 and 36 ppt. Spawning occurs from February-December with a peak in May

Abbreviations: MAB = Mid-Atlantic Bight; SAB = South Atlantic Bight.
Sources: MAFMC, 1998, 2008; SAFMC 1998; NEFMC, 1998a,b,c; 2002.
Note: Fifteen species of groundfish are managed under the NE Multispecies FMP: Atlantic cod, haddock, pollock, yellowtail flounder, witch flounder, winter flounder, windowpane flounder, American plaice, Atlantic halibut, redfish, ocean pout, silver hake (whiting), red hake, and offshore hake. Barndoor, clearnose, smooth, thorny, and winter skates and spiny dogfish are managed under separate plans and may be associated with demersal habitat. A subset of those species are presented in this table.

Table A-7

Representative Coastal Pelagic Species and Life Stages with Essential Fish Habitat Identified within the Study Area

Species	Eggs and Larvae	Juveniles	Adults
Longfin squid (*Loligo pealei*)	Coastal and offshore bottom habitats from Georges Bank southward to Cape Hatteras, NC egg masses are found attached to rocks and boulders on sand or mud bottom, as well as attached to aquatic vegetation where bottom water temperatures range between 10and 23 °C, salinities range from 30-32 ppt, and depths are less than 50 m	Pelagic waters of the continental shelf from the Gulf of Maine through Cape Hatteras, NC, from shore to 213 m water depths in temperatures ranging from 3.8-27 °C	Pelagic waters of the continental shelf from the Gulf of Maine through Cape Hatteras, NC, from shore to 305 m water depths in temperatures ranging from 3.8-27 °C
Shortfin squid (*Illex illecebrosus*)		Pelagic waters of the continental shelf from the Gulf of Maine through Cape Hatteras, NC, from shore to 183 m water depths in temperatures ranging from 2.2-22.8 °C	Pelagic waters of the continental shelf from the Gulf of Maine through Cape Hatteras, NC, from shore to 183 m water depths in temperatures ranging from 3.8-19 °C
Atlantic herring (*Clupea harengus*)	Eggs found in bottom habitats of gravel, sand, cobble, and shell fragments in the study area south to Cape Hatteras, NC. Typically in water depths 20-80 m from July to November. Larvae not found in study area.	Pelagic waters and bottom habitats in the study area south to Cape Hatteras, NC. Generally, the following conditions exist where Atlantic herring juveniles are found: water temperatures below 10 °C, water depths from 15-135 m, and a salinity range from 26-32 ppt	Pelagic waters and bottom habitats in study area south to Cape Hatteras, NC. Generally, the following conditions exist where Atlantic herring adults are found: water temperatures below 10 °C, water depths from 20-130 m, and salinity above from 28 ppt
Cobia (*Rachycentron canadum*)	Pelagic waters of SAB and MAB from shore to the shelf edge	Shelf waters of SAB and MAB; artificial and natural hard bottom; associates with larger nekton (i.e., sharks, rays, sea turtles)	Shelf waters of SAB and MAB; artificial and natural hard bottom structures; associates with larger nekton (i.e., sharks, rays, sea turtles)
King mackerel (*Scomberomorus cavalla*)	Pelagic waters of SAB and MAB from shore to the shelf edge	Shelf waters of SAB and MAB; associates with artificial and natural hard bottom	Shelf waters of SAB and MAB; associates with artificial and natural hard bottom
Spanish mackerel (*Scomberomorus maculatus*)	Pelagic waters of SAB and MAB from shore to the shelf edge	Shelf and inshore waters of SAB and MAB; associates with artificial and natural hard bottom	Shelf and inshore waters of SAB and MAB; associates with artificial and natural hard bottom
Little tunny (*Euthynnus alletteratus*)	Pelagic waters of SAB and MAB from shore to beyond the shelf edge	Shelf waters of MAB and SAB; associates with artificial and natural hard bottom	Shelf waters of MAB and SAB; associates with artificial and natural hard bottom
Atlantic mackerel (*Scomber scomber*)	Shelf waters of MAB from Maine to Cape Hatteras, NC	Shelf waters of MAB from Maine to Cape Hatteras, NC to 320 m	Shelf waters from Maine to Cape Hatteras, NC (from shore to 320 m
Bluefish (*Pomatomus saltatrix*)	Shelf waters of MAB from Maine to Cape Hatteras, NC	Estuaries and coastal waters of the AOI	Shelf and inshore waters of SAB and MAB

Table A-7 continued: Representative Coastal Pelagic Species and Life Stages with Essential Fish Habitat Identified within the Study Area

Species	Eggs and Larvae	Juveniles	Adults
Butterfish (*Peprilus triacanthus*)	Pelagic waters of MAB from shore to beyond the shelf edge where temperatures range from 11-17 °C	Pelagic waters of MAB from shore to beyond the shelf edge where temperatures are 11-20 °C and water depths range from 10-366 m	Pelagic waters of MAB from shore to beyond the shelf edge where temperatures are 3-28 °C and water depths range from 10-366 m
Spiny dogfish (*Squalus acanthias*)	Does not apply	Study area where temperatures range from 3-28 ºC	Study area where temperatures range from 3-28 ºC

Abbreviations: MAB = Mid-Atlantic Bight; SAB = South Atlantic Bight.
Sources: SAFMC 1998; MAFMC, 1998, 2008; NEFMC, 1998a,b,c,2002.
Note: Fifteen species of groundfish are managed under the NE Multispecies FMP: Atlantic cod, haddock, pollock, yellowtail flounder, witch flounder, winter flounder, windowpane flounder, American plaice, Atlantic halibut, redfish, ocean pout, silver hake (whiting), red hake, and offshore hake. Barndoor, clearnose, smooth, thorny, and winter skates and spiny dogfish are managed under separate plans and may be associated with pelagic habitat. Similarly, migrating adult Atlantic Salmon may also occur in pelagic waters in the Gulf of Maine. A subset of those species are presented in this table.

Table A-8

Small Coastal Shark Species and Life Stages with Essential Fish Habitat Identified within the Study Area

Species	Neonate/Early Juveniles	Late Juveniles/Subadults	Adults
Angel shark (*Squatina dumerili*)	Off the coast of MAB in shallow coastal waters out to the 25-m isobath, including the mouth of Delaware Bay	Off the coast of MAB in shallow coastal waters out to the 25-m isobath, including the mouth of Delaware Bay	Off the coast of MAB in shallow coastal waters out to the 25-m isobath, including the mouth of Delaware Bay
Bonnethead shark (*Sphyrna tiburo*)	Shallow coastal waters, inlets, and estuaries less than 25 m deep from Jekyll Island, GA, to just north of Cape Canaveral, FL	Shallow coastal waters, inlets, and estuaries less than 25 m deep from Cape Fear, NC, to West Palm Beach, FL	Shallow coastal waters, inlets and estuaries from Cape Fear, NC, to Cape Canaveral, FL
Atlantic sharpnose shark (*Rhizoprionodon terraenovae*)	Shallow coastal areas including bays and estuaries out to the 25-m isobath from Daytona Beach, FL north to Cape Hatteras, NC	From Daytona Beach, FL, north to Cumberland Island, GA; Hilton Head Island, SC, north to Cape Hatteras, NC, out to the 25-m isobath (slightly deeper – to the 50 m isobath – off NC)	MAB south to the NC/SC border; shallow coastal areas north of Cape Hatteras, NC, to the 25-m isobath; south of Cape Hatteras between the 25- and 100-m isobaths; offshore St. Augustine, FL, to Cape Canaveral, FL, from inshore to the 100-m isobath
Blacknose shark (*Carcharhinus acronotus*)	Shallow coastal waters less than 25 m deep from the GA/FL border to Cape Canaveral, FL	Shallow coastal waters less than 25 m deep from the GA/FL border to Cape Canaveral, FL	Shallow coastal waters to the 25-m isobath from St. Augustine, FL south to Cape Canaveral, FL
Finetooth shark (*Carcharhinus isodon*)	Shallow coastal waters of SC, GA, and FL out to the 25-m isobath from 33°-30° N	Shallow coastal waters of SC, GA, and FL out to the 25-m isobath from 33°-30° N	Shallow coastal waters of SC, GA, and FL out to the 25-m isobath from 33°-30° N

Source: USDOC, NMFS 2009.

Table A-9

Large Coastal Shark Species and Life Stages with Essential Fish Habitat Identified within the Study Area

Species	Neonate/Early Juveniles	Late Juveniles/Subadults	Adults
Basking shark (*Cetorhinus maximus*)	Insufficient information	Offshore the mid-Atlantic U.S. south of Nantucket Shoals at 70°W to the northern edge of Cape Hatteras, NC, at 35.5° N in waters from 50-200 m deep	Not in the Study Area
Scalloped hammerhead (*Sphyrna lewini*)	Not in the Study Area	Pelagic waters of the U.S. Atlantic seaboard from the shoreline out to the 200-m isobath from 39° N south to the Florida Keys	Pelagic waters of the South from 36.5°-33° N between the 25 and 200-m isobaths
Great hammerhead (*Sphyrna mokarran*)	Insufficient information	Off the FL coast, all shallow coastal waters out to the 100-m isobath from 30° N south around peninsular FL to 82.5° W, including Florida Bay and adjacent waters east of 81.5° W (north of 25°N), and east of 82.5° W	Off the entire east coast of FL, all shallow coastal waters out to the 100-m isobath, south of 30° N, including the west coast of FL to 85.5° W
Bigeye thresher shark (*Alopias superciliosus*)	Insufficient information	Offshore NC from 36.5°-34°N, between the 200- and 2,000-m isobaths	Offshore NC from 35.5°-35°N, between the 200- and 2,000-m isobaths
White shark (*Carcharodon carcharias*)	Insufficient information	Offshore northern NJ and Long Island, NY, in pelagic waters from the 25- to 100-m isobaths in the New York Bight area, bounded to the east at 71.5° W and to the south at 39.5° N; also, offshore Cape Canaveral, FL, between the 25- and 100-m isobaths from 29.5° N south to 28° N	Insufficient information
Nurse shark (*Ginglymostoma cirtatum*)	Not in the Study Area	Shallow coastal waters from the shoreline to the 25-m isobath off the east coast of FL from south of Cumberland Island, GA (at 30.5° N)	Shallow coastal waters from the shoreline to the 25-m isobath off the east coast of FL from south of Cumberland Island, GA (at 30.5° N)
Bignose shark (*Carcharhinus altimus*)	From offshore Delmarva Peninsula (38° N) to Bull's Bay, SC (32° N), between the 100- and 200-m isobaths	From offshore Delmarva Peninsula (38° N) to Bull's Bay, SC (32° N), between the 100- and 500-m isobaths	Insufficient information

Table A-9 continued: Large Coastal Shark Species and Life Stages with Essential Fish Habitat

Species	Neonate/Early Juveniles	Late Juveniles/Subadults	Adults
Blacktip shark (*Carcharhinus limbatus*)	Shallow coastal waters to the 25-m isobath from Bull's Bay, SC, at 33.5° N, south to Cape Canaveral, FL, at 28.5° N	Shallow coastal waters from the shoreline to the 25-m isobath from Cape Hatteras, NC, at 35.25° N to 29° N at Ponce de Leon Inlet, St. Augustine, FL	Shallow coastal waters of the Outer Banks, NC, from the shoreline to the 200-m isobath between 36° N and 34.5° N; shallow coastal waters offshore to the 50-m isobath from St. Augustine, FL (30° N), to offshore Cape Canaveral, FL (28.5° N)
Bull shark (*Carcharhinus leucas*)	In shallow coastal waters, inlets, and estuaries in waters less than 25 m deep from just north of Cape Canaveral, FL, at 29° N to just south of Cape Canaveral, FL, at 28° N	In shallow coastal waters, inlets and estuaries in waters less than 25 m deep from Savannah Beach, GA, at 32°N	Not in the Study Area
Dusky shark (*Carcharhinus obscurus*)	Shallow coastal waters, inlets, and estuaries to the 25-m isobath from the eastern end of Long Island, NY, at 72° W south to Cape Lookout, NC, at 34.5° N; from Cape Lookout south to West Palm Beach, FL (27.5° N), shallow coastal waters, inlets, and estuaries and offshore areas to the 90-m isobath	Pelagic waters from VA/NC border to Jacksonville, FL, between the 25- and 200-m isobaths	Pelagic waters from VA/NC border south to Ft. Lauderdale, FL, between the 25- and 200-m isobaths
Night shark (*Carcharhinus signatus*)	Insufficient information	Pelagic waters from offshore Assateague Island, MD (38° N), south to offshore of Cape Fear, NC (33.5° N), from the 100- to 2,000-m isobaths	Pelagic waters of the South Atlantic Bight from the 100-m isobath to either the 2,000-m isobath or 100 miles from shore
Sandbar shark (*Carcharhinus plumbeus*)	Shallow coastal waters, inlets, and estuaries in waters less than 25 m deep from Montauk, NY, to Cape Canaveral, FL (27.5° N)	Shallow coastal waters, inlets, and estuaries in waters less than 25 m deep from Montauk, NY, to Cape Canaveral, FL (27.5° N)	Areas on the east coast of the U.S., shallow coastal areas from the coast to the 50-m isobath from Nantucket, MA, south to Miami, FL
Silky shark (*Carcharhinus falciformis*)	Waters off Cape Hatteras, NC, between the 100- and 2,000-m isobaths, plus shallow coastal waters just north and immediately west of Cape Hatteras; waters off St. Augustine, FL, south to off Miami in depths of 25-1,000 m (likely along the west edge of the Gulf Stream)	From offshore Chesapeake Bay, MD, south to offshore of NC/SC border from the 50- to 2,000-m isobaths	Insufficient information
Spinner shark (*Carcharhinus brevipinna*)	Shallow coastal waters less than 25 m deep from Cape Hatteras, NC, to around FL	Shallow coastal waters less than 200 m deep from GA/FL border south to Cape Canaveral, FL (28.5° N)	Shallow coastal waters less than 100 m deep from GA/FL border south to Cape Canaveral, FL (28.5° N)

Table A-9 continued: Large Coastal Shark Species and Life Stages with Essential Fish Habitat

Species	Neonate/Early Juveniles	Late Juveniles/Subadults	Adults
Lemon shark (*Negaprion brevirostris*)	Shallow coastal waters, inlets, and estuaries out to the 25-m isobath from Savannah, GA, at 32° N, south to Indian River Inlet, FL at 29° N	Shallow coastal waters, inlets, and estuaries offshore to the 25-m isobath, west of 79.75° W from Bull's Bay, SC, to south of Cape Canaveral (West Palm Beach), FL, at 28° N	Shallow coastal waters, inlets, and estuaries offshore to the 25-m isobath from Cumberland Island, GA, at 31° N to St. Augustine, FL, at 31° N
Tiger shark (*Gaelocerdo cuvier*)	Shallow coastal waters to the 200-m isobath from Canaveral, FL (27.5° N) to Montauk, NY	Around the peninsula of FL to the 100-m isobath to the FL/GA border; north to Cape Lookout, NC, from the 25- 100-m isobaths; from Cape Lookout north to just south of the Chesapeake Bay, MD, from inshore to the 100-m isobath	Offshore from Chesapeake Bay, MD, south to Ft. Lauderdale, FL, to the western edge of the Gulf Stream
Sand tiger shark (*Carcharias taurus*)	Shallow coastal waters less than 25 m deep from Barnegat Inlet, NJ, to Cape Canaveral, FL (27.5° N)	Insufficient information	Shallow coastal waters less than 25 m deep from Barnegat Inlet, NJ, to Cape Canaveral, FL (27.5° N)

Source: USDOC, NMFS 2009.

Table A-10

Highly Migratory Fishes and Life Stages with Essential Fish Habitat Identified within the Study Area

Species	Eggs, and Larvae	Juveniles/Subadults	Adults
Dolphin (*Coryphaena hippurus*)	Pelagic waters of the Gulf Stream including the "Point" offshore NC	Pelagic waters of the Gulf Stream including the "Point" offshore NC	Pelagic waters of the Gulf Stream including the "Point" offshore NC
Wahoo (*Acanthocybium solandri*)	Pelagic waters of the Gulf Stream including the "Point" offshore NC	Pelagic waters of the Gulf Stream including the "Point" offshore NC	Pelagic waters of the Gulf Stream including the "Point" offshore NC
Albacore (*Thunnus alalunga*)	Insufficient information	In pelagic waters with temperatures between 15.6 and 19.4 °C, offshore the U.S. east coast in the Mid-Atlantic Bight from the 50-m isobath to the 2,000-m isobath from 71° W (northeast boundary) to 38° N (southwest boundary)	In surface waters with temperatures between 13.5 and 25.2 °C, offshore the U.S. eastern seaboard between the 100- and 2,000-m isobaths from southeastern Georges Bank at 41.25° N, south to 36.5° N, offshore the VA/NC border; also, in the Blake Plateau and Spur region, from 79° W east to the Exclusive Economic Zone (EEZ) boundary and 29° N south to the EEZ boundary
Bigeye tuna (*Thunnus obesus*)	Insufficient information	In surface waters from southeastern Georges Bank to the boundary of the EEZ to Cape Hatteras, NC, at 35° N from the 200-m isobath to the EEZ boundary; also, in the Blake Plateau region off Cape Canaveral, FL, from 29° N south to the EEZ boundary (28.25° N) and from 79° W east to the EEZ boundary (approximately 76.75° W)	In pelagic waters from the surface to a depth of 250 m; from southeastern Georges Bank at the EEZ boundary to offshore Delaware Bay at 38° N, from the 100-m isobath to the EEZ boundary; from offshore Delaware Bay south to Cape Lookout, NC (approximately the region off Cape Canaveral, FL), from 29° N south to the EEZ boundary (28.25° N), and from 79° W east to the EEZ boundary (76.75° W)
Bluefin tuna (*Thunnus thynnus*)	In pelagic and near-coastal surface waters from the NC/SC border at 33.5° N, south to Cape Canaveral, FL, from 15 miles from shore to the 200-m isobath; all waters from offshore Cape Canaveral at 28.25° N	All inshore and pelagic surface waters warmer than 12 °C of the Gulf of Maine and Cape Cod Bay, MA, from Cape Ann, MA (~42.75° N), east to 69.75° W (including waters of the Great South Channel west of 69.75° W), continuing south to and including Nantucket Shoals at 70.5° W to off Cape Hatteras, NC (approximately 35.5° N)	South of 39° N, from the 50-m isobath to the 2,000-m isobath to offshore Cape Lookout, NC, at 34.5°N. In pelagic waters from offshore Daytona Beach, FL (29.5°N) south to Key West (82° W) from the 100-m isobath to the EEZ boundary

Table A-10 continued: Highly Migratory Fishes and Life Stages with Essential Fish Habitat Identified within the Study Area

Species	Eggs, and Larvae	Juveniles/Subadults	Adults
Skipjack tuna (*Katsuwonus pelamis*)	Not in Study Area	Not in Study Area	In pelagic surface waters from 20-31 °C in the Mid-Atlantic Bight, from the 25-m isobath to the 200-m isobath from 71° W off the coast of Martha's Vineyard, MA, south and west to 35.5° N, offshore Oregon Inlet, NC
Yellowfin tuna (*Thunnus albacares*)	Not in Study Area	Not in Study Area	Not in Study Area
Swordfish (*Xiphias gladius*)	From Cape Hatteras, NC (35° N) extending south around peninsular FL through the Gulf of Mexico to the U.S./Mexico border from the 200-m isobath to the EEZ	Pelagic waters warmer than 18 °C from the surface to a depth of 500 m from Manasquan Inlet, NJ, at 40° N, east to 73° W, south to GA at 31.5° N	Pelagic waters warmer than 13 °C from the surface to 500 m deep from Cape Cod, MA, to Biscayne Bay, FL
Blue marlin (*Makaira nigricans*)	Offshore FL, identical to adult EFH in that area: from offshore Ponce de Leon Inlet (29.5° N) south to offshore Melbourne, FL, from the 100-m isobath to 50 miles seaward (79.25° W); from offshore Melbourne, FL	Pelagic waters warmer than 24 °C from offshore Delaware Bay (38.5° N) south to Cape Lookout, NC, between the 200- and 2,000-m isobaths	Pelagic waters warmer than 24 °C from offshore Delaware Bay (38.5° N) south to Wilmington, NC (33.5° N), between 200 and 2,000 m isobath
White marlin (*Kijikia albida*)	Insufficient information	Pelagic waters warmer than 22 °C from offshore Georges Bank (41° N) south to Miami, FL (25.25° N), between the 50- and 2,000-m isobaths	Pelagic waters warmer than 22 °C from offshore the northeast U.S. east coast from 33.75°to 39.25° N between the 50- and 2,000-m isobaths
Sailfish (*Istiophorus platypterus*)	Not in Study Area	Not in Study Area	Pelagic and coastal waters between 21 and 28 °C offshore of the U.S. southeast coast from 5 miles off the coast to 200 m water depths from 36°-34° N, then from 5 miles offshore to 125 miles offshore or the EEZ boundary
Longbill spearfish (*Tetrapterus pfluegeri*)	Insufficient information	Offshore NC from 36.5°-35° N from the 200-m isobath to the EEZ boundary	Offshore of NC from 37°-31° N, including the Charleston Bump
Roundscale Spearfish (*Tetrapturus georgi*)	Insufficient information	Insufficient information	Offshore of NC, Cape Hatteras

Sources: SAFMC, 2003; USDOC, NMFS 2009.

Table A-11

Pelagic Shark Species and Life Stages with Essential Fish Habitat Identified within the Study Area

Species	Neonate/Early Juveniles	Late Juveniles/Subadults	Adults
Longfin mako (*Isurus paucus*)	Pelagic waters of the northeast U.S. coast from the 100-m isobath out to the Exclusive Economic Zone (EEZ) boundary from Georges Bank to Cape Hatteras (35° N)	Pelagic waters of northeast U.S. coast from the 100-m isobath out to the EEZ boundary from Georges Bank to Cape Hatteras (35° N)	Pelagic waters of northeast U.S. coast from the 100-m isobath out to the EEZ boundary from Georges Bank to Cape Hatteras (35° N)
Shortfin mako (*Isurus oxyrinchus*)	Between the 50- and 2,000-m isobaths from Cape Lookout, NC (35° N) north to just east of Georges Bank (42° N and 66° W) to the EEZ boundary; and between the 25- and 50-m isobaths from the VA/NC border to southwest of Georges Bank	Between the 25- and 2,000-m isobaths from offshore Onslow Bay, NC, north to Cape Cod, MA, and extending west between 38° and 41.5° N to the EEZ boundary	Between the 25- and 2,000-m isobaths from offshore Cape Lookout, NC, north to Long Island, NY; and extending west between 38.5° N and 41.5° N to the EEZ boundary
Oceanic whitetip shark (*Carcharhinus longimanus*)	In the vicinity of the Charleston Bump, shelf out to the 2,000-m isobath, between 32.5° and 31° N	Offshore the southeast U.S. coast from 32°-26° N, to the EEZ boundary, or 75° W, whichever is nearer	Pelagic waters offshore the U.S. east coast out to the EEZ boundary, from 36°-30° N
Porbeagle shark (*Lamna nasus*)	Insufficient information	Offshore Canada to Massachusetts, and seasonally to New Jersey shelf	Offshore Canada to Massachusetts, and seasonally to New Jersey shelf
Blue shark (*Prionace galauca*)	Not in the Study Area	Pelagic waters from offshore Cape Hatteras, NC (35° N), north to the EEZ boundary off Georges Bank, from the 25-m isobath to the EEZ	Pelagic waters from offshore Cape Hatteras, NC (35° N), north to the EEZ offshore off Georges Bank from the 25-m isobath to the EEZ
Bigeye thresher shark (*Alopias superciliosus*)	Insufficient information	Offshore NC from 36.5°-34° N,	Offshore NC from 35.5°-35° N
Smooth dogfish	Offshore Massachusetts to south Carolina	Offshore Massachusetts to south Carolina	Offshore Massachusetts to south Carolina

Source: USDOC, NMFS 2009.

Table A-12

Habitat Areas of Particular Concern Identified within the Study Area

Habitats of Particular Concern	Fishery Management Plan					
	Snapper-Grouper Complex	**Coral, Coral Reefs, and Live/Hard Bottom Habitats**	**Coastal Migratory Pelagic Resources**	**Spiny Lobster**	**Dolphin and Wahoo**	**Atlantic Highly Migratory Species (NJ, VA, NC)**
Tilefish	X					
SEAMAP Hardbottom	X			X		
SEAMAP Nearshore Hardbottom	X	X	X			
SEAMAP Offshore Hardbottom	X	X				
Phragmatopoma (worm reefs) reefs	X	X	X			
Florida Special Management Zone	X					
Georgia Special Management Zone	X					
South Carolina Special Management Zone	X					
The Point/Amberjack Lump	X	X	X		X	
Ten Fathom Ledge	X	X	X		X	
Pelagic *Sargassum*	X		X			
Platform Margin Reef				X		
Outer Hurl Rocks		X	X			
Sandy Shoals of Capes Lookout, Fear, and Hatteras			X			
Sandbar Shark						X
Florida Keys National Marine Sanctuary		X				

Table A-13

Summary of Marine Fish Hearing Sensitivity

Family	Common Name of Taxa	Highest Frequency Detected (Hz)[1]	Notes
Asceripensidae	Sturgeon	800	Several different species tested. Relatively poor sensitivity
Anguillidae	Eels	300	Poor sensitivity
Batrachoididae	Toadfishes	400	--
Clupeidae	Shad, menhden	> 120,000	Ultrasound detecting, but sensitivity relatively poor
	Anchovy, sardines, herrings	4,000	Not detect ultrasound, and relativley poor sensitivitiy
Chondrichthyes [Class]	Rays, sharks, skates	1,000	Low frequency hearing, not very sensitive to sound
Gadidae	Atlantic cod, haddock, pollack, hake	500	Probably detect infrasound (below 40 Hz). Best hearing 100-300 Hz.
	Grenadiers	--	Deep sea, highly specialized ear structures suggesting good hearing, but no measures of hearing
Gobidae	Gobies	400	--
Labridae	Wrasses	1,300	--
Lutjanidae	Snappers	1,000	--
Malacanthidae	Tilefish		No data
Moronidae	Striped bass	1,000	--
Pomacentridae	Damselfish	1,500 – 2,000	--
Pomadasyidae	Grunts	1,000	--
Polyprionidae	Wreckfish	--	No data
Sciaenidae	Drums, weakfish, croakers	1,000	Hear poorly
	Silver perch	3,000	--
Serranidae	Groupers	--	No data
Scombridae	Yellowfin tuna	1,100	With swim bladder
	Tuna	1,000	Without swim bladder
	Bluefin tuna	1,000	Based only on ear anatomy

Sources: Data compiled from Fay (1988) and Nedwell et al. (2004). Scientific names marked with an asterisk have a different name in the literature (updated names are from www.fishbase.org).

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Appendix B

Finding of No Historic Properties Affected

Finding of No Historic Properties Affected
for Atlantic Outer Continental Shelf Proposed Geological
and Geophysical Activities to Identify Sand Resources and Borrow Areas
for Coastal Restoration Projects

Finding

The Bureau of Ocean Energy Management (BOEM) has made a Finding of No Historic Properties Affected for this undertaking. Through contract conditions and active bureau oversight, BOEM will require the contractor to avoid, during geological sampling activities, any potential historic properties identified through geophysical surveys, or, when undertaken, diver-conducted visual surveys.

Documentation in Support of the Finding

I. Description of the Undertaking

<u>Background</u>

The purpose of the undertaking is to identify and characterize sand resources and potential borrow areas on the Atlantic outer continental shelf (OCS) for possible use in future beach nourishment, coastal restoration, and resiliency projects. Sand resources and borrow areas will be identified by conducting geophysical and geological (G&G) surveys and relevant laboratory/analytical methods to determine presence and volume of beach-compatible sand based on geological properties such as grain size. Once beach quality sand resource areas have been identified, these sand resources could be available to local, state, and Federal agencies for beach nourishment, coastal restoration, and coastal resiliency to provide protection of infrastructure, create coastal habitat, and reduce damage caused by storms, currents, and waves. **Those future proposed actions are not connected actions and would undergo a separate Section 106 consultation process if they are determined to be an undertaking under 36 CFR 800.**

The need for the undertaking is to identify, characterize, and inventory OCS sand resources for beach nourishment and coastal restoration projects, including projects associated with short- and long-term recovery from impacts due to Hurricane Sandy. The additional information will allow BOEM to properly inventory and manage this important sand resource. An OCS sand resource inventory is necessary because sand resources in state waters are diminishing, of poor quality, and are precluded from use due to environmental factors. Moreover, excavation of nearshore (non-OCS) sand often occurs within the active coastal system, compromising long-term effectiveness of projects and failing to address the need to supplement a deficit in the coastal sand budget. Utilizing OCS sand resources introduces new sand from outside of the active coastal system to decrease the coastal sand deficit, improving project sustainability and geomorphic function.

BOEM is obligated to meet the terms of the Disaster Relief Appropriations Act by (1) providing funds to aid in the recovery from Hurricane Sandy and meet future coastal resiliency objectives and (2) complying with a 24-month schedule to complete projects and spend funding. By collecting and analyzing these G&G data, BOEM would be able to identify resources for enhancing coastal resiliency, more adequately manage resources within its jurisdiction, and develop a more comprehensive understanding of available resources.

Project Location and Description

The proposed project area includes three distinct areas: the North-Atlantic Planning Area, Mid-Atlantic Planning Area, and the South-Atlantic/Straits-of-Florida Planning Areas (see Figure 1). The project area extends from approximately 3 to 8 nautical miles (nm, 5.6 to 14.8 kilometers (km)) from the shore and to depths of about 90 feet (ft, 27.5 meters (m)).

While exact areas for the sand characterization surveys are not known at this time, the proposed project area is composed of all areas that could be surveyed for sand resources, so a conservative approach was used in delineating an expanded geographic extent where the undertaking could occur. Actual G&G surveys will not occur across the entire project area, but are likely to be concentrated in discrete areas that are a small fraction of the overall contiguous project area. The entire proposed project area is approximately 8.5 million acres; BOEM anticipates that G&G activities would occur within 38,000 to 58,000 acres, or less than one percent of the total project area.

Forty percent of funding received to recover from Hurricane Sandy is required to be spent for activities adjacent to New Jersey and New York; therefore, it is anticipated that almost half of the G&G activities within the proposed project area would be concentrated offshore of New Jersey and New York. Prior to G&G activities commencing, BOEM plans to coordinate with Atlantic coastal states, Federal stakeholders, and relevant planning bodies to determine areas of greatest need, defined in terms of the need for data to identify additional borrow areas.

A comprehensive and systematic approach to gather G&G data to inventory, identify, and delineate Atlantic OCS sand resources is proposed. Varying levels of research have been conducted on the Atlantic OCS regarding sand resources and identification of borrow areas. In some areas, reconnaissance studies are still needed as a first step to identify areas potentially containing sand resources. In other areas, reconnaissance-level surveys have occurred and additional site-specific investigations are needed to map the lateral and vertical extent of new borrow areas and determine if any limitations to potentially use said resources are present. Consequently, the proposed project consists of both reconnaissance and site-specific studies, depending on the site and level of previous investigation.

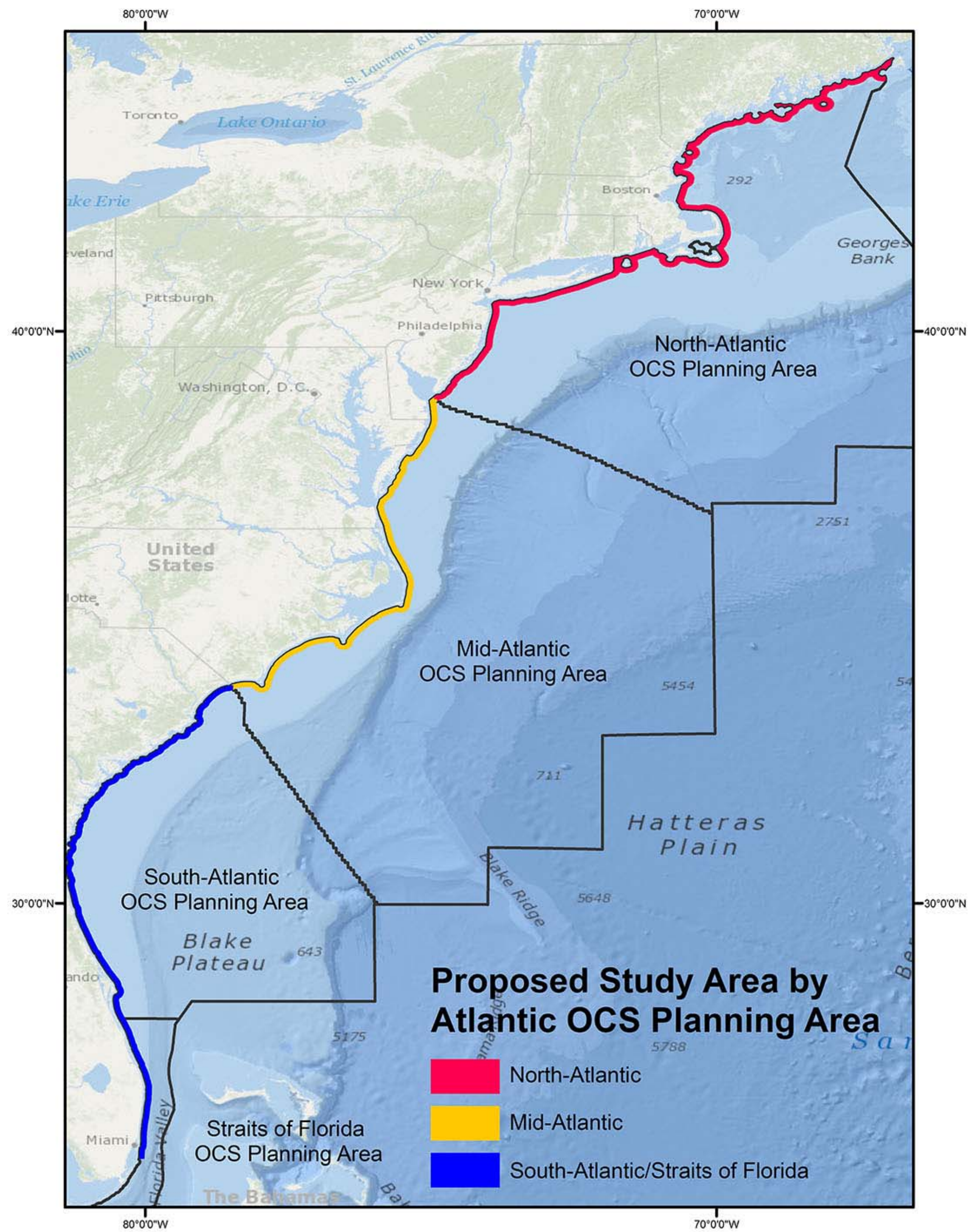

Figure 1. Map showing proposed extent of the proposed project area in which G&G activities could occur (Actual G&G activities will be concentrated in discrete areas, comprising a small fraction of the overall project area.)

To complete reconnaissance or site-specific surveys, two general types of G&G surveys would be employed (see Table 1). Geophysical surveys are conducted to obtain information about shallow sediment stratigraphy, shallow hazards (such as presence of munitions of explosive concern or buried cables), archaeological resources, and sensitive benthic habitats. Typical equipment used in these surveys includes subbottom profilers (chirp or boomer), swath bathymetric sonar, side-scan sonar, and magnetometers. ***BOEM has determined that geophysical surveys do not have the potential to affect historic properties.***

Geological surveys involve seafloor-disturbing activities such as sample collection through the use of grab samples or a platform-mounted vibracore, which are conducted to evaluate the quality of mineral resources for their intended use as sand resources. Vibracores are shallow in nature, focusing on characterizing the sand layer, and penetrate to a depth of no more than 20 ft (6 m) or the extent of the sand layer, whichever is less. ***BOEM has determined that the seafloor-disturbing portions of the geological surveys may have the potential to affect historic properties, and that determination is the basis for preparing this Finding.***

Reconnaissance surveys would be performed over comparatively large areas (i.e., regional in scope) to identify sand bodies and characterize the shallow geological framework and surficial geology of potential sand resources. These surveys would help to ascertain if sand resources are of a certain quality (sediment type) and quantity to warrant further exploration. Site-specific surveys would occur over smaller areas and be used to delineate a potential borrow area. It is projected that approximately 4,000 to 8,000 line-miles of geophysical surveys and 500 sediment samples total would be collected during the life of the project. Anticipated line-miles for geophysical surveys and the number of sediment samples for each planning area are shown in Table 2. It is anticipated that approximately 75-85 percent of the survey work conducted under the proposed project would be reconnaissance in nature and 15-25 percent would be site-specific.

Geophysical surveys and geological sampling, whether reconnaissance or site-specific in nature, may be conducted simultaneously, or in sequence, depending upon the information needs, field conditions, and various project management issues or cost factors. Principal goals of the survey design are to decrease the overall number of separate vessel mobilizations and to reduce redundant data collection. The survey design and selection of technologies, deployment modes, and timing should balance data quality needs, potential environmental impacts, and cost factors. To the extent possible, BOEM proposes to use the least number of lowest-energy (and highest-frequency) acoustic sources to obtain the necessary geophysical data, thereby reducing potential impacts and minimizing acquisition costs.

Table 1. Summary of Geophysical and Geological Techniques

Survey Purpose	Survey Technology	Equipment Used	Reconnaissance or Site-Specific Studies
Geophysical Survey Equipment and Techniques			
Identify near-bottom geologic stratigraphy and potential relict landscapes	Subbottom profiling: Chirp or Boomer systems	Vessel, chirp profiler, or boomer, and hydrophone array (only with boomer source)	Reconnaissance, Site-Specific
Map seafloor bathymetry, image the seafloor, archaeological resources and benthic habitat potential	Swath bathymetry: Multibeam or Interferometric systems	Vessel, multibeam or interferometric transducer	Reconnaissance, Site-Specific
Image the seafloor, archaeological resources, benthic habitat potential, and relict landscapes	Side-scan sonar (frequencies greater than 180 kHz), Acoustic Backscatter using multibeam or interferometric swath bathymetry	Vessel, side scan sonar tow fish	Site-Specific, possibly Reconnaissance
Archaeological resources and hazards potential, including MECs	Magnetometer	Vessel, magnetometer tow fish	Site-Specific
Geological Survey Equipment and Techniques			
Verify geophysical findings, determine sediment attributes and beach compatibility, delineate borrow areas	Sediment samples: Vibracoring or grab samples	Vessel, vibracore coring rig, geologic core barrel (20 feet penetration maximum), limited anchoring if not using dynamic positioning	Reconnaissance, Site-Specific

Note: For all geophysical survey techniques, the technology may also be deployed as a sensor on an autonomous underwater vehicle (AUV).

Table 2. Approximate Survey Parameters by Planning Area

Study Area	Geophysical Surveys (Line-Miles)	Geologic Samples
North-Atlantic Planning Area	2,000 to 3,000	200
Mid-Atlantic Planning Area	1,000 to 2,500	150
South-Atlantic/Straits-of-Florida Planning Areas	1,000 to 2,500	150
Total	**4,000 to 8,000**	**500**

Reconnaissance-level and site-specific surveys will occur either through two sequential mobilizations (one to collect geophysical data and one to collect geological or geotechnical information) or through simultaneous (concurrent) mobilization potentially using more than one vessel. Before any geological sampling occurs, the area will be archaeologically cleared by the appropriate means, which could entail advance or real-time interpretation of geophysical data by qualified personnel or by divers assisting with vibracoring. Data collection will be continuous during the survey, but could stop while the vessel is travelling from line to line or temporarily cease due to environmental considerations.

Depending on the type of equipment being deployed, a vessel with an A-frame, boom, or davit may be required to manage heavy equipment. Typically, survey equipment will be deployed from a single vessel ranging from 28 to 120 ft (9 to 37 m) in length, depending on the survey activity to be conducted/equipment needs, and will travel at speeds between 3 and 5 knots (5.6 to 9.3 kilometers per hour (km/hr)) during survey operations. Vessels will be equipped with an integrated navigational system with layback ranging instrumentation to track the position and depth of towed survey equipment. Because acoustic technologies will be used, vessels that generate little acoustic noise (e.g., bow wake, prop wash) are usually deployed. Vessels will use dynamic positioning and anchoring would be avoided to the maximum extent possible.

Vessels with a vibracoring rig could be larger to support the rig and associated equipment. Vibracore rig configurations vary greatly but typically consist of a tripod or quadrapod consisting of a 20-ft (6 m) long core barrel with a hydraulic, pneumatic, or electric vibrator at the top of the unit. Some rigs use floats instead of a structural tripod or quadrapod to keep the core barrel and vibrator upright so that the only seafloor disturbance occurs locally at the footprint of the 3- to 4-inch diameter core barrel. During sampling, the vessel must remain in a stationary position most often using dynamic positioning, or in some cases, anchors are used. Because anchor positioning requires additional time and skill, dynamic positioning is usually the preferred method of choice.

Information from geological surveys (i.e., sediment sampling) will be used in tandem with geophysical survey data to ground-truth geophysical data and determine the location, volume, and quality of offshore sand resources. Sediment sampling will occur on selected points along the survey track lines where geophysical data has been collected to the above-specified criteria. Some samples will be taken at sites on the flanks of the resource areas to determine the footprint and other geologic characteristics, and other samples will be taken in the center of the resource areas to obtain data regarding the thickness of the sand resource. Sediment sampling could be completed using a grab sampler or a vibracore. In general, grab sampling is conducted when surficial sediment composition needs to be studied as opposed to sediment thickness and stratigraphy. The vibracores are being collected to characterize the sand resource and are not expressly for archaeological interest or identification. The sediment targeted is generally limited to near surface sands, as compared to other geologic facies, such as finer-grained material typical to near-surface or exposed Holocene and Pleistocene back-barrier deposits (where potentially intact relict landforms may be preserved). Those other geological layers are not the target for sampling or subsequent use. Any penetration below the surface sand layer will be incidental and limited in nature. Sediment sampling using each of the two techniques is discussed below.

- Vibracoring. A 3- or 4-inch (7.6- 10.1-cm) diameter aluminum core barrel mounted on a platform or support assembly would be used to penetrate sediments in the upper 20 ft (6 m) of the seafloor or to the extent of the sand layer, whichever is less. To penetrate dense sands and gravels, the corer's barrel is vibrated by pneumatic or electric vibrahead, facilitating penetration into the sediment (Fugro 2003; ISSMGE 2005). Some operations use a single, non-reuseable aluminum core barrel to collect and preserve the core sample, whereas others have a reusable core barrel that is lined with a plastic or Kevlar sleeve that collects and preserves the sample. A typical vibracore survey can obtain 15 to 25 cores approximately 20 ft (6 m) deep in an area measuring 1 square mile (640 acres or 259 hectares). The vibracores are collected along the geophysical track lines in a manner to validate the thickness of the geologic unit and accurately the variability of the sand characteristics. The cores are not collected on a pre-determined regular spaced arbitrary grid; instead they are based on an interpretation of the geophysical data. A vertical sediment sample of 5 to 20 ft (1.5 to 6 m) would be required to determine sediment characteristics and sand resource thickness.
- Grab Samplers. Grab samplers are one of the most common methods of retrieving sediment samples from the surface of the seabed. A grab sampler is a device that collects a sample of the topmost layers of the seabed by bringing two steel clamshells together. The grab is lowered to the seabed and activated either automatically or by remote control. The sample is recovered to the ship for examination. Typical sampling rates are between three and four grabs per hour. Grab sampling penetrates from a few inches to a few feet below the seafloor.

It is projected that approximately 500 sediment samples would be collected (see Table 2). Of the 500 sediment samples anticipated to be collected, most of the samples would be vibracores and only a small portion would be surface grab samples. Grab samples would primarily be collected for ground-truthing geophysical data and interpretations. The time that the coring equipment is on the sea bottom would be less than 15 minutes. Due to the small size of the vibracores and associated platforms, the area of seabed to be disturbed during individual sampling events is estimated to range from 1 to 9 square ft (0.3 to 2.7 square m). The total area of seafloor disturbed by bottom sampling and shallow coring activities would be a very small portion of the total project area.

Area of Potential Effects

As defined at 36 CFR 800.16(d), the area of potential effects (APE) is the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if such properties exist. The APE is influence by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking.

Specific to the undertaking under discussion in this Finding (geological survey activities) BOEM considers the APE to be the depth and breadth of the seabed that could potentially be impacted by any proposed seafloor/bottom-disturbing activities. The geological survey activities may include the collection of sand core samples through the use of a vibracore or grab samples through a clamshell, and under certain conditions, anchorages that could directly impact historic properties on or under the seafloor, if present. BOEM will require, except in limited circumstances (as discussed above), the use of dynamically-positioned vessels to avoid affects associated with anchoring. The footprint of the potential impacts from the vibracore or grab sample is estimated to range from 1 to 9 square ft (0.3 to 2.7 square m). Where anchoring is utilized, BOEM considers the bottom disturbance related to those anchors as part of the APE.

Consultation

BOEM has strived to develop a consistent approach to Section 106 consultation when considering undertakings that may affect historic properties in the Atlantic. BOEM has previously consulted with State Historic Preservation Offices (SHPOs), federally-recognized Tribes, state-recognized tribes, and the Advisory Council on Historic Preservation for lease issuance and site characterization activities related to wind energy development from Florida to Massachusetts. These consultations cover the Mid-Atlantic, South Atlantic, and Rhode Island and Massachusetts (Information related to these consultations can be viewed at: http://www.boem.gov/Renewable-Energy/Historic-Preservation-Activities/). The G&G activities considered in those consultations are similar to the ones discussed in this Finding with the following exception: whereas, during geologic survey activities in this undertaking are utilized to characterize sand deposits on the OCS with a maximum penetration of 20 ft (6 m); those conducted for wind energy development may include borings and could penetrate much deeper into the seafloor to characterize the subsea geology to ensure that it can support wind energy structures. The APE, identification efforts, and avoidance measures discussed in this Finding take into consideration the information obtained during those consultations, and are consistent with those implemented for site characterization activities related to wind energy development in the Atlantic OCS.

Ideally, BOEM would have initiated the Section 106 process much earlier in the planning process for this undertaking, but that has not been possible due to the time constraints associated with this funding source and the need to complete the work within 24 months of awarding the contract. With this in mind, BOEM is sending letters to the following federally-recognized Tribes, SHPOs, and federal agencies initiating Section 106 consultation and is requesting concurrence with this Finding provided it is found to be acceptable.

Federally-Recognized Tribes (in Alphabetic Order):

Absentee Shawnee Tribe of Oklahoma; Aroostook Band of Micmacs; Catawba Indian Nation; Cayuga Nation; Cherokee Nation; The Delaware Nation - Anadarko; The Delaware Nation - Bartlesville; The Delaware Nation - Emporia; Eastern Band of Cherokee Indians; The Eastern Shawnee Tribe of Oklahoma; Houlton Band of Maliseet Indians; Mashantucket Pequot Tribe of Connecticut; Mashpee Wampanoag Tribe; Miccosukee Tribe; Mohegan Indian Tribe of Connecticut; Narragansett Indian Tribe; The Oneida Indian Nation; Onondaga Nation; Passamaquoddy Tribe - Indian Township; Passamaquoddy Tribe - Pleasant Point; Penobscot Nation; Saint Regis Mohawk Tribe; Seminole Tribe of Florida; Seneca Nation of New York; Shinnecock Indian Nation; Stockbridge-Munsee Community of Mohican Indians; Tonawanda Band of Seneca Indians; Tuscarora Nation; United Keetoowah Band of Cherokee Indians in Oklahoma; and Wampanoag Tribe of Gay Head (Aquinnah).

State Historic Preservation Offices:

Connecticut; Delaware; Florida; Georgia; Maine; Maryland; Massachusetts; New Hampshire; New Jersey; New York; North Carolina; Rhode Island; South Carolina; and Virginia.

Federal Agencies:

Advisory Council on Historic Preservation.

To satisfy the public participation component of the Section 106 process, 36 CFR 800.2(d)(2), BOEM will make this Finding available to the public through its website and provide contact information for commenting on the proposed undertaking. BOEM will also notify potentially interested parties using a contact list that it maintains for similar projects in the Atlantic coastal region,

II. Description of the Steps Taken to Identify Historic Properties

Existing and Available Information

BOEM has reviewed existing and available information regarding historic properties that may be present with the proposed project area. Sources of this information include consultations with appropriate parties, SHPOs, and Indian Tribes on similar proposed G&G activities related to renewable energy siting on the Atlantic, and accessing information gathered by BOEM for an updated study of archaeological resource potential on the Atlantic OCS (TRC 2012). This last study compiles information on historic shipwrecks in the Atlantic Shipwreck Database (ASD) and additionally models the potential for pre-European contact sites based on reconstruction of past landscapes, human settlement patterns, and site formation and preservation conditions. This report is publically available (without the database) and can be found on BOEM's website at: http://www.data.boem.gov/PI/PDFImages/ESPIS/5/5196.pdf.

Existing governmental databases form the core of the data for BOEM's ASD and include: The National Oceanic and Atmospheric Administration (NOAA) Automated Wreck and

Obstructions Information System (AWOIS), a database of wrecks and obstructions compiled from hydrographic surveys and field reports, and the U.S. Navy Non-Submarine Contact List (NSC), a database created for military use in distinguishing shipwrecks from submarines hiding on the ocean floor. The U.S. Navy also maintains a database entitled Partial List of Foundered U.S. Navy Craft, which is included in the ASD. Commercial databases were also compiled including The Global Maritime Wrecks Database and the International Registry of Sunken Ships (TRC 2012). The inherent expectation for utilizing multiple sources of information for the same area, however, is that these databases often include redundant listings for the same shipwrecks. Where listings are reasonably close geographically, and/or contain similar enough information to be understood to be one shipwreck location or obstruction, they were analyzed for the purposes of the Finding to contain only one potential shipwreck location or obstruction.

The accuracy of location information is quantified in the ASD by a ranking between "1" and "4." Shipwrecks that have been positively located through recent survey are given a location reliability of "1." Those shipwrecks with specific locations provided by informants, reported in literature, or marked on a map are considered a "2." A location reliability of "3" indicates that the location is given generally rather than specifically by an informant, in the literature, or on a map. Those locations that are unreliable or vague, such as "off the coast of North Carolina" or "at sea" are ranked at "4."

Historic Shipwrecks and Obstructions Atlantic Shipwreck Database

Based on the historically available information compiled in the report and database, a shipwreck density map was created (Figure 3). Another way of illustrating this information is to breakdown the distribution of shipwrecks by State and OCS Planning Area (Table 3). The information contained in the ASD clearly shows that within the proposed project area, there is a high potential for the presence of historic shipwrecks, with the highest concentration being in the Mid-Atlantic OCS Planning Area (TRC 2012).

Submerged Pre-contact Archaeological Resources within Atlantic OCS

Offshore archaeological resources that may exist within the proposed project area may also include submerged pre-contact sites or relict landforms that have a potential to contain these sites. No sites have been previously identified within the proposed project area; however, the area is located within a region of the OCS that was formerly exposed above sea level and available to human occupation during the last ice age. Because of this, the entirety of the proposed project area is within an area that is considered to have the potential for the presence of submerged pre-contact archaeological sites (TRC 2012).

Archaeological Potential within the Proposed Project Area

No detailed site-specific archaeological identification surveys have been conducted in the portions of the proposed project area that are likely to be chosen for reconnaissance and site-specific G&G surveys. Based on a geo-spatial query on the ASD, approximately 1488 shipwrecks may potentially be found in the overall proposed project area (see Table 4). The ASD will be made available to the selected contractor during the survey design and planning process to ensure that these potential wrecks sites will be considered and avoided during the planning phases of G&G surveys. The geophysical surveys required prior to bottom-disturbance (see below) should be effective in identifying any historic properties that may be present in sand characterization areas selected for geological survey activities.

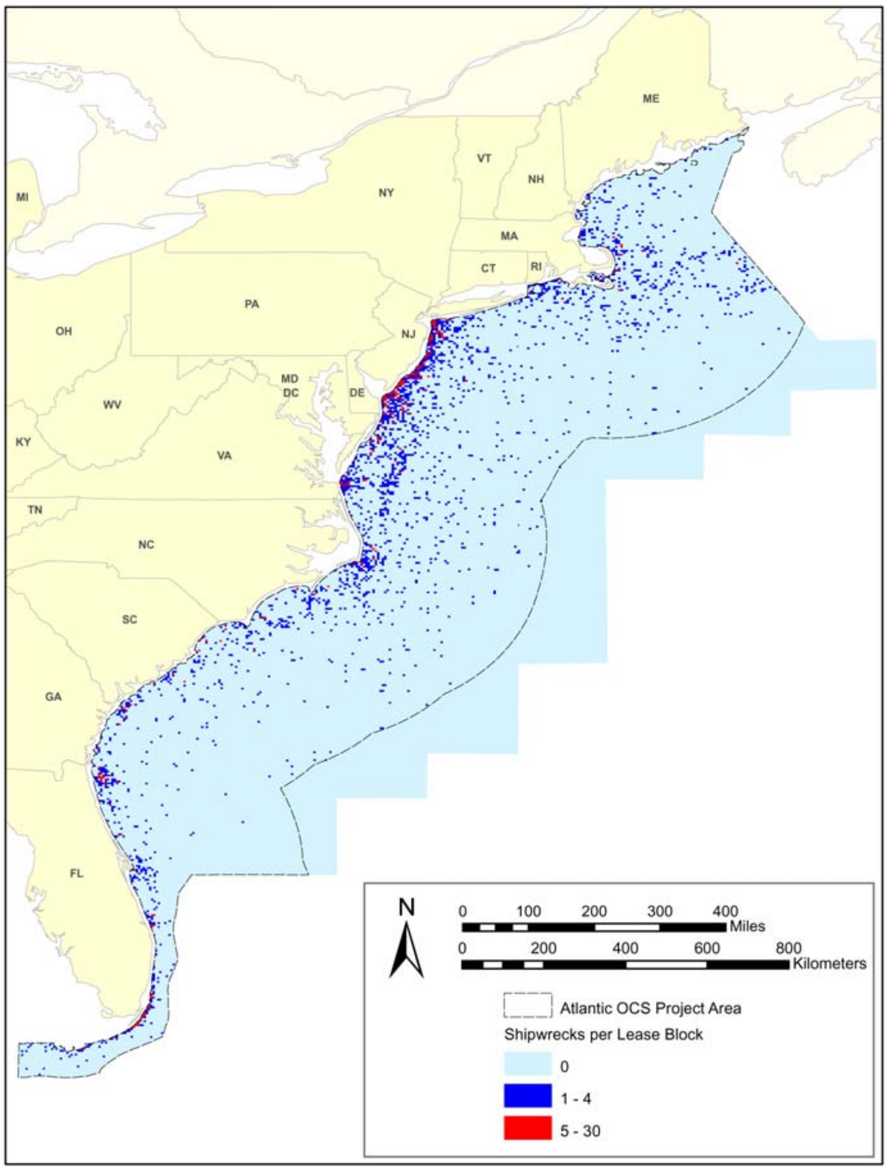

Figure 2. Shipwreck density map for BOEM lease blocks in the Atlantic OCS (TRC 2012)

Based on available information regarding paleoshoreline positions, relative seal level rise, and regional geology, the proposed project area is also considered to have the potential to contain relict landforms that have the potential to contain pre-contact archaeological sites. If surviving the coastal processes associated with sea level rise, these sites, in an undisturbed form, may exist below the sand layers in particular geological facies dating to the Holocene and Pleistocene epochs. Since the purpose of the proposed project is to characterize sand resources on the Atlantic OCS, it is unlikely that these layers will be disturbed during geological sampling.

Table 3. Distribution of Shipwrecks in the ASD by State and Planning Area (based on Table 12.2 in TRC 2012).

Nearest State	Number of Wrecks	Miles of Shoreline in State	Sites Per Linear Mile	Planning Area	Number of Wrecks per Planning Area	Miles of Shoreline in Planning Area	Sites Per Linear Mile
ME	137	240	0.57	North-Atlantic	3,185	789	4.04
NH	10	14	0.71				
MA	762	230	3.31				
RI	140	40	3.50				
CT	13	15	0.87				
NY	371	120	3.09				
NJ	1,752	130	13.48				
DE	310	25	12.40	Mid-Atlantic	4,252	490	8.68
MD	630	33	19.09				
VA	1,701	112	15.19				
NC	1,611	320	5.03				
SC	435	185	2.35	South-Atlantic/Straits of Florida	1,713	917	1.87
GA	160	97	1.65				
FL	1,118	635	1.76				
Totals	**9,150**	**2,196**	**4.17**				

Table 4. Number of Shipwrecks within Proposed Project Area

Planning Area	Number of Wrecks	Locational Reliability	Total Wrecks
North-Atlantic	288	1	826
	532	2	
	6	3	
Mid-Atlantic	100	1	348
	243	2	
	5	3	
South-Atlantic/Straits of Florida	51	1	314
	263	2	
		Total:	1488

Required Identification Efforts to be Specified in the Data Collection Contract

Survey vessels conducting the geophysical surveys would follow predetermined track lines so that the desired coverage of the seafloor is achieved. The length and orientation of the lines are determined by the feature to be mapped. In general, lines are oriented longitudinally and transverse to the feature, and would extend beyond the feature itself to define the footprint and further understand the surrounding geology. Although a grid pattern would be used, line spacing could be expanded in some areas and contracted in other areas that require greater detail. The grid pattern for each survey should cover the maximum area of potential effect for all anticipated physical disturbances. Specific grid requirements are as follows:

- Line spacing for any geophysical data for shallow hazards assessments (subbottom profilers and side-scan sonar) should not exceed 492 ft (150 m) throughout the area.
- Line spacing for all chirp seismic and magnetometer data for archaeological resources assessments should not exceed 98 ft (30 m) throughout the area.
- Line spacing for multibeam, or interferometric swath bathymetry or side-scan sonar should be suitable for the water depths encountered and provide full coverage of the seabed plus suitable overlap and resolution of small discrete targets of 1.5 to 3 ft (0.5 to 1.0 m) in diameter at the relevant slant range.
- When conducting simultaneous studies, the instrument that needs the narrowest line spacing would determine the survey coverage and line spacing.
- All track lines should run generally parallel to each other. Tie-lines running perpendicular to the track lines should not exceed a line spacing of 492 ft (150 m) throughout the survey area.
- All data would be collected to the highest standard 98 ft (30 m). This standard may be adjusted by BOEM in consultation with state stakeholders if different line spacing is determined to be necessary.

BOEM will require that all of the data collected during the geophysical surveys will be integrated together utilizing a state of the art GPS positioning system with real-time kinematic corrections capable of sub-meter accuracy.

III. Description of Proposed Avoidance Measures

BOEM will adopt an avoidance strategy to avoid potential effects to sensitive cultural resources and historic properties, such as historic shipwrecks and pre contact archaeological resources. For example, with advance or real-time mapping of the seafloor or geological framework where geological sampling and other bottom-disturbing activities are proposed, activities can be conducted in such a way to avoid or move to another area if sensitive resources are present.

Proposed Archaeological Mitigation Measures

For this undertaking, BOEM will generally limit vibracore and grab sampling to near-surface sand deposits and within a maximum bottom disturbance footprint of 9 square ft (~2.7 square m) for each sample. The sampling duration for a 20 ft (6 m), 3-4 inch diameter vibracore typically is less than 15 minutes in place. The cores are being collected to characterize the sand resource and are not expressly for archaeological interest or identification. The sediment targeted is generally limited to near surface sands, as compared to other geologic facies, such as finer-grained material typical to near-surface or exposed Holocene and Pleistocene back-barrier deposits (where potentially intact landforms may be preserved). Those other geological layers are not the target for sampling or subsequent use. Any penetration below the surface sand layer will be incidental and limited in nature. Any geologic or other information of archaeological interest will be documented, and any indicator of potentially intact landforms (e.g., color change in the core indicating organic deposits) will be noted and photographed. This information will be made available for use in the design of any future borrow areas to ensure that proposed activities also include the necessary avoidance protections.

BOEM will require to the maximum extent possible the use of a dynamically positioned vessel platform during vibracore and grab sampling operations to avoid unnecessary anchoring and bottom disturbance. No spudding or clump weight anchoring will be allowed. Although BOEM plans to minimize anchoring to the extent possible, there may be instances where anchoring cannot be avoided due to emergency situations or field situations/conditions. In these instances, a minimum sized anchor/anchor array will be used and advance or real-time clearance, through remote sensing, diver observation, or other means within the footprint of anchoring, will be required.

Before bottom-sampling is conducted, the contractor will submit a geological sampling plan to BOEM, which BOEM will share with relevant and interested stakeholders as appropriate. External or third-party participation in field work cannot be accommodated because of cost and logistic implications, which include complex scheduling and the potential for changing vessel size requirements. Upon request, BOEM will make available pertinent geological data, including core logs, photographs, and related textural data, in an electronic format. Prior to distribution, BOEM will review this information and determine if any of the data contains sensitive cultural information.

BOEM will require advance (sequential) or real-time (concurrent) site specific geophysical survey information, from sub-bottom, side scan sonar or multibeam/swath backscatter of equivalent resolution, and magnetometer data and/or direct observation, to determine the presence of potential archaeological resources prior to undertaking any seafloor-disturbing activities. BOEM or its contractors, with the assistance of a qualified marine archaeologist, would use this information to ensure that physical impacts to archaeological resources do not take place. All sampling must occur within the effective coverage of geophysical data. In the instances of sequential geophysical and geological data, the contractor must provide to BOEM a determination by a qualified marine archaeologist as to whether any potential archaeological resources are present in the area and can be effectively avoided. In instances where sequential data collection is not possible, concurrent geophysical surveys and geological sampling may occur real-time provided a qualified marine archaeologist participates in the field effort or has concurrent access to review data quality, interpret said data, and provide assurance that the immediate area is clear before vibracoring, grab sampling, and/or associated anchoring may begin. The contractor will report to BOEM all potential historic properties discovered during the geophysical survey and implement a buffer distance around the extent of the potential resource (not to be less than 164 ft (50 m)) based on the qualified marine archaeologist's interpretation of the geophysical survey data. BOEM will ensure that the qualified marine archaeologist has sufficient authority to require the minimum buffer, or a greater buffer when warranted. BOEM will work closely with the contractor and qualified marine archaeologist to ensure historic properties are not affected by the undertaking and that reporting of potential historic properties and implementation of avoidance measures is timely and complete. BOEM will ensure the "qualified marine archaeologist" meets the Secretary of the Interior's Professional Qualifications Standards for Archaeology (48 FR 44738- 44739) and has demonstrable, professional experience in interpretation of marine geophysical data.

BOEM will ensure that all geological sampling must avoid potential archaeological resources (e.g., known or suspected shipwrecks, and areas designated high probability areas in the Inventory and Analysis of Archaeological Site Occurrence on the Atlantic Outer Continental Shelf) by a minimum of 164 ft (50 m). The avoidance distance will be calculated from the maximum discernible extent of the archaeological resource. During vibracoring, vibracore penetration rates will be monitored to help ensure minimum sampling in geology units that are not indicative of surface sands.

Post-Review Discoveries Clause

BOEM will require that a post-review discoveries clause be included in the contract. This clause describes the actions that the contractor is required to take in the event of a post-review archaeological discovery during geological survey activities associated with this undertaking. In this event, BOEM will follow the post-review discoveries process outlined at 36 CFR 800.13(b)(3). In addition to the reporting requirements during the geophysical surveys, BOEM will require the contractor to report and avoid any previously undiscovered suspected archaeological resource, and precautions to protect the resource from activities. Undiscovered archaeological resources may include shipwrecks (e.g., a sonar image or visual confirmation of an iron, steel, or wooden hull, wooden timbers, anchors, concentrations of historic objects, piles of ballast rock), pre-contact artifacts, etc. within the project area. If the contractor discovers any archaeological resource while conducting geological survey operations, BOEM will require the contractor to: immediately halt seafloor/bottom-disturbing activities operations that may continue to affect the discovery; notify the BOEM Federal Preservation Officer within 24 hours of its discovery; and keep the location of the discovery confidential and take no action that may adversely affect the archaeological resource until BOEM has made an evaluation and instructs the contractor how to proceed. In the event that bottom disturbing activities impact potential historic properties, BOEM will require that the contractor and the qualified marine archaeologist working during the time of the impact provide a statement documenting the extent of these impacts to BOEM within 24 hours.

IV. The Basis for the Determination of No Historic Properties Affected

This Finding (see 36 CFR Part 800.4(d) of the Advisory Council on Historic Preservation's regulations implementing Section 106 of the National Historic Preservation Act) is based on the review conducted by BOEM of existing and available information, the proposed identification efforts and avoidance measures that will be included in the contract, the minimally invasive nature of the vibracoring itself, and the conclusions drawn from this information. The mandatory avoidance measures that will be included in the contract will ensure that the proposed undertaking will not affect historic properties.

REFERENCES

Fugro. 2003. Geophysical and geological techniques for the investigation of near-seabed soils and rocks. A handbook for non-specialists. U.S. Rev. 02-23/03. 55 pp. Available online at: http://www.fugro.com/downloads/corporate/other/GP-GT-TECHNIQUES-handbook.pdf. Accessed September 24, 2013.

International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE). 2005. Geotechnical & Geophysical Investigations for Offshore and Nearshore Developments. Compiled by Technical Committee 1, International Society for Soil Mechanics and Geotechnical Engineering, September 2005. 94 pp. Available online: http://www.geonet.nl/upload/documents/dossiers/Investigations%20for%20developments.pdf. Accessed September 24, 2013.

TRC Environmental Corporation. 2012. Inventory and analysis of archaeological site occurrence on the Atlantic outer continental shelf. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2012-008. 324 pp.

Appendix C

Agency Coordination and Consultation

STATE OF MAINE
DEPARTMENT OF AGRICULTURE, CONSERVATION AND FORESTRY
DIVISION OF GEOLOGY, NATURAL AREAS, AND COASTAL RESOURCES
93 STATE HOUSE STATION
AUGUSTA, MAINE 04333-0093

PAUL R. LEPAGE
GOVERNOR

WALTER E. WHITCOMB
COMMISSIONER

January 21, 2014

Mr. Geoffrey L. Wikel
Chief, Environmental Coordination Branch
United States Department of the Interior
Bureau of Ocean Energy Management
Washington, D.C. 20240-0001

RE: CZMA consistency; geophysical and geological survey of OCS sand resources

Dear Mr. Wikel:

I am writing in response to your letter dated November 8, 2013[1], which provided the Bureau of Ocean Energy Management's ("BOEM") determination pursuant to Section 307 of the Coastal Zone Management Act (16 U.S.C. §1456(c)) and its implementing regulations (15 C.F.R. Part 930, Subpart C) that its proposed "geophysical and geological surveys to identify Outer Continental Shelf ("OCS") sand resources along the Atlantic coast" are consistent with the enforceable policies of the Maine Coastal Program. In addition to the above-noted letter, BOEM provided its "analysis of the coastal effects of the proposed action" in the draft Environmental Assessment ("EA") as information in support of its consistency determination.[2]

The Maine Departments of Environmental Protection ("DEP"), Marine Resources ("DMR"), Agriculture, Conservation and Forestry, and Inland Fisheries and Wildlife have reviewed BOEM's determination and EA. On or about December 21, 2013, the State published notice of the opportunity to comment on the proposal.[3]

Based on review of BOEM's proposal by the afore-mentioned agencies, the State finds that BOEM's proposed surveys do not involve activities which trigger review under the enforceable policies of Maine's coastal management program. Accordingly, further consistency review of BOEM's survey proposal is not required.

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[1] The State provided BOEM notice of its request for a 14-day extension of the consistency review period in accordance with 15 C.F.R. §941(b).
[2] *Proposed Geophysical and Geological Activities in the Atlantic OCS to Identify Sand Resources and Borrow Areas*, Draft Environmental Assessment (BOEM, November 2013)
[3] No public comments on the proposal were received.

MAINE COASTAL PROGRAM
KATHLEEN LEYDEN, DIRECTOR

17 ELKINS LANE – WILLIAMS PAVILLION
AUGUSTA

PH: (207) 287-2801
FAX: (207) 287-2353
www.maine.gov/acf/gnc

We note that BOEM's proposed surveys would include measures to minimize and monitor potential adverse effects on marine mammals and other marine resources and to avoid conflicts with navigation and commercial fisheries, including measures recommended by the National Marine Fisheries Service, and urge BOEM to ensure full implementation of such measures. To help ensure that conflicts with commercial fishing activities do not occur during the survey, we request that BOEM consult with and provide notice to DMR of the dates, times, and locations of survey activities at least one month prior to their initiation so that notice may be provided to the commercial fishing industry. Please contact Denis-Marc Nault at DMR (Denis-Marc.Nault@maine.gov; 207-422-2092) regarding such consultation. In addition, we encourage BOEM to consult with DEP as needed to ensure that the proposed contractor-developed marine pollution control plan regarding survey activities addresses any applicable state as well as federal pollution prevention requirements. Please contact Melanie Loyzim, director of DEP's Bureau of Remediation and Waste Management (Melanie.Loyzim@maine.gov; 207-287-7890) regarding such consultation.

We appreciate BOEM's on-going efforts to work collaboratively with the State on OCS management matters. Please note that subsequent, related federal activities, such as dredging to remove OCS sand resources or deposition of those materials as beach nourishment, if proposed, may require review for consistency with the enforceable policies of the Maine Coastal Program; and we encourage BOEM to consult and coordinate with the State early in its planning process for OCS activities.

Please contact Todd Burrowes on my staff (207-287-1496; todd.burrowes@maine.gov) if you have questions or need additional information. Thanks for your consideration.

Sincerely,

Kathleen Leyden
Director, Maine Coastal Program

cc:\
Denis-Marc Nault, DMR
Mark Bergeron, DEP
Melanie Loyzim, DEP

The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

Thomas S. Burack, Commissioner

December 31, 2013

Geoffrey Wikel
Chief, Branch of Environmental Coordination
Division of Environmental Assessment
Office of Environmental Programs
Bureau of Ocean Energy Management
381 Elden Street, HM3107
Herndon, VA 20170

RE: File No. 2013-14; Hurricane Sandy Related Geophysical and Geological Surveys Along the Atlantic Outer Continental Shelf to Identify Sand Resources

Dear Mr. Wikel:

The New Hampshire Coastal Program has received the Bureau of Ocean Energy and Management's federal consistency determination for proposed funding of geophysical and geological surveys along the Atlantic Outer Continental Shelf to identify sand resources for potential use in coastal resiliency efforts and coastal habitat restoration, pursuant to Section 307(c)(1) of the Coastal Zone Management Act, 16 U.S.C. § 1456(c)(1). After reviewing the proposed action, we find it to be consistent, to the maximum extent practicable, with the enforceable policies of New Hampshire's federally approved coastal management program.

Should you have any questions, please feel free to contact me at (603) 559-0025.

Sincerely,

Christian Williams
Acting Manager
New Hampshire Coastal Program

cc: Doug Grout, NH Fish & Game Department

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
OFFICE OF COASTAL ZONE MANAGEMENT
251 Causeway Street, Suite 800, Boston, MA 02114-2136
(617) 626-1200 FAX: (617) 626-1240

December 12, 2013

Geoffrey L. Wikel
U.S. Department of the Interior
Bureau of Ocean Energy Management
Washington, DC 20240-0001

Re: CZM Federal Consistency Review of the Bureau of Ocean Energy Management proposed funding of Geophysical and Geological surveys; Statewide.

Dear Mr. Wikel:

The Massachusetts Office of Coastal Zone Management (CZM) has completed its review of the proposed funding of geophysical and geological surveys to identify Outer Continental Shelf sand resources along the Atlantic coast, including the waters offshore of Massachusetts.

Based upon our review of applicable information, we concur with your finding that the proposed activity is not reasonably likely to directly or indirectly affect any of Massachusetts' coastal uses and resources and find that the activity's effects on resources and uses in Massachusetts coastal zone as proposed are consistent with the CZM enforceable program policies.

If the above-referenced project is modified in any manner, including any changes resulting from permit, license or certification revisions, including those ensuing from an appeal, or the project is noted to be having effects on coastal resources or uses that are different than originally proposed, it is incumbent upon the proponent to notify CZM, submit an explanation of the nature of the change pursuant to 15 CFR 930, and submit any modified state permits, licenses, or certifications. CZM will use this information to determine if further federal consistency review is required.

Thank you for your cooperation with CZM.

Sincerely,

Bruce K. Carlisle
Director

BKC/rlb
CZM# 13500

State of Rhode Island and Providence Plantations
Coastal Resources Management Council
Oliver H. Stedman Government Center
4808 Tower Hill Road, Suite 3
Wakefield, RI 02879-1900

(401) 783-3370
Fax (401) 783-3767

November 25, 2013

Geoffrey L. Wikel, Chief
Environmental Coordination Branch
Department of the Interior
Bureau of Ocean Energy Management
1849 C Street, NW
Washington, DC 20240

RE: CRMC File No. A2013-11-089 – Geophysical and Geotechnical Surveys on OCS

Dear Mr. Wikel:

In accordance with Title 15 of the code of Federal Regulations, Part 930, subpart C (Consistency for Federal Activities) and a review of the Draft Environmental Assessment for the "Proposed Geophysical and Geological Activities in the Atlantic OCS to identify sand resources and borrow areas".

The Coastal Resources Management Council (CRMC) hereby concurs with the determination that the referenced project is consistent with the Federally approved Rhode Island Coastal Resources Management Council Program and applicable regulations therein. It is our expectation that any work beyond the proposed survey work will be reviewed by the CRMC with an additional Consistency determination.

Please contact this office upon initiation of construction, or if you should have any questions regarding this project.

Sincerely,

Jeffrey M. Willis, Deputy Director
Coastal Resources Management Council

/lat

Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

January 9, 2014

Geoffrey L. Wikel
Bureau of Ocean Energy Management
United States Department of the Interior
Washington, DC 20240-0001

RE: **Federal Consistency Concurrence Determination for Surveying the Mid-Atlantic Planning Area to Support Post-Hurricane Sandy Recovery**

Dear Mr. Wikel:

This Office has reviewed your request for federal consistency concurrence to conduct reconnaissance level and site specific surveys in the Mid-Atlantic Planning Area to support coastal recovery/resilience efforts related to Hurricane Sandy as shown in materials received by this Office on November 18, 2013 pursuant to section 307(c)(1) of the Coastal Zone Management Act of 1972, as amended, and Subpart C of 15 Code of Federal Regulations (CFR), Part 930. Based on a review of the proposed activities as described in the above-referenced plans and the application received by this Office, we concur with your determination that the activities as proposed are consistent with Connecticut's federally approved Coastal Management Program and will be conducted in a manner consistent with that program.

Please be advised that any subsequent modifications to the proposed activity, regardless of their magnitude or impact, constitute a new application for the purposes of federal consistency certification. Accordingly, all such modifications must be submitted to this Office for a coastal consistency concurrence pursuant to 15 CFR 930.50.

Thank you for providing a consistency determination and supporting information for our review. Should you have any questions regarding this consistency determination or any other coastal management matter, please contact Kristal Kallenberg in the Office of Long Island Sound Programs at (860) 424-3760 or Kristal.Kallenberg@ct.gov.

Yours truly,

Betsey C. Wingfield, Chief
Bureau of Water Protection and Land Reuse

cc: Allison Castellan, OCRM
David Simpson, CT DEEP

BCW/kk

STATE OF NEW YORK
DEPARTMENT OF STATE
ONE COMMERCE PLAZA
99 WASHINGTON AVENUE
ALBANY, NY 12231-0001

ANDREW M. CUOMO
GOVERNOR

RUTH NOEMÍ COLÓN
ACTING SECRETARY OF STATE

January 15, 2014

Re: F-2013-0992 (FA)
U.S. Department of Interior, Bureau of Ocean Energy Management (BOEM)
Funding for Hurricane Sandy-Related Geophysical and Geological Surveys along the Atlantic Coast to Identify Outer Continental Shelf Sand Resources
General Concurrence - No Objection To Funding

Geoffrey Wikel
Chief, Branch of Environmental Coordination
Division of Environmental Assessment
Office of Environmental Programs
Bureau of Ocean Energy Management
381 Elden Street, HM3107
Herndon, VA 20170

Dear Mr. Wikel:

The Department of State (DOS) received the information that you submitted regarding the above matter on November 8, 2013. DOS has determined that this proposal meets the Department's general consistency concurrence criteria. Therefore, the Department of State has no objection to the use of BOEM funds for this financial assistance activity.

The Department looks forward to working closely with your office to develop plans for conducting the geophysical and geological surveys and to discuss the identification of specific areas offshore New York for reconnaissance-level and site-specific surveys. The Department's Ocean and Great Lakes Program recently released its Offshore Atlantic Ocean Study[1], providing the most comprehensive information available on coastal and ocean uses and resources within a nearly 17,000 square mile planning area offshore New York, and continues its offshore planning efforts. In collaboration with federal partners, the Department has identified the locations of uses and resources of high importance to New York, including commercial navigation, commercial and recreational fishing, recreational boating, shipwreck

[1] The New York Department of State Offshore Atlantic Ocean Study, and supporting documents, can be downloaded from http://www.dos.ny.gov/press/2013/atlantic7-10.html

and dive sites, known locations of deep sea corals and sponges, and predicted hard bottom habitats, and has developed a predictive sediment grain size classification model with a focus on coarse sand areas. Once the preliminary locations for the site-specific surveys have been identified in discussion with the Department, the Department requests that your office adopts appropriate mitigation measures in response to any potential site-specific impacts to these and other uses and resources discussed in the Draft Environmental Assessment.

It should be noted that this concurrence pertains to the financial assistance activity for this project only. If a federal permit or other form of federal agency authorization is required for this activity, the Department of State will conduct a separate review for those permit activities. In such a case, please forward a copy of the federal application for authorization, a completed Federal Consistency Assessment Form, and all supporting information to the Department at the same time it is submitted to the federal agency from which the necessary authorization is requested.

When communicating with us regarding this matter, please contact Jeffrey Zappieri at (518) 474-6000 and refer to our file #F-2013-0992 (FA).

Sincerely,

Jeffrey Zappieri
Consistency Review
Office of Planning and Development

JZ/dc

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Division of Land Use Regulation
Mail Code 501-02A
P.O. Box 420
Trenton, New Jersey, 08625
www.state.nj.us/dep/landuse

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

March 5, 2014

Geoffrey L. Wikel
Chief, Environmental Coordination Branch
Division of Environmental Assessment
Office of Environmental Programs
Bureau of Ocean Energy Management
381 Elden Street, HM3107
Herndon, VA 20170

Amendment to:
Federal Consistency
DLUR File No.: 0000-13-0021.1 CDT 130001
Geophysical and Geological surveys to identify Outer Continental Shelf (OCS) sand resources along the Atlantic coast

Dear Mr. Wikel:

It should be noted that this correspondence deletes conditions one through five of the original Federal Consistency, which pertained to the protection of marine mammals. After further consultation with the NJ Division of Fish and Wildlife, it was determined that the remaining conditions in the Federal Consistency, from the National Marine Fisheries Service/National Oceanic and Atmospheric Administration, will adequately address these concerns.

Please attach this amendment letter to the original Federal Consistency Determination. Please be advised that all other requirements outlined in the above referenced authorization shall remain in effect. If you have any questions, please do not hesitate to contact Kara Turner of my staff at (609) 777-0454 or in writing at the above address.

Sincerely,

David B. Fanz
Assistant Director
Bureau of Coastal Regulation

C: Marty Rosen, Division of Coastal and Land Use Planning
Carlo Popolizio, 927 N. Main Street, Pleasantville NJ 08232

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION
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CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

JAN 2 1 2014

Geoffrey L. Wikel
Chief, Environmental Coordination Branch
Division of Environmental Assessment
Office of Environmental Programs
Bureau of Ocean Energy Management
381 Elden Street, HM3107
Herndon, VA 20170

RE: Federal Consistency
DLUR File No.: 0000-13-0021.1 CDT 130001
Geophysical and Geological surveys to identify Outer
Continental Shelf (OCS) sand resources along the Atlantic coast

Dear Mr. Wikel:

The New Jersey Department of Environmental Protection, Division of Land Use Regulation, acting under Section 307 of the Federal Coastal Zone Management Act (P.L. 92-583) as amended, concurs with the certification that the above referenced project is consistent with the approved New Jersey Coastal Management Program.

Specifically, the project consists of utilizing money from the Disaster Relief Appropriations Act of 2013 to identify and delineate additional sand resources on the Outer Continental Shelf (OCS). In order to determine which OCS areas contain appropriate sand resources (i.e. grain size, shape, sorting size, color, sediment, volume and proximity to project sties), reconnaissance level and site-specific geophysical and geotechnical (G&G) surveys will be carried out to map OCS sand resources and delineate potential sand resources for future projects. The Bureau of Ocean Energy Management (BOEM) will provide funding to a contractor to carry out the survey work. The proposed action is further described in the Draft Environmental Assessment (EA) "Proposed Geophysical and Geological Activities in the Atlantic OCS to Identify Sand Resources and Borrow Areas North Atlantic, Mid-Atlantic and South-Atlantic-Straits of Florida Planning Area" (BOEM 2013).

The proposed surveys will occur within the North Atlantic Planning Area, Mid-Atlantic Planning Area, and the South Atlantic-Straits of Florida Planning Areas of the OCS. This Study Area is approximately 8.5 million acres and extends from approximately 3 to 8 nautical miles (4.8 to 12.9 kilometers (km)) from the shore and to depths of about 90 feet (27.5 meters (m)). BOEM anticipates that G&G activities would occur in a small fraction of that overall footprint, approximately 50,000 to 450,000 acres (200-1, 800 km2) or less than 5 percent of the overall Study Area. It is anticipated that almost half of the G&G activities within the Study Area would be concentrated offshore in New Jersey and New York.

New Jersey's environmental review consists of, but is not limited to, reviews from the State Historic Preservation Office (SHPO), Division of Fish and Wildlife's Endangered and Nongame Species Program (ENSP), and the Division of Land Use Regulation.

SHPO has reviewed the proposed activities with regard to the potential to affect historic and archeological resources. Based on the information submitted, it appears that the proposed activities will not affect historic properties.

ENSP has concerns regarding the protection of fish, sea turtles, and marine mammals. With the implementation of the conditions below, the ENSP concerns will be met.

The Division has reviewed the submitted information and has determined that the project is consistent, to the maximum extent practicable, and with the conditions implemented below, with New Jersey's Rules on Coastal Zone Management N.J.A.C. 7:7E-1.1 et seq., (as amended on June 17, 2013). The Division does encourage the BOEM to be responsive to the concerns that have been expressed by the various Federal and State agencies, when conducting the surveys.

This consistency determination is issued subject to compliance with the following conditions:

1. A minimum of 2 dedicated marine mammal lookouts must be posted at all times when active sonar is being used, lookouts must include binoculars (night vision goggles, infrared sensors, if activities occur at night). A 35 minute period must be used to scan the area for cetaceans before engaging active sonar. Active Sonar should be terminated when marine mammals spotted within 1,000 meter. If conditions deteriorate during daylight hours such that the observations are not possible, visual observations must resume as soon as conditions permit. Ongoing activities may continue, for one hour, if conditions do not improve the activity must cease. The activity may not be initiated under such conditions (i.e., without appropriate pre-activity monitoring).

2. Passive sonar must be used to listen for whales and ensure that they are not within the testing area prior to switching to active sonar. Aerial monitoring must be done for at least sixty minutes before sonar use, if sonar is being used during the periods of February through April and September through December, when endangered marine mammal's transit through the area. It is recommended that active sonar be minimized during these time periods.

3. Active sonar must be minimized during June through August when bottlenose dolphins birth and nurse young in New Jersey waters.

4. G&G survey activities, including active sonar, must be minimized during May through September, when sea turtles are known to be present in New Jersey waters.

5. Vessel speeds must be reduced to 10 knots within the mid-Atlantic management area, and even further reduced when marine mammals are observed.

During all geophysical surveys BOEM will require the following:

1. An acoustic exclusion zone shall be monitored during G&G surveys using any boomer or sub-bottom profiler sound source(s) operating below 180kHz. The acoustic exclusion zone will be a 328 foot (1 00 m) radius zone around the sound source. Accounting for differences in the source levels, operational frequency, and deployment mode, this 328 foot (1 00 m) exclusion zone will encompass the 150 dB re 1 f.lPa RMS isopleth.

2. For geophysical surveys using sound sources operating at frequencies below 180kHz, operations shall be monitored by a trained protected species observer (PSO). One PSO will be required aboard

G&G survey vessels at all times during daylight hours (dawn to dusk- i.e., from about 30 minutes before sunrise to 30 minutes after sunset) when survey operations are being conducted, unless conditions (e.g., fog, rain, darkness) make sea surface observations impossible. If conditions deteriorate during daylight hours such that the observations are not possible, visual observations must resume as soon as conditions permit. Ongoing activities may continue, for one hour, if conditions do not improve the activity must cease. The activity may not be initiated under such conditions (i.e., without appropriate pre-activity monitoring).

3. Visual monitoring of acoustic exclusion zones must be conducted to observe and document the presence of marine mammals and sea turtles and their behavior, by searching the area around the vessel using hand-held reticle binoculars, and the unaided eye. PSOs may be trained third-party observers, crew members trained as observers, or use a combination of both trained third-party and crew observers. PSOs will be solely dedicated to perform visual observer duties. PSOs shall operate under the following guidelines: Other than brief alerts to make personnel aware of maritime hazards, no additional duties shall be assigned to observers during their watch. A watch shall be no longer than six continuous hours. Consequently, at least two PSOs shall be required on board vessels to monitor the acoustic exclusion zone when daily survey activities exceed six hours. A break of at least two hours shall occur between 6 hour watches, no other duties shall be assigned during this period.

4. During nighttime operations, observers must monitor the waters around the acoustic exclusion zone using shipboard lighting, enhanced vision equipment, night-vision equipment, infrared sensors and/or passive acoustic monitoring (PAM). G&G sound sources operating at frequencies below 180 kHz may be approved during periods of reduced visibility or at night, provided the nighttime survey and PAM protocol is followed.

5. Start-up and shut-down requirements: The acoustic exclusion zone for sound sources operating below 180 kHz shall be monitored for all marine mammals and sea turtles for no less than 30 minutes prior to start-up and continue until operations cease. If the source is operating below 2 kHz, shutdown of the sound source would occur immediately if any whale or sea turtle, is detected entering or within the acoustic exclusion zone. Subsequent restart of the equipment may only occur following a confirmation that the exclusion zone is clear of all marine mammals and sea turtles for 30 minutes.

6. BOEM will notify the National Marine Fisheries Service (NMFS) at least 30 days in advance of the start of the proposed activity. This notification will include details of the proposed surveys and BOEM's determination that the surveys proposed are consistent with the activities and special conditions outlined in this consultation. If BOEM cannot make this consistency determination, reinitiation of section 7 consultation may be necessary.

7. Data on all marine mammal and sea turtle observations must be recorded by the observer in accordance with standard data collection protocols. The information that must be recorded is listed in the EA and includes relevant information on location, environmental conditions, species observed and behavior of animals.

8. BOEM will require the contractor to prepare a monthly report that summarizes the survey activities and an estimate of the number of listed marine mammals, sea turtles, and any other protected species observed during these survey activities. BOEM shall provide a consolidated annual report to NMFS.

All G&G surveys, regardless of vessel size, will be required to comply with the following requirements:

1. Vessel operators, crews, and visual observers or protected species observers must maintain a vigilant watch for listed species, and slow down or stop their vessel regardless of vessel size to

avoid striking protected species. A visual observer aboard all G&G survey vessels must monitor an area around a transiting survey vessel, the vessel strike exclusion zone, to ensure it is free of listed species. At least one observer will be required aboard all vessels. Visual observers, for the purpose of vessel strike, may be third-party or not third-party, but require training. In addition, vessel operators would be required to comply with NMFS marine mammal and sea turtle viewing guidelines for the Northeast Region or the Southeast Region as appropriate.

2. Marine mammals and sea turtles may surface in unpredictable locations or approach slow moving vessels. When marine mammals or sea turtles are sighted in the vessel's path or in close proximity to a moving vessel regardless of vessel size, vessel operators must reduce speed and shift the engine to neutral. Engines will not be re-engaged until the animals are clear of the exclusion area specified below.

3. In accordance with NMFS Compliance Guide for the Right Whale Ship Strike Reduction Rule (50 CFR 224.105 and 78 FR 73726-73736), when safety allows, vessels, regardless of size, shall transit within the 10 knot (18.5 km/h) speed restriction in DMAs, Northeast critical habitat and SMAs (Great South Channel, April 1 through July 31; Off Race Point, March 1 through April 30), mid-Atlantic SMAs (November 1 through April 30), and critical habitat and southeast SMAs from November 15 through April15. When safety permits, vessel speeds should also be reduced to 10 knots (18.5 km/h) or less when mother/calf pairs, pods, or large assemblages of cetaceans are observed near a transiting vessel. A single cetacean at the surface may indicate the presence of submerged animals in the vicinity of the vessel. Therefore, precautionary measures should be exercised when an animal is observed. Mandatory reductions in speed will also limit continuous noise levels related to propeller cavitation and hull-wave interaction.

4. When North Atlantic right whales are sighted at any time during the year, vessels, regardless of size, must maintain a minimum separation distance of 1,640 feet (500 m). The following avoidance measures must be taken if a vessel comes within 1, 640 feet (500 m) of a right whale: a. While underway, the vessel operator shall steer a course away from the right whale at 10 knots (18.5 km/h) or less until the minimum separation distance has been established. b. If a right whale is spotted in the path of a vessel or within 328 feet (1 00 m) of a vessel underway, the operator shall reduce speed and shift engines to neutral. The operator shall only re-engage engines after the right whale has moved out of the path of the vessel and is more than 328 feet (100m) away. If the right whale is still within 1,640 feet (500 m) of the vessel, the vessel shall select a course awayfrom the whale's course at a speed of 10 knots (18.5 km/h) or less. This procedure shall also be followed if a right whale is spotted while a vessel is stationary. Whenever possible, a vessel should remain parallel to the whale's course while transiting, avoiding abrupt changes in direction until it has left the area.

5. Vessels regardless of size must maintain a minimum separation distance of 3 28 feet (100 m) year-round if whales other than right whales, seals, or manatees are sighted. The survey will comply with other relevant manatee construction conditions when operating within the species range. All vessels will follow routes of deep water whenever possible. Vessels, regardless of size, shall maintain a distance of 164 feet (50 m) or greater from delphinoid cetaceans at all times. If encountered during transit, a vessel shall attempt to remain parallel to the animal's course, avoiding excessive speed or abrupt changes in course.

6. If sea turtles or small tooth sawfish are sighted, all vessels regardless of size must maintain a distance of 164 feet (50 m) or greater whenever possible. The survey will comply with other relevant smalltooth sawfish construction conditions when operating within the species range. During night-time geophysical surveys and transit, nighttime observer requirements will be implemented, and vessel speed will not exceed 5 knots in areas where sea turtles may be present.

7. Sightings of any injured or dead protected species must be reported to BOEM, NMFS and U.S. Fish and Wildlife Service (USFWS) within 24 hours, regardless of whether the injury or death was caused by their vessel.

This Federal Consistency is authorized pursuant to all parties following the guidelines set forth, and agreed upon, for the proposed activities.

Pursuant to 15 CFR 930.44, the Division reserves the right to object and request remedial action if this proposal is conducted in a manner, or is having an effect on, the coastal zone that is substantially different than originally proposed.

Thank you for your attention to and cooperation with New Jersey's Coastal Zone Management Program. If you have any questions regarding this determination, please do not hesitate to call Kara Turner of our staff at (609) 777-0454.

Sincerely,

David B. Fanz

David B. Fanz, Assistant Director
Division of Land Use Regulation

1/21/14
Date

c: Marty Rosen, Division of Coastal and Land Use Planning
Carlo Popolizio, 927 N. Main Street, Pleasantville NJ 08232

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES & ENVIRONMENTAL CONTROL

DELAWARE COASTAL
MANAGEMENT PROGRAM

89 KINGS HIGHWAY
DOVER, DELAWARE 19901

Phone: (302) 739- 9283
Fax: (302) 739-2048

January 8, 2014

Geoffrey L. Wikel
Bureau of Ocean Energy Management
Environmental Coordination Branch
Washington, DC 20240-0001

Re: Proposed Geophysical & Geological Activities in the Atlantic OCS to Identify Sand Resources and Borrow Areas
Delaware Coastal Management Federal Consistency Certification (FC# 2014.0014)

Dear Mr. Wikel,

The Delaware Coastal Management Program (DCMP) received your consistency determination and supporting Draft Environmental Assessment (EA) for the proposed geophysical and geological activities in the Atlantic Outer Continental Shelf to identify sand resources and borrow areas on November 12, 2013. We support identification and mapping of sand resources. Delaware routinely maintains healthy beaches through beach nourishment to provide storm protection and coastal wildlife habitat, and to sustain recreation destinations crucial to the tourism industry. Designating new borrow areas will support these efforts.

Based upon our review and pursuant to National Oceanic & Atmospheric Administration regulations (15 CFR 930), the DCMP concurs with your consistency certification for the above referenced project.

We understand that the Draft EA is the initial general assessment necessary in order to utilize funding from the Disaster Relief Appropriations Act of 2013 to pursue post-Hurricane Sandy recovery efforts and future storm resiliency projects; and that more detailed information on resource impacts will be included in subsequent environmental documents. Should areas offshore of Delaware be identified as potential borrow sites and more detailed surveys be required, federal consistency review of these site specific actions and the associated environmental documents will be required.

If you have any questions, please contact me or Tricia Arndt of my staff at (302) 739-9283.

Sincerely,

Sarah W. Cooksey, Administrator

SWC/tka

cc: Collin P. O'Mara, Secretary
Tony Pratt, DNREC
File: 2014.0014

January 27, 2014

Geoffrey Wikel
Chief, Branch of Environmental Coordination
Division of Environmental Assessment
Office of Environmental Programs
Bureau of Ocean Energy Management
381 Elden Street, HM3107
Herndon, VA 20170

Re: Concurrence with BOEM's Consistency Determination for Proposed Funding of Geophysical and Geological Surveys to Identify Outer Continental Shelf (OCS) Sand Resources along the Atlantic Coast

Dear Mr. Wikel:

On behalf of the State of Maryland, the Chesapeake and Coastal Service (CCS) has completed its review of BOEM's Federal Consistency Determination and data and information for the above referenced project in accordance with the federal Coastal Zone Management Act (CZMA). Pursuant to 15 CFR 930.41, CCS concurs with the Federal Consistency Determination for the project under the enforceable policies of the Maryland Coastal Management Program (CMP).

Maryland, as a coastal state directly impacted by Hurricane Sandy, understands the importance of protecting our shore, especially given our increasing vulnerability to sea level rise. The proposed survey work is an important step toward helping Maryland and other coastal states along the Atlantic coast better protect our coastal communities such as Ocean City and coastal resources such as Assateague Island through beach and barrier island replenishment. However, while the Maryland CMP concurs with the proposed funded project, there are a number of issues that deserve special consideration. The attached comments are provided to help frame future Federal-State coordination efforts as this project moves forward.

Thank you for the opportunity to review BOEM's Federal Consistency Determination and the *Proposed Geophysical and Geological Surveys in the Atlantic OCS to Indentify Sand Resources and Burrow Areas: North Atlantic, Mid-Atlantic, and South Atlantic Straits of Florida Planning Areas Draft Environmental Assessment (EA).* Please contact Joe Abe of my staff at (410) 260-8740 or jabe@dnr.state.md.us if you have any questions regarding the above comments.

Sincerely,

Matthew Fleming, Director
Chesapeake and Coastal Service

Cc: Elder Ghigiarelli (MDE)
Joe Abe (DNR)
Mark Talty (OAG)

Attachment

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
Street address: 629 East Main Street, Richmond, Virginia 23219
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TDD (804) 698-4021
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Douglas W. Domenech
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
1-800-592-5482

January 6, 2014

Mr. Geoffrey Wikel, Chief
Branch of Environmental Coordination
Division of Environmental Assessment
Office of Environmental Programs
Bureau of Ocean Energy Management
381 Elden Street, HM3107
Herndon, Virginia 20170

RE: Federal Consistency Determination for Hurricane Sandy-Related Geophysical and Geological Surveys along the Atlantic to Identify Outer Continental Shelf Sand Resources, Department of the Interior, Bureau of Ocean Energy Management, DEQ 13-194F.

Dear Mr. Wikel:

The Commonwealth of Virginia has completed its review of the Federal Consistency Determination (FCD) submitted by the Department of the Interior (DOI) Bureau of Ocean Energy Management (BOEM) for Hurricane Sandy-Related Geophysical and Geological Surveys along the Atlantic to Identify Outer Continental Shelf Sand Resources. The Department of Environmental Quality (DEQ) is responsible for coordinating Virginia's review of FCDs submitted under the Coastal Zone Management Act and responding to appropriate officials on behalf of the Commonwealth. This letter is in response to the FCD dated November 8, 2013 (received November 12, 2013) submitted by BOEM. The following agencies and planning district commission participated in this review:

Department of Environmental Quality
Department of Game and Inland Fisheries
Virginia Marine Resources Commission
Department of Health
Department of Historic Resources
Hampton Roads Planning District Commission

In addition, the Department of Agriculture and Consumer Services, Department of Conservation and Recreation, Department of Mines, Minerals and Energy, Virginia Institute of Marine Science, Accomack-Northampton Planning District Commission, City of Virginia Beach, and the Counties of Accomack and Northampton were invited to comment on the proposed project.

DESCRIPTION OF THE PROPOSED ACTION

BOEM is proposing to fund ($11.7 million) geophysical and geological surveys to identify Outer Continental Shelf (OCS) sand resources along the Atlantic coast as part of recovery efforts in Atlantic states affected by Hurricane Sandy. BOEM's Marine Minerals Program (MMP) would fund geophysical and geotechnical surveys along the Atlantic Coast from Florida to Maine, 3-8 nautical miles offshore (with a focus on New Jersey and New York), to identify OCS sand resources for potential use in coastal resiliency efforts, such as beach, barrier island, and coastal habitat restoration. To determine which OCS areas contain appropriate sand resources (e.g., sediment grain size, shape, sorting size, color, sediment volume, and proximity to project sites), the MMP is proposing to conduct reconnaissance-level and site-specific studies to map OCS sand resources and delineate potential sand resources for future projects. These resources could be used to add resiliency to the coastline to protect infrastructure and ecosystems from coastal storms and create coastal habitat. In support of the proposal, BOEM has prepared an Environmental Assessment (EA) that evaluates whether significant impacts on Atlantic resources could occur as a result of the proposed geophysical and geological (G&G) activities and specifies mitigation and monitoring measures that would be implemented to avoid, reduce, or minimize impacts.

FEDERAL CONSISTENCY PUBLIC PARTICIPATION

In accordance with 15 CFR §930.2, the public was invited to participate in the review of BOEM's submission under federal consistency. Public notice of this proposed action was published on the DEQ website from November 22, 2013 through December 10, 2013. No public comments were received in response to the notice.

FEDERAL CONSISTENCY UNDER THE COASTAL ZONE MANAGEMENT ACT

Pursuant to the Coastal Zone Management Act of 1972 (§ 1456(c)), as amended, and the *Federal Consistency Regulations* implementing the CZMA (15 CFR Part 930, Subpart C, § 930.30 *et seq.*), federal actions that can have reasonably foreseeable effects on Virginia's coastal uses or resources must be conducted in a manner which is consistent, to the maximum extent practicable, with the Virginia Coastal Zone Management Program (VCP). The VCP is comprised of a network of programs administered by several agencies. In order to be consistent with the VCP, the federal agency action must be consistent with all the applicable enforceable policies of the VCP prior to commencing the action.

FEDERAL CONSISTENCY CONCURRENCE

Based on our review of BOEM's consistency determination and the comments submitted by agencies administering the enforceable policies of the VCP, DEQ concurs that the proposal is consistent with the VCP provided it complies with all the applicable permits, approvals, and conditions of the enforceable policies of the VCP.

Other state approvals which may apply to this project are not included in this conditional concurrence. Therefore, BOEM must ensure that this project is constructed and operated in accordance with all applicable federal, state, and local laws and regulations.

FEDERAL CONSISTENCY ANALYSIS

According to information in the FCD, the proposed action would have no effect on the following enforceable policies: subaqueous lands management; wetlands management; dunes management; point source pollution control; shoreline sanitation; and coastal lands management. The resource agencies that are responsible for the administration of the enforceable policies of the VCP generally agree with the findings of the FCD. BOEM must ensure that the proposed action is consistent with the aforementioned policies. In addition, the FCD considers potential project impacts on the advisory policies of the VCP and finds the proposed action may have reasonably foreseeable effects on coastal natural resource areas (significant wildlife habitat areas and underwater historic sites). However, the proposal is otherwise consistent with those policies. The analysis which follows responds to the discussion of the enforceable policies of the VCP that apply to this project.

1. Fisheries Management. According to the FCD (page 1), activities may result in minor potential impacts upon finfish or shellfish resources or upon commercial or recreational facilities. Impact producing factors related to significant wildlife habitat areas identified in the initial screening included (1) active sound sources (i.e., electromechanical sources [e.g., boomer and chirp sub-bottom profilers, side-scan sonars, and single beam, interferometric, or multi-beam depth sounders]) and vessel and equipment noise, including vibracoring; (2) vessel presence and traffic; (3) vessel waste and accidental discharge (including marine trash); and (4) seafloor disturbance. The document concludes that cumulative impacts upon fish, shorebirds and listed bird species, benthic communities, sea turtles and marine mammals are expected to be negligible, with the exception of minor potential impacts from vessel strikes or fuel spills. These impacts would be very minor and localized, however.

1(a) Agency Jurisdiction. The Department of Game and Inland Fisheries (Virginia Code 29.1-100 to 29.1-570) and Virginia Marine Resources Commission (Virginia Code 28.2-200 to 28.2-713) have management authority for the conservation and enhancement of finfish and shellfish resources in the Commonwealth. In addition, The Virginia Department of Health's (VDH) Division of Shellfish Sanitation (DSS) is responsible for protecting the health of the consumers of molluscan shellfish and crustacea by ensuring that shellfish growing waters are properly classified for harvesting, and that molluscan shellfish and crustacea processing facilities meet sanitation standards.

1(b) Agency Findings.

(i) Department of Game and Inland Fisheries

DGIF defers to VMRC with respect to impacts to fisheries resources since the activities are proposed in marine waters.

(ii) Virginia Marine Resources Commission

VMRC finds that the project does not fall under the agency's jurisdiction. Therefore, no authorization would be required from VMRC.

(iii) Virginia Department of Health

VDH-DSS did not indicate that the project would impact shellfish resources under its jurisdiction.

1(c) Requirements. Should any portion of the proposed project or future sand mining takes place within three miles of the coast of Virginia, a permit will be required from VMRC.

1(d) Conclusion. The project is consistent with the fisheries management enforceable policy.

For additional information, contact DGIF, Amy Ewing at (804) 367-2211; VRMC, George Badger at (757) 414-0710; and/or VDH-DSS, Keith Skiles at (804) 864-7487.

2. Subaqueous Lands Management. The FCD (page 1) states that the proposed action consists of reconnaissance studies over large areas and potential site-specific sampling to determine whether identified sand resources are of sufficient quality and quantity to warrant further exploration. The potential study area is not in close proximity to state-owned subaqueous lands, as the area extends from approximately 3 to 8 nautical miles from the shore. The document concludes that survey activities are unlikely to have reasonably foreseeable coastal impacts upon state-owned subaqueous lands.

2(a) Agency Jurisdiction. Pursuant to Section 28.2-1204 of the Code of Virginia the Virginia Marine Resources Commission has jurisdiction over any encroachments in, on, or over any state-owned rivers, streams, or creeks in the Commonwealth. Accordingly, any portion of the project involving encroachments channelward of mean low water below the fall line may require a permit.

VMRC serves as the clearinghouse for the Joint Permit Application used by:

- VMRC for encroachments on or over state-owned subaqueous beds as well as tidal wetlands;
- U.S. Army Corps of Engineers for issuing permits pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act;
- DEQ for issuance of a Virginia Water Protection Permit; and
- local wetlands board for impacts to wetlands.

2(b) Agency Findings. As noted above, VMRC finds that the project does not fall under the agency's jurisdiction. Therefore, no authorization would be required from VMRC.

2(c) Requirements. Should any portion of the proposed project or future sand mining takes place within three miles of the coast of Virginia, a permit will be required from VMRC.

2(d) Conclusion. This project is consistent with the subaqueous lands management enforceable policy of the VCP.

3. Wetlands Management. According to the FCD (page 2), the potential study area is not in close proximity to wetlands, as the area extends from approximately 3 to 8 nautical miles from the shore. The document concludes that survey activities are unlikely to have reasonably foreseeable coastal impacts upon wetlands.

3(a) Agency Jurisdiction. The wetlands management enforceable policy is administered by the Virginia Marine Resources Commission for tidal wetlands (Virginia Code 28.2-1301 through 28.2-1320) and the Department of Environmental Quality through the Virginia Water Protection Permit program for tidal and non-tidal wetlands (Virginia Code §62.1-44.15:5 and Water Quality Certification pursuant to Section 401 of the Clean Water Act).

3(b) Agency Findings.

(i) Department of Environmental Quality

The Virginia Water Protection Permit Program (VWPP) program at the DEQ Tidewater Regional Office (TRO) has no comments on the proposal.

(ii) Virginia Marine Resources Commission

As noted above, no authorization would be required from VMRC as the project does not fall under the agency's jurisdiction.

3(d) Conclusion. The proposed activity is consistent with the wetlands management enforceable policy of the VCP.

For additional information, contact DEQ-TRO, Bert Parolari at (757) 518-2166 and/ VMRC, George Badger at (757) 414-0710.

4. Air Pollution Control. According the FCD (page 3), survey activities will not contribute significantly to diminished air quality, as the area extends from approximately 3 to 8 nautical miles from the shore. The document concludes that survey activities are unlikely to have reasonably foreseeable coastal impacts upon air pollution.

4(a) Agency Jurisdiction. DEQ's Air Quality Division, on behalf of the State Air Pollution Control Board, is responsible to develop regulations that become Virginia's *Air Pollution Control Law*. DEQ is charged to carry out mandates of the state law and related regulations as well as Virginia's federal obligations under the *Clean Air Act* as amended in 1990. The objective is to protect and enhance public health and quality of life through control and mitigation of air pollution. The division ensures the safety and quality of air in Virginia by monitoring and analyzing air quality data, regulating sources of air pollution, and working with local, state and federal agencies to plan and implement strategies to protect Virginia's air quality. The appropriate regional office is directly responsible for the issue of necessary permits to construct and operate all stationary sources in the region as well as to monitor emissions from these sources for compliance. As a part of this mandate, the environmental documents of new projects to be undertaken in the state are also reviewed. In the case of certain projects, additional evaluation and demonstration must be made under the general conformity provisions of state and federal law.

4(b) Agency Findings. The Air Permits program at DEQ-TRO has no comments on the proposal.

4(c) Conclusion. The project is consistent with the air pollution control enforceable policy of the VCP.

5. Coastal Natural Resource Areas (Advisory Policy).

(i) Significant Wildlife Habitat Areas

According to the FCD (page 3), a Seasonal Management Area for the North Atlantic Right Whale from November 1 through April 30 is located at the mouth of Chesapeake Bay just outside state waters, and overlaps with the potential study area. No active acoustic sources operating below 30 kHz (the hearing threshold for North Atlantic Right Whales) will be used in Seasonal Management Areas between those dates. BOEM will require vessel operators make use of the Early Warning System, Sighting Advisory System, and Mandatory Ship Reporting System while operating in the Seasonal Management Area. If mitigation measures are followed, the reasonably foreseeable impacts upon wildlife habitat are likely to be negligible. Cumulative impacts upon fish, shorebirds and listed bird species, benthic communities, sea turtles and marine mammals are expected to be negligible, with the exception of minor potential impacts from vessel strikes or fuel spills which would be very minor and localized.

(ii) Underwater Historic Sites

The FCD (page 3) states that the potential for impacts on cultural resources resulting from G&G surveys would be associated with sediment sampling activities and anchoring. BOEM will ensure that physical impacts on cultural resources identified during geophysical surveys can be avoided by implementing the mitigation measures contained in the Finding of No Historic Properties Affected document. BOEM will adopt an avoidance strategy to mitigate potential effects to sensitive cultural resources and sensitive benthic communities and habitats. The FCD concludes that no adverse impacts on submerged cultural resources are anticipated, and impacts on archaeological resources from seafloor disturbance associated with cumulative G&G actions would result in no impacts.

5(a) Agency Findings.

(i) Significant Wildlife Habitat Areas

Neither DGIF nor VMRC indicated that project activities would have an adverse impact upon significant wildlife habitat areas.

For additional information, contact DGIF, Amy Ewing at (804) 367-2211; VRMC, George Badger at (757) 414-0710

(ii) Underwater Historic Sites

Pursuant to Section 106 of the National Historic Preservation Act, DHR has been in direct consultation with BOEM regarding this project and the parties have reached consensus that the Hurricane Sandy Related Geophysical & Geological Surveys will not affect historic properties.

For additional information, contact DHR, Roger Kirchen at (804) 482-6091.

ADDITIONAL ENVIRONMENTAL CONSIDERATIONS

In addition to the enforceable policies of the VCP, comments were also provided with respect to applicable requirements and recommendations of the following programs:

1. Solid and Hazardous Wastes.

1(a) Agency Jurisdiction. Solid and hazardous wastes in Virginia are regulated by the Virginia Department of Environmental Quality, the Virginia Waste Management Board (VWMB) and the U.S. Environmental Protection Agency. They administer programs created by the federal Resource Conservation and Recovery Act, Comprehensive Environmental Response Compensation and Liability Act, commonly called Superfund, and the Virginia Waste Management Act. DEQ administers regulations established by the VWMB and reviews permit applications for completeness and conformance with facility standards and financial assurance requirements. All Virginia localities are required, under the Solid Waste Management Planning Regulations, to identify the strategies they will follow on the management of their solid wastes to include items such as facility siting, long-term (20-year) use, and alternative programs such as materials recycling and composting.

1(b) Agency Findings. The DEQ Division of Land Protection and Revitalization (DLPR) (formerly the Waste Division) conducted a cursory search in the coastal areas identified in the FCD and identified land-based sites for possible project impacts. However, none appear to be of concern within this project scope. DEQ-DLPR finds that as all work will be done in the waters off the Virginia coast, land based solid and hazardous waste issues under DLPR's jurisdiction do not appear to be relevant to the project.

1(c) Recommendation. DEQ encourages the implementation of pollution prevention principles, including the reduction, reuse, and recycling of all solid wastes generated. All generation of hazardous wastes should be minimized and handled appropriately.

Questions regarding these comments or requests for further information may be directed to DEQ-DLPR, Steve Coe at (804) 698-4029.

2. Regional Agency Review.

2(a) Agency Jurisdiction. In accordance with CFR 930, Subpart A, § 930.6(b) of the *Federal Consistency Regulations*, DEQ, on behalf of the state, is responsible for securing necessary review and comment from other state agencies, the public, regional government agencies, and local government agencies, in determining the Commonwealth's concurrence or objection to a federal consistency determination.

2(b) Agency Findings. The Hampton Roads Planning District Commission (HRPDC) reviewed the FCD and consulted with the City of Virginia Beach regarding the project.

According to the HRPDC, the project appears to be consistent with local and regional plans and policies.

For additional information, contact HRPDC, Dwight Farmer at (757) 420-8300.

Thank you for the opportunity to review and respond to the consistency determination prepared for the Hurricane Sandy-Related Geophysical and Geological Surveys along the Atlantic to Identify Outer Continental Shelf Sand Resources. The detailed comments of reviewing agencies are attached for your review. If you have questions, please call me at (804) 698-4325 or John Fisher at (804) 698-4339.

Sincerely,

Ellie Irons

Ellie Irons, Program Manager
Environmental Impact Review

Enclosures

Ec: Cindy Keltner, DEQ-TRO
Steve Coe, DEQ-DLPR
Kotur Narasimhan, DEQ-Air
Daniel Moore, DEQ-Water
Tony Watkinson, VMRC
Robbie Rhur, DCR
Amy Ewing, DGIF
Keith Tignor, VDACS
Barry Matthews, VDH
B. Keith Skiles, VDH-DSS
Roger Kirchen, DHR
Pam Mason, VIMS
David Spears, DMME
Clay Bernick, City of Virginia Beach
Katherine Nunez, Northampton County
County Administrator, Accomack County
Dwight Farmer, Hampton Roads PDC
Elaine Meil, Accomack-Northampton PDC
Patrick Marchman, BOEM

NCDENR
North Carolina Department of Environment and Natural Resources
Division of Coastal Management
Braxton C. Davis
Director

Pat McCrory
Governor

John E. Skvarla, III
Secretary

December 16, 2013

Geoffrey L. Wikel, Chief
Environmental Coordination Branch
Bureau of Ocean Energy Management
381 Elden Street, HM3107
Herndon, VA 20170

SUBJECT: **CD13-070** – Consistency Concurrence for Proposed Geophysical Surveying Along the Atlantic Coast (DCM#20130118)

Dear Mr. Wikel:

We received your consistency submission on November 8, 2013 concerning proposed geophysical and geological surveys to identify Outer Continental Shelf (OCS) sand resources along the Atlantic Coast.

North Carolina's coastal zone management program consists of, but is not limited to, the Coastal Area Management Act, the State's Dredge and Fill Law, Chapter 7 of Title 15A of the North Carolina Administrative Code, and the land use plan of the County and/or local municipality in which the proposed project is located. It is the objective of the Division of Coastal Management (DCM) to manage the State's coastal resources to ensure that proposed Federal activities would be compatible with safeguarding and perpetuating the biological, social, economic, and aesthetic values of the State's coastal waters.

To solicit public comments, DCM circulated a description of the proposed action to State agencies that would have a regulatory interest. No comments asserting that the proposed activity would be inconsistent with the State's coastal management program were received.

DCM has reviewed the submitted information pursuant to the management objectives and enforceable policies of Subchapters 7H and 7M of Chapter 7 of Title 15A of the North Carolina Administrative Code and concurs that the proposed Federal activity is consistent, to the maximum extent practicable, with the relevant enforceable policies of North Carolina's coastal management program.

400 Commerce Ave., Morehead City, NC 28557-3421
Phone: 252-808-2808 \ FAX: 252-247-3330 Internet: www.nccoastalmanagement.net

Should the proposed action be modified, a revised consistency determination could be necessary. This might take the form of either a supplemental consistency determination pursuant to 15 CFR 930.46, or a new consistency determination pursuant to 15 CFR 930.36. Likewise, if further project assessments reveal environmental effects not previously considered by the proposed development, a supplemental consistency certification may be required. If you have any questions, please contact me at 252-808-2808 x212. Thank you for your consideration of the North Carolina Coastal Management Program.

Sincerely,

Doug Huggett

Doug Huggett
Manager, Major Permits and Consistency Unit

Cc: Patrick M. Marchman, Bureau of Ocean Energy Management

January 8, 2014

Mr. Geoffrey Wikel
Chief, Branch of Environmental Coordination
Division of Environmental Programs
Office of Environmental Programs
Bureau of Ocean Energy Management
381 Elden Street, HM3107
Herndon, VA 20170

Re: Federal Consistency certification review of BOEM's proposed funding of surveys in the Outer Continental Shelf – Atlantic Coast

CZC project ID # CZC-13-1036

Dear Mr. Wikel:

This is in response to the Bureau of Ocean Energy Management's (BOEM) October 24, 2013, Federal Consistency certification determination for the funding of geophysical and geological (G&G) surveys to identify sand resources along the Atlantic coast in the Outer Continental Shelf (OCS).

The consistency determination outlines the potential Study Area in the North Atlantic Planning Area, Mid-Atlantic Planning Area, and the South Atlantic (South Carolina) to Straits of Florida Planning Areas of the OCS. The potential Study Area extends from approximately 3 to 8 nautical miles from the shore and to depths of about 90 feet. Actual G&G activities will not occur across the entire Study Area, but will be concentrated in very limited subareas, comprising a small fraction of the overall contiguous inner shelf area. The entire potential Study Area is approximately 8.5 million acres. BOEM anticipates that G&G activities would occur in a small fraction of that overall footprint, approximately 50,000 to 450,000 acres or less than 5 percent of the overall Study Area identified. The smaller area where proposed G&G surveys and supporting trips would occur would be considered to be the Action Area.

Consequently, the proposed action consists of funding and completion of both reconnaissance and site-specific studies, depending on the study location and level of previous investigation. To complete reconnaissance or site-specific surveys, two general types of G&G surveys would be employed: geophysical surveys for mapping the geologic framework and seafloor condition and geological surveys to collect sediment sampling and shallow cores. Geophysical surveys use a high-resolution, low-energy electromechanical source and receiver system towed behind a vessel and sediment sampling/shallow cores will be 3 to 4 inches in diameter to depths of approximately 20 feet. It is anticipated that in the South Atlantic to Straits of Florida Planning Areas, approximately 1,000 to 2,500 geophysical line miles will be surveyed and 150 geologic samples will be taken.

CZC Staff agrees with your consistency determination that the proposed funding and completion of these studies are consistent to the maximum extent practible as required by 15 CFR § 930, Subpart C. In concurring, Staff referred to the following policies the following policies contained within the South Carolina's Coastal Zone Management Program (CZMP): the policies associated with Activities in Areas of Special Resource Significance (Barrier Islands, Dune Areas), and the priority of uses associated with Geographic Areas of Particular Concern (GAPC's).

Please do not hesitiate to contact me should you have any questions.

Sincerely,

Curtis M. Joyner
Manager, Coastal Zone Consistency Section
Regulatory Division – DHEC OCRM
1362 McMillan Avenue, Suite 400
Charleston, S. C. 29405
843-953-0205
joynercm@dhec.sc.gov

Cc: Carolyn Boltin - Kelly
Rheta DiNovo
Blair Williams

GEORGIA
DEPARTMENT OF NATURAL RESOURCES
COASTAL RESOURCES DIVISION

MARK WILLIAMS
COMMISSIONER

A.G. 'SPUD' WOODWARD
DIRECTOR

January 7, 2014

USDOI, BOEM
Attn: Mr. Geoffrey L. Wikel
Environmental Coordination Branch Chief
Washington, DC 20240-0001

RE: Consistency Determination for BOEM Proposed Geophysical & Geological Activities in the Atlantic OCS to Identify Sand Resources and Borrow Areas: North Atlantic, Mid-Atlantic & South Atlantic-Straits of Florida Planning Areas DEA

Dear Mr. Wikel:

Staff of the Georgia Coastal Management Program (GCMP) and Georgia Department of Natural Resources' Wildlife Resources Division have reviewed your November 8, 2013 letter and attached Internal Draft Environmental Assessment (DEA) for the Proposed Geophysical and Geological Activities in the Atlantic Outer Continental Shelf (OCS) to Identify Sand Resources and Borrow Areas: North Atlantic, Mid-Atlantic, and South Atlantic-Straits of Florida Planning Areas. The Bureau of Ocean Energy Management (BOEM) received funds under the Disaster Relief Appropriations Act to conduct research to identify and delineate additional OCS beach-quality sand resources within a 5-mile wide band stretching from 3 miles to 8 miles offshore of the East coast. Approximately 4,000 – 8,000 line-miles of geophysical surveys and up to 500 shallow-core sediment samples are proposed during a 165 to 330-day period beginning in 2014. The proposed sampling techniques do not include air guns or sparkers. No active acoustic sources below 30 kHz will be used within the North American right whale (NARW) Southeast Seasonal Management Area (SMA) between November 15th and April 15th and operations will be conducted during daylight hours under both Alternative A and Alternative B in this area and timeframe.

Georgia has 4 developed barrier islands that are either actively engaged in beach renourishment (Tybee & Sea) or may at some point in the future be in need of beach-quality sand resources (St. Simons & Jekyll). Coincidentally, the OCS areas adjacent to these islands have not been proposed for designation as Loggerhead Sea Turtle Critical Habitat by the National Marine Fisheries Service, whereas all remaining offshore areas have.

Upon completion of this 3-years study BOEM will share information with federal, state and local agencies for use in coastal resiliency and storm damage reduction projects (including beach renourishment and coastal restoration). In order to get the most benefit from limited funding, GCMP recommends that geophysical and geological surveys offshore of Georgia prioritize OCS areas adjacent to developed barrier islands where sand resources would be most economical to obtain should they be needed at a future date.

ONE CONSERVATION WAY | BRUNSWICK, GEORGIA 31520-8686
912.264.7218 | FAX 912.262.3143 | WWW.COASTALGADNR.ORG

The proposed mitigation measures for Alternative A appear adequate to minimize potential impacts to marine mammals and sea turtles. The Program concurs with your consistency determination. This determination ensures that the proposed project has been designed to comply to the maximum extent practicable with the applicable enforceable policies of the Georgia Coastal Management Program.

Please feel free to contact Kelie Moore or me if we can be of further assistance.

Sincerely,

A.G. "Spud" Woodward
Director

SW/km

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

MARJORY STONEMAN DOUGLAS BUILDING
3900 COMMONWEALTH BOULEVARD
TALLAHASSEE, FLORIDA 32399-3000

RICK SCOTT
GOVERNOR

HERSCHEL T. VINYARD JR.
SECRETARY

January 7, 2014

Mr. Geoffrey L. Wikel
Chief, Environmental Coordination Branch
Division of Environmental Assessment
Office of Environmental Programs
Bureau of Ocean Energy Management
381 Elden Street, HM3107
Herndon, VA 20170

Dear Mr. Wikel:

The State of Florida has completed a review of the Bureau of Ocean Energy Management's (BOEM) draft Environmental Assessment (EA) and accompanying Consistency Determination (CD) for the Proposed Geophysical and Geological (G&G) Activities on the Atlantic Outer Continental Shelf (OCS) to Identify Sand Resources and Borrow Areas. As part of recovery efforts in the Atlantic states affected by Hurricane Sandy, BOEM's Mineral Management Program is proposing to fund G&G surveys 3-8 nautical miles offshore the Atlantic Coast from Maine to Florida, with an emphasis on New Jersey and New York, to identify OCS sand resources for use in coastal resiliency efforts, such as beach, barrier island, and coastal habitat restoration.

The EA describes and evaluates potential impacts within the nearshore portion of the North Atlantic Planning Area, the Mid-Atlantic Planning Area, and the South Atlantic-Straits of Florida Planning Areas covering approximately 8.5 million acres. However, BOEM anticipates that the actual G&G activities will only occur in 50,000 to 450,000 acres or less than 5 percent of the study area. Prior to commencing G&G activities, BOEM will coordinate with stakeholders to determine areas of greatest need. Following this coordination, detailed survey and sampling plans including defined geographic scope and timing will be developed prior to undertaking any G&G activities.

The protection of marine and coastal habitats, their associated species, and historical resources located along Florida's Atlantic coast is critical to the state. The Department of Environmental Protection (DEP), designated as the State's lead coastal management agency pursuant to section 306(c) of the Coastal Zone Management Act, 16 U.S.C. section 1456(c), and section 380.22, Florida Statutes, hereby notifies BOEM that the state does not object to the consistency determination for proposed G&G activities along its Atlantic coast with the implementation of mitigation measures described in the EA. Thus, the state recommends that Passive Acoustic Monitoring (PAM) be required along with additional mitigation measures identified in Alternative B as long as the costs for their implementation are commensurate with increased resource protection.

The Florida Geology Survey (FGS) notes that it has the ability to archive geologic samples and geophysical data collected offshore of Florida and to make those samples and data available for future research. FGS requests to be given access to any geological and geophysical data collected proximal to the coast of Florida (see enclosed comments). Additional comments from the Florida DEP and the Department of State are enclosed for your consideration.

Thank you for the opportunity to review the draft EA along with the consistency determination. We look forward to continue working with you to finalize the EA. Should you have any questions, please contact me at (850) 245-2181.

Sincerely,

Deborah L. Tucker
Environmental Administrator

Enclosures

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

DEC 19 2013

Jill Lewandowski, Chief
Environmental Consultation Branch
Bureau of Ocean Energy Management
381 Elden Street, HM 1328
Herndon, Virginia 20170-4817

Dear Ms. Lewandowski:

We have completed consultation pursuant to section 7 of the Endangered Species Act (ESA) of 1973, as amended, concerning the proposed geophysical and geological surveys to be funded by the Bureau of Ocean Energy Management (BOEM) to identify sand resources and potential sand borrow areas on the Atlantic Outer Continental Shelf (OCS). We concur with the determination contained in your November 8, 2013, letter that the proposed action is not likely to adversely affect any listed species or critical habitat designated by us. The justification for our concurrence is provided below.

Description of the Proposed Action

BOEM is proposing to use funding from the Disaster Relief Appropriations Act of 2013 (Public Law 113-2) to identify and delineate additional sand resources on the OCS. Forty-percent of the funds are required to be spent on recovery/resiliency efforts offshore New Jersey and New York, and all funding must be spent within 24 months of obligation. To determine which OCS areas contain appropriate sand resources (e.g., sediment grain size, shape, sorting size, color, sediment volume, and proximity to project sites), reconnaissance-level and site-specific geophysical and geotechnical (G&G) surveys will be carried out to map OCS sand resources and delineate potential sand resources for future projects. BOEM will provide funding to a contractor to carry out the survey work.

The proposed surveys will occur within the North Atlantic Planning Area, Mid-Atlantic Planning Area, and the South Atlantic-Straits of Florida Planning Areas of the OCS (see Figures 1 and 2). This Study Area is approximately 8.5 million acres and extends from approximately 3 to 8 nautical miles (4.8 to 12.9 kilometers (km)) from the shore and to depths of about 90 feet (27.5 meters (m)). BOEM anticipates that G&G activities would occur in a small fraction of that overall footprint, approximately 50,000 to 450,000 acres (200–1,800 km^2) or less than 5 percent of the overall Study Area. It is anticipated that almost half of the G&G activities within the Study Area would be concentrated offshore New Jersey and New York. Several areas within the study areas are being excluded from the proposed action, including Nantucket Sound, any marine protected areas, and National Marine Sanctuaries.

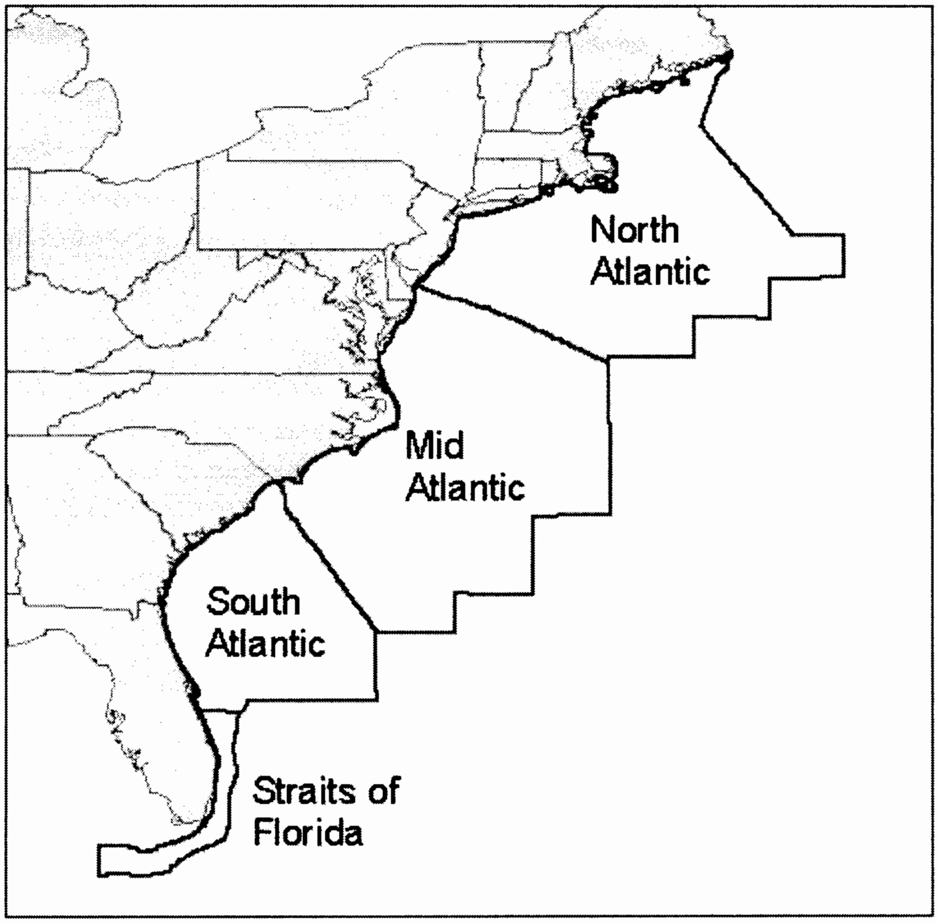

Figure 1. OCS Planning Areas. From BOEM 2013.

Surveys would occur either through phased mobilizations from regional ports and shorebases (one to collect geophysical data and one to collect geological or geotechnical information), or through a single mobilization to simultaneously collect geophysical and geotechnical data (potentially using more than one vessel). The survey time of year is largely constrained by seasonal sea state conditions consisting of wave heights of less than 3 feet (1 m) for geophysical surveys and less than 5 feet (1.5 m) for geological sampling. In the North and Mid-Atlantic, surveys are expected to begin in May or June and continue through mid-September or early October. The same times are preferred in the South Atlantic; however, if only one vessel is used, surveys would likely occur in the South Atlantic during the winter and early spring.

Once the presence of sand resources has been confirmed, borrow area delineation could occur by conducting more detailed G&G surveys and relevant laboratory/analytical methods to determine presence and volume of beach-compatible sand based on geological properties such as grain size. Once beach quality sand resource areas have been identified and delineated, sand resources could be made available to local, state, and Federal agencies for beach nourishment, coastal restoration, and coastal resiliency to provide protection of infrastructure and coastal habitat to reduce damage caused by storms, currents, and waves. BOEM is not proposing to issue any leases for sand removal at any new OCS borrow areas and no dredging or other sand removal efforts are proposed to be undertaken at this time. We have considered whether future dredging of any borrow areas discovered during these surveys meet the definition of "indirect", "interrelated" or "interdependent" actions and have determined that they do not. Indirect effects are those that are caused later in time, but are still reasonably certain to occur; while any dredging at the borrow sites would occur after the surveys were completed, and therefore be "later in time," dredging is not reasonably certain to occur. That is because we do not know if any sand resources will be discovered, and even if they are, there is no funding obligated or plans in place to remove sand from those areas and at this time, BOEM is not proposing to issue any leases for or otherwise authorize use of OCS sand resources. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402.02). Future dredging and beach nourishment activities would be carried out to provide storm protection and/or restore storm damage; these activities do not depend on the proposed G&G surveys for their justification and any future dredging and beach nourishment has independent utility apart from the proposed G&G surveys. As such, these future potential actions are not considered interdependent or interrelated actions and effects of any future dredging and/or beach nourishment are not considered to be indirect effects of the action under consultation. Any future leasing, dredging, and beach nourishment activities and would be considered in a subsequent and separate environmental review and would be the subject of separate ESA Section 7 consultation between BOEM and/or USACE and NMFS. Thus, this consultation does not evaluate the effects of any future activities at the potentially identified borrow areas.

BOEM is proposing to use G&G surveys to carry out both reconnaissance and site-specific investigations on the OCS. Reconnaissance studies would be performed over large areas to identify sand bodies and characterize the shallow geological framework and surficial geology of potential sand resources. More spatially refined, site-specific studies would be performed to delineate a potential borrow area. BOEM anticipates that approximately 70–85 percent of the survey work would be reconnaissance in nature and 15–30 percent would be site-specific. In total, it is projected that approximately 4,000 to 8,000 line-miles (6,400–12,800 line-km) of geophysical surveys and up to 500 sediment samples would be collected over the entire 8.5 million acre Study Area. Survey vessels would follow planned tracklines in a grid pattern as described in the EA so that the desired coverage of the seafloor is achieved. Anticipated line-miles for geophysical surveys and the number of sediment samples for each planning area are shown in Table 1.

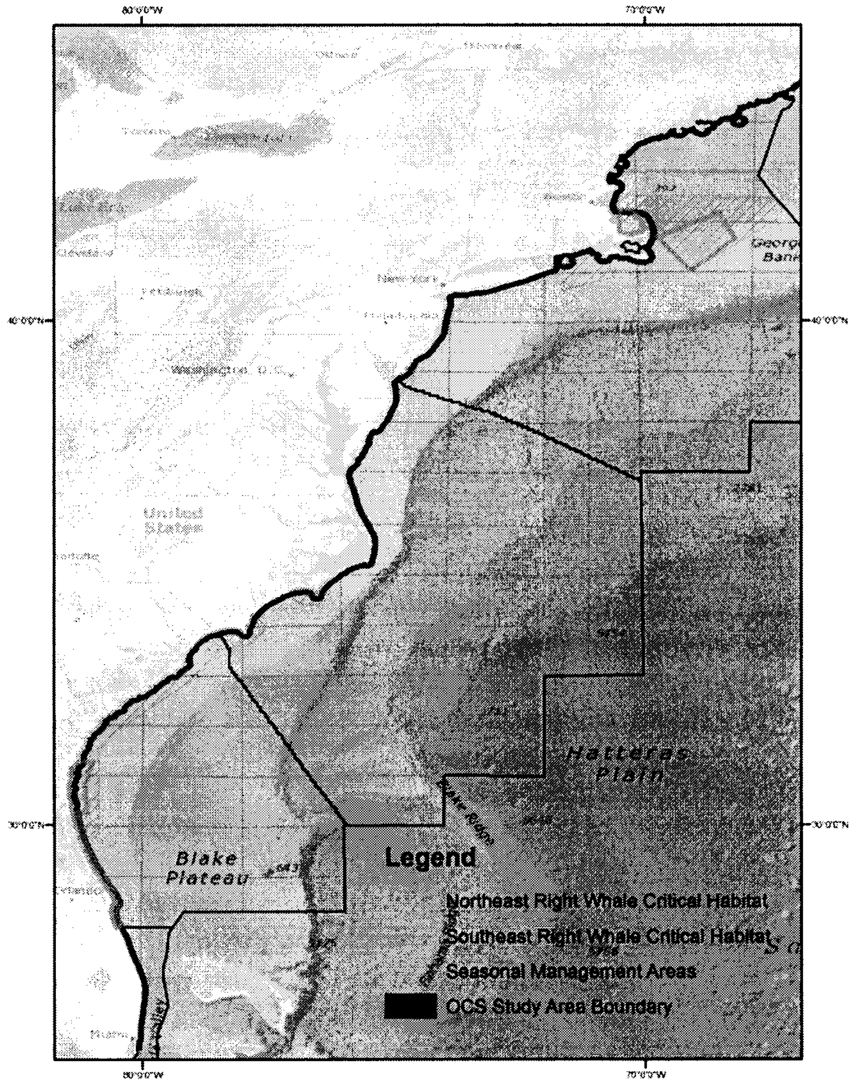

Figure 2. Map Illustrating the Study Area where G&G Activities could occur (from BOEM 2013).

Typically, geophysical survey equipment would be deployed from a single vessel ranging from approximately 28 to 120 feet (9 to 37 m) in length, and would travel at speeds between 3 and 5 knots (5.6 to 9.3 kilometers per hour (km/hr)). Depending on the nature of operations, surveys would be conducted by vessels that could potentially remain offshore for 5 to 30 days; the survey vessel would travel periodically to an onshore support base for fuel, supplies, equipment repairs, and crew changes. One to three vessels would be required to carry out the necessary surveys.

It is expected that most surveys will be restricted to daylight hours. However, occasional night time surveys may take place. In those instances, special conditions will be in place to minimize the potential for impacts to listed species (see below).

Table 1. Approximate Survey Parameters by Planning Area

Study Area	Geophysical Surveys (Line-Miles)	Geologic Samples	Approximate Number of Survey Days
North Atlantic Planning Area	2,000-3,000	200	85-130
Mid-Atlantic Planning Area	1,000-2,500	150	40-100
South Atlantic-Straits of Florida Planning Area	1,000-2,500	150	40-100
Total	**4,000-8,000**	**500**	**165-330**

The types of surveys proposed are summarized in Table 2. Summaries of the survey techniques are presented below; complete descriptions of the activities are included in BOEM's EA.

Geophysical Surveys
Geophysical surveys use a high-resolution, low-energy electromechanical source and receiver system towed behind a vessel. Table 2 provides a more detailed characterization of these proposed sources and their sound propagation characteristics. No air guns or sparkers are proposed for use.

Sub-bottom profiling would be accomplished through use of a chirp and/or boomer system. Boomer systems provide the best results for deeper penetration in coarser sediments, whereas chirp systems deliver greater detail for most sediments. The chirp system is generally towed so it remains within approximately 9.8 ft (3 m) above the seafloor. The boomer is towed at or near the surface.

Other geophysical data would be collected using a combination of equipment and techniques. Multibeam or interferometric swath bathymetry is used to gather information about water depths/seafloor topography/seafloor condition. Side-scan sonar generates an image of seabed morphology, submerged objects, and other features by emitting a high-frequency acoustic pulse; to limit sound exposure, any use of side-scan sonar would be limited to operating at frequencies greater than 180 kHz. The marine magnetometer is a passive remote sensing device (i.e., nothing is emitted) that identifies materials with ferrous or ferric components or other objects having a distinct magnetic signature. The magnetometer sensor is towed as closely as possible to the seafloor but always within 19.7 ft (6 m) of the seafloor. As an alternative to a towed deployment, a compact autonomous underwater vehicle (AUV) could be deployed from the research vessel with side-scan sonar and magnetometer capability provided it remains observable from the vessel.

Geological and Geotechnical Surveys
Information from geological surveys (i.e., sediment sampling) would be used to ground-truth geophysical data and determine the location, volume, and quality of offshore sand resources. Sediment sampling would occur at selected locations where geophysical data indicate promising targets for quality sand. Sediment sampling would be completed using a grab sampler or a

vibracore. The time that the coring equipment is on the sea bottom would be approximately 5 to 15 minutes. The area of seabed to be disturbed during individual sampling events is estimated to range from 1 to 9 square feet (0.3 to 2.7 square m).

During vibracoring a 3- or 4-inch (7.6- 10.1-centimeter (cm)) -diameter aluminum core barrel mounted on a platform or support assembly is used to penetrate sediments in the upper 20 feet (6 m) of the seafloor. To penetrate dense sands and gravels, the corer's barrel is vibrated by pneumatic or electric vibrahead, facilitating penetration into the sediment (Fugro 2003; ISSMGE 2005 in BOEM 2013). The vibratory mechanism on the vibracorer would introduce underwater sound in addition to broadband noise from the vessel. The vibratory mechanism produces a short-duration broadband noise with peak frequency less than 1 kHz. Source levels are generally expected to be less than 180–190 dB re 1 μPa @ 1 m (RMS) depending on the intensity of the vibrations, barrel material, and nature of sediment penetration (Reiser et al. 2011).

A grab sampler is a device that collects a sample of the topmost layers of the seabed by bringing two steel clamshells together and cutting a sediment sample. The grab is lowered to the seabed and activated either automatically or by remote control. The shells swivel together in a cutting action and by so doing remove a section of seabed. The sample is recovered to the ship for examination. Typical sampling rates are between three and four grabs per hour. Grab sampling penetrates from a few inches to a few feet below the seafloor.

Table 2. Summary of G&G Techniques

Equipment Type	Frequency Range	Peak Source Level (re 1 uPa at 1m)	Representative Beam Pattern	Representative Pulse Length	Within Hearing Range: Cetaceans	Within Hearing Range: Sea Turtles	Within Hearing Range: Atlantic sturgeon
Boomer	300 Hz - <10 kHz	<220 dB	Horizontal: omnidirectional Vertical: downward	<1 ms	**Yes**	**Yes**	**Yes**
Chirp sub-bottom profiler	500 Hz - 24 kHz	<220 dB	Horizontal: omnidirectional Vertical: downward	10-50 ms	**Yes**	**Yes**	**Yes**
Side-scan sonar	>180-900 kHz	<240 dB	Along-track: very narrow; Across-track: wide	<0.5 ms	No	No	No
multibeam	>180-500 kHz	<230 dB	Determined by number of beams, beam spacing, frequency etc. Along-track: very narrow; Across-track: wide	<0.5 ms	No	No	No
interferometric swath	>180-600 kHz	<220 dB	Depends on frequency; along-track: very narrow; Across-track: wide	<0.5 ms	No	No	No
single beam	>180-540 kHz	< 230 dB	Horizontal: omnidirectional Vertical: downward	0.1 ms	No	No	No

Mitigation Measures
BOEM will incorporate several measures into the proposed surveys to minimize and monitor effects of the G&G activities on listed species, other marine resources and avoid navigational and commercial fisheries conflicts. Measures relevant to listed species are discussed below; a complete discussion of minimization measures is contained in the EA.

North Atlantic Right Whale Time Area Restrictions
No surveys will occur in Cape Cod Bay. Geophysical surveys will be scheduled and conducted so that no active acoustic sources operating below 30 kHz (hearing threshold for North Atlantic Right Whales) will be used in the other right whale critical habitat areas and any right whale seasonal management areas (SMAs). The Great South Channel SMA extends from April 1 through July 31; Off Race Point SMA from March 1 through April 30; Mid-Atlantic SMAs from November 1 through April 30; and Southeastern U.S. SMA from November 15 through April 15. In these time/areas, the only surveys that will occur will be restricted to daylight only and only survey equipment operating above 180 kHz will be used, which is the upper hearing threshold for cetaceans.

Additionally, vessels operating in critical habitat or within SMAs and Dynamic Management Areas (DMAs) will be required to use the Early Warning System, Sighting Advisory System, and Mandatory Ship Reporting System. If, during the course of a geophysical survey, a DMA is established, use of all sound sources operating below 30 kHz in that DMA must be discontinued within 24 hours of its establishment. Any geophysical surveys in proximity of DMA boundaries are required to remain at a distance such that received levels for all sound sources at these boundaries are no more than 160 dB re 1 μPa RMS.

Geophysical Survey Protocol
Only electromechanical sources would be used during geophysical surveys (no air guns). The use of boomers would be limited to circumstances where penetration from chirp sources is insufficient to map or delineate near-surface geologic units. Only the chirp and boomer would be operated at frequencies below 180 kHz, which is the upper hearing threshold for cetaceans. Source levels for sub-bottom profilers and boomers would not exceed 220 dB re 1 μPa (rms SPL) and would be operated at lowest power setting, narrowest beamwidth, and highest frequency possible to fulfill data needs and effectively reduce exposure and received levels.

During all geophysical surveys BOEM will require the following:

1. An acoustic exclusion zone will be monitored during G&G surveys using any boomer or sub-bottom profiler sound source(s) operating below 180 kHz. The acoustic exclusion zone will be a 328 foot (100 m) radius zone around the sound source. Accounting for differences in the source levels, operational frequency, and deployment mode, this 328 foot (100 m) exclusion zone will encompass the 150 dB re 1 μPa RMS isopleth.
2. For geophysical surveys using sound sources operating at frequencies below 180 kHz, operations will be monitored by a trained protected species observer (PSO). One PSO will be required aboard G&G survey vessels at all times during daylight hours (dawn to dusk – i.e., from about 30 minutes before sunrise to 30 minutes after sunset) when survey operations are being conducted, unless conditions (e.g., fog, rain, darkness) make sea surface observations impossible. If conditions deteriorate during daylight hours such that

the observations are not possible, visual observations must resume as soon as conditions permit. Ongoing activities may continue, but may not be initiated under such conditions (i.e., without appropriate pre-activity monitoring). These circumstances are expected to be rare.

3. Visual monitoring of acoustic exclusion zones will be conducted to observe and document the presence of marine mammals and sea turtles and their behavior, by searching the area around the vessel using hand-held reticle binoculars, and the unaided eye. PSOs may be trained third-party observers, crew members trained as observers, or use a combination of both trained third-party and crew observers. PSOs will be solely dedicated to perform visual observer duties. PSOs shall operate under the following guidelines: a. Other than brief alerts to make personnel aware of maritime hazards, no additional duties shall be assigned to observers during their watch. b. A watch shall be no longer than six continuous hours. Consequently, at least two PSOs will be required on board vessels to monitor the acoustic exclusion zone when daily survey activities exceed six hours. c. A break of at least two hours shall occur between 6-hour watches, no other duties shall be assigned during this period.

4. During nighttime operations, observers will monitor the waters around the acoustic exclusion zone using shipboard lighting, enhanced vision equipment, night-vision equipment, and/or passive acoustic monitoring (PAM). G&G sound sources operating at frequencies below 180 kHz may be approved during periods of reduced visibility or at night, provided the nighttime survey and PAM protocol is followed.

5. Start-up and shut-down requirements: The acoustic exclusion zone for sound sources operating below 180 kHz shall be monitored for all marine mammals and sea turtles for no less than 30 minutes prior to start-up and continue until operations cease. If the source is operating below 2 kHz, shutdown of the sound source would occur immediately if any whale or sea turtle, is detected entering or within the acoustic exclusion zone. Subsequent restart of the equipment may only occur following a confirmation that the exclusion zone is clear of all marine mammals and sea turtles for 30 minutes.

6. BOEM will notify the National Marine Fisheries Service (NMFS) at least 30 days in advance of the start of the proposed activity. This notification will include details of the proposed surveys and BOEM's determination that the surveys proposed are consistent with the activities and special conditions outlined in this consultation. If BOEM can not make this consistency determination, reinitiation of section 7 consultation may be necessary.

7. Data on all marine mammal and sea turtle observations must be recorded by the observer based on standard data collection protocols. The information that must be recorded is listed in the EA and includes relevant information on location, environmental conditions, species observed and behavior of animals.

8. BOEM will require the contractor to prepare a monthly report that summarizes the survey activities and an estimate of the number of listed marine mammals, sea turtles, and any other protected species observed during these survey activities. BOEM will provide a consolidated annual report to NMFS.

Vibracore Sampling Protocol

Only vibracorers and grab samplers will be used to sample near-surface sediments during geological surveys. The vibratory mechanism on the vibracorer will be the primary source of underwater sound during geological sampling operations in addition to broadband noise from the vessel. The vibrahead will not be operated until the vibracore platform makes contact with the seabed and core barrel makes contact with the seafloor. The vibrahead will not be operated when vibracore platform is being retrieved. No noise is associated with use of grab samplers. Visual monitoring of an acoustic exclusion of 328 feet (100 m), consistent with the geophysical protocol, will be implemented. The same startup and shutdown requirements as that used with the geophysical protocol will be implemented when marine mammals and sea turtles are observed approaching or within the acoustic exclusion zone.

Nighttime Geophysical Surveys and Passive Acoustic Monitoring Protocol

Geophysical surveys will occur during day-light hours to the maximum extent practicable. If nighttime operations occur, a PAM system will be used, provided the system is deployable from the same survey platform, said system is demonstrated to be effective, and its use does not unreasonably interfere with geophysical equipment deployment and data acquisition. If BOEM determines that PAM cannot effectively be used to monitor and maintain the 100 meter exclusion zone for whales, night time surveys will only occur with equipment operating at frequencies, that cannot be perceived by listed species in the action area, provided adequate data quality is achievable. PAM will be used in addition to observers visually monitoring the 100 meter exclusion area with night-vision goggles or other appropriate equipment. PAM involves towing an additional hydrophone streamer that detects frequencies produced by vocalizing marine mammals and can be used to allow some localization of the bearing (direction) of the animal from the vessel. The PAM system will have real-time processing and detection capability for marine mammal vocalizations over the frequency range of 100 Hz to 175 kHz. Because PAM does not aid in the detection of sea turtles or sturgeon, during any night-time surveys, the frequency of chirp and boomer sources will be modulated to operate outside the upper limit of hearing range of the sea turtle and sturgeon species likely to be present in the survey area (e.g., loggerhead: less than 1 kHz; leatherback: less than 2 kHz; sturgeon: less than 1kHz) to avoid producing any survey noise detectable by sturgeon and turtles.

Vessel Strike Avoidance Protocol

All G&G surveys, regardless of vessel size, will be required to comply with the following requirements:

1. Vessel operators, crews, and visual observers or protected species observers must maintain a vigilant watch for listed species, and slow down or stop their vessel regardless of vessel size to avoid striking protected species. A visual observer aboard all G&G survey vessels will monitor an area around a transiting survey vessel, the vessel strike exclusion zone, to ensure it is free of listed species. At least one observer will be required aboard all vessels. Visual observers, for the purpose of vessel strike, may be third-party or not third-party, but require training. In addition, vessel operators would be required to comply with NMFS marine mammal and sea turtle viewing guidelines for the Northeast Region or the Southeast Region as appropriate.

2. Marine mammals and sea turtles may surface in unpredictable locations or approach slow moving vessels. When marine mammals or sea turtles are sighted in the vessel's path or

in close proximity to a moving vessel regardless of vessel size, vessel operators must reduce speed and shift the engine to neutral. Engines will not be re-engaged until the animals are clear of the exclusion area specified below.

3. In accordance with NMFS Compliance Guide for the Right Whale Ship Strike Reduction Rule (50 CFR 224.105 and 78 FR 73726-73736), when safety allows, vessels, regardless of size, shall transit within the 10 knot (18.5 km/h) speed restriction in DMAs, Northeast critical habitat and SMAs (Great South Channel, April 1 through July 31; Off Race Point, March 1 through April 30), mid-Atlantic SMAs (November 1 through April 30), and critical habitat and southeast SMAs from November 15 through April 15. When safety permits, vessel speeds should also be reduced to 10 knots (18.5 km/h) or less when mother/calf pairs, pods, or large assemblages of cetaceans are observed near a transiting vessel. A single cetacean at the surface may indicate the presence of submerged animals in the vicinity of the vessel; therefore, precautionary measures should be exercised when an animal is observed. Mandatory reductions in speed will also limit continuous noise levels related to propeller cavitation and hull-wave interaction.

4. When North Atlantic right whales are sighted at any time during the year, vessels, regardless of size, must maintain a minimum separation distance of 1,640 feet (500 m). The following avoidance measures must be taken if a vessel comes within 1,640 feet (500 m) of a right whale: a. While underway, the vessel operator shall steer a course away from the right whale at 10 knots (18.5 km/h) or less until the minimum separation distance has been established. b. If a right whale is spotted in the path of a vessel or within 328 feet (100 m) of a vessel underway, the operator shall reduce speed and shift engines to neutral. The operator shall only re-engage engines after the right whale has moved out of the path of the vessel and is more than 328 feet (100 m) away. If the right whale is still within 1,640 feet (500 m) of the vessel, the vessel shall select a course away from the whale's course at a speed of 10 knots (18.5 km/h) or less. This procedure shall also be followed if a right whale is spotted while a vessel is stationary. Whenever possible a vessel should remain parallel to the whale's course while transiting, avoiding abrupt changes in direction until it has left the area.

5. Vessels regardless of size must maintain a minimum separation distance of 328 feet (100 m) year-round if whales other than right whales, seals, or manatees are sighted. The survey will comply with other relevant manatee construction conditions when operating within the species range. All vessels will follow routes of deep water whenever possible. Year-round, vessels, regardless of size, shall maintain a distance of 164 feet (50 m) or greater from delphinoid cetaceans. If encountered during transit, a vessel shall attempt to remain parallel to the animal's course, avoiding excessive speed or abrupt changes in course.

6. Year round if sea turtles or smalltooth sawfish are sighted, all vessels regardless of size must maintain a distance of 164 feet (50 m) or greater whenever possible. The survey will comply with other relevant smalltooth sawfish construction conditions when operating within the species range. During night-time geophysical surveys and transit, nighttime observer requirements will be implemented, and vessel speed will not exceed 5 knots in areas where sea turtles may be present.

7. Sightings of any injured or dead protected species must be reported to BOEM, NMFS and U.S. Fish and Wildlife Service (FWS) within 24 hours, regardless of whether the injury or death was caused by their vessel.

Avoidance of Sensitive Seafloor and Near-Seafloor Resources
BOEM will adopt an avoidance strategy to mitigate potential effects on sensitive cultural resources such as historic and pre-contact archaeological resources as well as sensitive benthic communities and habitats at or near the seafloor.

Marine Pollution Control Plan
All G&G survey activities will occur under a contractor-developed marine pollution control plan. The marine pollution control plan must address the marine debris awareness requirement. The contractor must prepare for and take all necessary precautions to prevent discharges of waste or hazardous materials that may impair water quality.

Action Area
The action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR §402.02). For this activity, the action area includes the area within the North Atlantic, Mid-Atlantic and South Atlantic planning areas where the survey activities will take place (see Figures 1 and 2), as well as waters between the survey areas and the shore where project vessels will transit. This area is expected to encompass all effects of the proposed actions. As explained below, at any one time, an area with a radius of 100 meters around the survey equipment would have noise loud enough to potentially affect listed species. Surveys will only occur within approximately 5% of the planning areas, but the exact location of the surveys is not available.

NMFS Listed Species and Critical Habitat in the Action Area

While mentioned in the EA, we have determined that the proposed activities will have no effect on shortnose sturgeon, smalltooth sawfish, the Gulf of Maine Distinct Population Segment (DPS) of Atlantic salmon, sei (*Balaenoptera borealis*), sperm whale (*Physeter macrocephalus*), and blue whale (*B. musculus*). Shortnose sturgeon primarily occur in coastal rivers. While coastal migrations have been documented in some portions of the species range, these migrations occur near shore and individuals are not present on the OCS. Smalltooth sawfish are usually found in shallow waters (less than 32 ft (10 m)), very close to shore over muddy and sandy bottoms; this species does not occur in the action area. While the Gulf of Maine DPS of Atlantic salmon occurs in coastal waters off the coast of Maine and New Hampshire, they are not known to occur in the waters of the OCS where surveys will occur; individuals do not occur in the action area. Sperm whales occur on the continental shelf edge, over the continental slope, and into mid-ocean regions. Sei whales occur in deep water throughout their range, typically over the continental slope or in basins situated between banks (NMFS 2011). Blue whales are rare on the US OCS with only five sightings recorded (Waring et al. 2013); individual blue whales are not considered to be present in the action area. Because these species do not occur in the action area, no individuals will be exposed to any effects of the survey activities.

Several ESA-listed species occur at least seasonally in the action area. These include: North Atlantic right whale, fin whale, sei whale, and humpback whale, hawksbill, leatherback, green, and Kemp's ridley sea turtles and North Atlantic DPS loggerhead sea turtles; and individuals from five DPSs of Atlantic sturgeon. Additionally, critical habitat designated for right whales is located within the action area.

Staghorn and elkhorn corals may occur in the action area. However, due to their physiology, corals cannot perceive sound; therefore, there will be no acoustic impacts to these species. No sediment samples or anchoring will be taken in areas where corals occur; therefore, there will be no physical disturbance of any corals and no potential for injury or mortality. Corals are dependent on a healthy predatory and herbivorous fish population. Predatory fish control populations of fish that prey on corals while herbivorous fish remove macroalgae from the corals which would otherwise limit growth and settlement. As discussed below, the acoustic surveys may result in temporary displacement of fish when the survey vessel moves through an area. However, because this displacement will be limited to a very small area (no more than 100 meters extending from the survey equipment) and the displacement will occur for a very short period of time (seconds), these activities will not affect the distribution, abundance or quality of the herbivorous or predatory fish populations associated with corals in the action area. Therefore, while these coral species occur in the action area, the proposed activities will have no effect on staghorn or elkhorn corals.

Individual North Atlantic right whales (*Eubalaena glacialis*) occur in the action area year round. The species population size was estimated to be at least 444 individuals in 2009 based on a census of individual whales identified using photo-identification techniques (Waring *et al.* 2013). The population trend for right whales is increasing; the mean growth rate for the population from 1990-2009 was 2.6% (Waring *et al.* 2013). Six major habitats or congregation areas for western North Atlantic right whales exist: the coastal waters of the southeastern United States; the Great South Channel; Georges Bank/Gulf of Maine; Cape Cod and Massachusetts Bays; the Bay of Fundy; and the Scotian Shelf (Waring et al. 2013). Right whales demonstrate extensive movements between these habitats. New England waters are important feeding habitats for right whales. Right whales forage on extremely dense patches of zooplankton, primarily copepods *Calanus finmarchus* but also *Pseudocalanus* spp. and *Centropages* spp.; (Pace and Merrick 2008) . Calving occurs in nearshore waters off the coast of Georgia and Florida between December and March.

Certain U.S. waters were designated as critical habitat for Northern right whales[1] in 1994 (59 FR 28793). The Great South Channel critical habitat is the area bounded by 41°40′ N/69°45′ W; 41°00′ N/69°05′ W; 41°38′ W; and 42°10′ N/68°31′ W. The Cape Cod Bay critical habitat is the area bounded by 42°02.8′ N/70°10′ W; 42°12′ N/70°15′ W; 42°12′ N/70°30′ W; 41°46.8′

[1] In 2008, NMFS listed the endangered northern right whale (*Eubalaena spp.*) as two separate, endangered species: the North Pacific right whale (*E. japonica*) and North Atlantic right whale (*E. glacialis*) (*73 FR 12024*). We received a petition to revise the 1994 critical habitat designation in October 2009. In an October 2010 Federal Register notice, we announced that we intend to revise existing critical habitat by continuing our ongoing rulemaking process to designate critical habitat for North Atlantic right whales. To date, we have not published a proposed rule so the 1994 critical habitat designation is the only critical habitat for right whales in the Atlantic.

N/70°30′ W and on the south and east by the interior shore line of Cape Cod, Massachusetts. The Southeastern US critical habitat is the area between 31 deg.15'N (approximately located at the mouth of the Altamaha River, GA) and 30 deg.15'N (approximately Jacksonville, FL) from the shoreline out to 15 nautical miles offshore; and the waters between 30 deg.15'N and 28 deg.00'N (approximately Sebastian Inlet, FL) from the shoreline out to 5 nautical miles. The Cape Cod Bay critical habitat area is outside the action area; the other two areas are within the action area.

Humpback whales (*Megaptera novaeangliae*) feed on herring, sand lance and other small fish, during the spring, summer, and fall over a range that encompasses the eastern coast of the United States. During the winter months, humpback whales mate and calve in the West Indies. Humpback whales in this area belong to the Gulf of Maine stock. The humpback whale population is thought to be steadily increasing and numbers over 11,000 individuals (Waring *et al.* 2013).

Fin whales (*Balaenoptera physalus*) occur in the action area. The best abundance estimate available for the western North Atlantic fin whale stock is 3,985 (CV=0.24) (Waring *et al.* 2010). Fin whales are common in waters of the U. S., principally from Cape Hatteras northward, with New England waters representing a major feeding ground. Some calving is thought to take place between October and January in latitudes of the U.S. mid-Atlantic region (Hain et al. 1992); however, it is unknown where calving, mating, and wintering occurs for most of the population. Fin whales are thought to undergo migrations into Canadian waters, open-ocean areas, and perhaps even subtropical or tropical regions (Waring et al. 2013).

Five species of sea turtles occur in the action area: the threatened Northwest Atlantic DPS of loggerhead (*Caretta caretta*); endangered Kemp's ridley (*Lepidochelys kempi*); endangered leatherback (*Dermochelys coriacea*); endangered green *(Chelonia mydas)* and endangered hawksbill (*Eretmochelys imbricata*) sea turtles. The distribution of sea turtles in the action area is limited by seasonal temperature patterns; sea turtles are extremely rare north of Cape Hatteras between November and April due to cold water temperatures. Sea turtles make seasonal migrations into the Mid-Atlantic and North Atlantic as water temperatures warm in the spring and then move south as waters cool in the fall.

Hawksbill sea turtles are extremely rare north of South Florida and we do not expect hawksbills outside of the far southern extreme of the action area. Post-hatchling, juvenile and adult hawksbills may be present. No nesting occurs in the action area. Hawksbills feed primarily on sponges and are most often found near coral habitat. Green sea turtles may be present throughout the action area although they are rare north of Cape Cod Bay. In the action area, nesting occurs on beaches along the central and south coast of Florida. Green turtles forage on seagrasses and algae. Kemp's ridley sea turtles are present throughout the action area. Nesting does not occur within the action area. Kemp's ridleys forage primarily on swimming crabs but also on molluscs. Loggerhead sea turtles originating from the Northwest Atlantic DPS occur in the action area; nesting occurs on beaches along the southeastern coast. Loggerheads feed primarily on crabs and mollusks. Leatherback sea turtles occur throughout the action area, with a minor nesting colony in southeastern Florida. Leatherback sea turtles forage primarily on jellyfish.

The marine range of all five Atlantic sturgeon DPSs extends along the Atlantic coast from Canada to Cape Canaveral, Florida. Atlantic sturgeon originating from all five DPSs occur in the action area. Atlantic sturgeon originating from the New York Bight, Chesapeake Bay, South Atlantic and Carolina DPSs are listed as endangered. Atlantic sturgeon originating from the Gulf of Maine DPS are listed as threatened. Atlantic sturgeon spawn in their natal river and remain in the river until approximately age two and at lengths of approximately 76-92 cm (30-36 inches; ASSRT 2007). After emigration from the natal estuary, subadult and adult Atlantic sturgeon forage within the marine environment, typically in waters less than 50 m in depth, using coastal bays, sounds, and ocean waters (see ASSRT 2007). Only sub-adult or adult Atlantic sturgeon would be present in the action area. Individuals are likely to be migrating and could also be foraging opportunistically.

Effects of the Actions on NMFS Listed Species
Potential effects of the proposed action can be broadly categorized into the following categories: (1) acoustic effects, (2) effects to benthic habitat, (3) and effects of an increase in vessel traffic. As explained above, BOEM's proposed action will not involve any dredging or beach nourishment activities; thus, this consultation does not consider the effects of any future potential dredging or beach nourishment activities.

Acoustic Effects
Sources of noise associated with the proposed action include the geophysical survey equipment, vibracores and project vessels.

Frequency (i.e., number of cycles per unit of time, with hertz (Hz) as the unit of measurement) and amplitude (loudness, measured in decibels, or dB) are the measures typically used to describe sound. Sound waves consist of both pressure and particle motion components that propagate from the source. Sound in water follows the same physical principles as sound in air. The major difference is that due to the density of water, sound in water travels about 4.5 times faster than in air (approx. 4900 feet/s vs. 1100 feet/s), and attenuates much less rapidly than in air. As a result of the greater speed, the wavelength of a particular sound frequency is about 4.5 times longer in water than in air (Rogers and Cox 1988; Bass and Clarke 2003).

The level of a sound in water can be expressed in several different ways, but always in terms of dB relative to 1 micro-Pascal (μPa). Decibels are a log scale; each 10 dB increase is a ten-fold increase in sound pressure. Accordingly, a 10 dB increase is a 10x increase in sound pressure, and a 20 dB increase is a 100x increase in sound pressure.

The following are commonly used measures of sound:

- Peak sound pressure level (SPL): the maximum sound pressure level (highest level of sound) in a signal measured in dB re 1 μPa.

- Sound exposure level (SEL): the integral of the squared sound pressure over the duration of the pulse (e.g., a full pile driving strike.) SEL is the integration over time of the square of the acoustic pressure in the signal and is thus an indication of the total acoustic energy received by an organism from a particular source (such as pile strikes). Measured in dB re $1\mu Pa^2$-s.

- Cumulative SEL (cSEL or SEL_{cum}): the energy accumulated over time. cSEL indicates the full energy to which an animal is exposed during any kind of signal. The rapidity with which the cSEL accumulates depends on duration of exposure. The actual level of accumulated energy (cSEL) is the logarithmic sum of the total number of single strike SELs. Thus, cSEL (dB) = Single-strike SEL + $10\log_{10}(T)$; where T is time in seconds.

- Root Mean Square (RMS): the average level of a sound signal over a specific period of time.

Background Information on Acoustics and Marine Mammals and Sea Turtles

When anthropogenic disturbances elicit responses from sea turtles and marine mammals, it is not always clear whether they are responding to visual stimuli, the physical presence of humans or man-made structures, or acoustic stimuli. However, because sound travels well underwater, it is reasonable to assume that, in many conditions, marine organisms would be able to detect sounds from anthropogenic activities before receiving visual stimuli. Possible effects of noise exposure on marine organisms can be characterized by the following range of physical and behavioral responses (Richardson et al. 1995):

1. Behavioral reactions – Range from brief startle responses, to changes or interruptions in feeding, diving, or respiratory patterns, to cessation of vocalizations, to temporary or permanent displacement from habitat.
2. Masking – Reduction in ability to detect communication or other relevant sound signals due to elevated levels of background noise.
3. Temporary threshold shift (TTS) – Temporary, fully recoverable reduction in hearing sensitivity caused by exposure to sound.
4. Permanent threshold shift (PTS) – Permanent, irreversible reduction in hearing sensitivity due to damage or injury to ear structures caused by prolonged exposure to sound or temporary exposure to very intense sound.
5. Non-auditory physiological effects – Effects of sound exposure on tissues in non-auditory systems either through direct exposure or as a consequence of changes in behavior, e.g., resonance of respiratory cavities or growth of gas bubbles in body fluids.

Right, Humpback, and Fin Whale Hearing

In order for whales to be adversely affected by a noise, they must be able to perceive the noises produced by the activities. If a species cannot hear a sound, or hears it poorly, then the sound is unlikely to have a significant effect (Ketten 1998). Baleen whale hearing has not been studied directly, and there are no specific data on sensitivity, frequency or intensity discrimination, or localization (Richardson et al. 1995) for these whales. Thus, predictions about probable impact on baleen whales are based on assumptions about their hearing rather than actual studies of their hearing (Richardson et al. 1995; Ketten 1998).

Ketten (1998) summarized that the vocalizations of most animals are tightly linked to their peak hearing sensitivity. Hence, it is generally assumed that baleen whales hear in the same range as their typical vocalizations, even though there are no direct data from hearing tests on any baleen whale. Most baleen whale sounds are concentrated at frequencies less than 1 kHz (Richardson et al. 1995), although humpback whales can produce songs up to 8 kHz (Payne and Payne 1985). Based on indirect evidence, at least some baleen whales are quite sensitive to frequencies below 1 kHz but can hear sounds up to a considerably higher but unknown frequency. Most of the manmade sounds that elicited reactions by baleen whales were at frequencies below 1 kHz (Richardson et al. 1995). Some or all baleen whales may hear infrasounds, sounds at frequencies well below those detectable by humans. Most species also have the ability to hear beyond their region of best sensitivity. This broader range of hearing probably is most likely related to their need to detect other important environmental phenomena, such as the locations of predators or prey. Among marine mammal species, considerable variation exists in hearing sensitivity and absolute hearing range (Richardson et al. 1995; Ketten 1998). The baleen whales have hearing ranges that are likely to have peak sensitivities with low frequencies (below 1 kHz). Based on the best available information, we assume that sources with frequencies above 180 kHz are not perceived by these species.

Criteria for Assessing Effects to Listed Whales
The available information on the hearing capabilities of cetaceans and the mechanisms they use for receiving and interpreting sounds remains limited due to the difficulties associated with conducting field studies on these animals. However, current thresholds for determining the potential onset of impacts to marine mammals typically center around root-mean-square (RMS) received levels of 180 dB re 1μPa for potential injury, 160 dB re 1μPa for potential behavioral disturbance/harassment from a non-continuous noise source, and 120 dB re 1μPa for potential behavioral disturbance/harassment from a continuous noise source. Marine mammal responses to sound can be highly variable, depending on the individual hearing sensitivity of the animal, the behavioral or motivational state at the time of exposure, past exposure to the noise which may have caused habituation or sensitization, demographic factors, habitat characteristics, environmental factors that affect sound transmission, and non-acoustic characteristics of the sound source, such as whether it is stationary or moving (NRC 2003). Nonetheless, the threshold levels referred to above are considered conservative based on the best available scientific information and are considered to be reasonable predictors of the noise levels that may begin to affect listed whales.

Sea Turtle Hearing
The information available for sea turtle hearing suggests that the auditory capabilities of sea turtles are centered in the low frequency range between 100 Hz and 2,000 Hz (Ridgway *et al.* 1969; Lenhardt *et al.* 1983; Bartol *et al.* 1999, Lenhardt 1994, O'Hara and Wilcox 1990). An early experiment measured cochlear potential in three Pacific green turtles and suggested a best hearing sensitivity in air of 300–500 Hz and an effective hearing range of 60–1,000 Hz (Ridgway et al. 1969). Sea turtle underwater hearing is believed to be about 10 dB less sensitive than their in-air hearing (Lenhardt 1994). Lenhardt et al. (1996) used a behavioral "acoustic startle response" to measure the underwater hearing sensitivity of a juvenile Kemp's ridley and a juvenile loggerhead turtle to a 430-Hz tone. Their results suggest that those species have a hearing sensitivity at a frequency similar to those of the green turtles studied by Ridgway et al. (1969). Lenhardt (1994) was also able to induce startle responses in loggerhead turtles to low frequency (20–80 Hz) sounds projected into their tank. He suggested that sea turtles have a

range of best hearing from 100–800 Hz, an upper limit of about 2,000 Hz, and serviceable hearing abilities below 80 Hz. More recently, the hearing abilities of loggerhead sea turtles were measured using auditory evoked potentials in 35 juvenile animals caught in tributaries of Chesapeake Bay (Bartol et al. 1999). Those experiments suggest that the effective hearing range of the loggerhead sea turtle is 250–750 Hz and that its most sensitive hearing is at 250 Hz. In general, however, these experiments indicate that sea turtles generally hear best at low frequencies and that the upper frequency limit of their hearing is no more than 2 kHz.

Ridgway *et al.* (1969) studied the auditory evoked potentials of three green sea turtles (in air and through mechanical stimulation of the ear) and concluded that their maximum sensitivity occurred from 300 to 400 Hz with rapid declines for tones at lower and higher frequencies. They reported an upper limit for cochlear potentials without injury of 2000 Hz and a practical limit of about 1000 Hz. This is similar to estimates for loggerhead sea turtles, which had most sensitive hearing between 250 and 1000 Hz, with rapid decline above 1000 Hz (Bartol *et al.* 1999). We assume that these sensitivities to sound apply to all of the sea turtles in the action area (i.e., the green, hawksbill, Kemp's ridley, leatherback and loggerhead sea turtles).

A study on the effects of airguns on sea turtle behavior also suggests that sea turtles are most likely to respond to low-frequency sounds. McCauley *et al.* (2000) reported that green and loggerhead sea turtles avoided air-gun arrays at 2 km and at 1 km with received levels of 166 dB re 1 Pa and 175 dB re 1 uPa, respectively. The sea turtles responded consistently: above a level of approximately 166 dB re 1 uPa RMS the turtles noticeably increased their swimming activity compared to non-airgun operation periods. Above 175 dB re 1 Pa mean squared pressure their behavior became more erratic possibly indicating the turtles were in an agitated state.

Criteria for Assessing Effects to Sea Turtles

Currently there are no established thresholds for injury or behavioral disturbance for sea turtles. Behavioral reactions of sea turtles (McCauley et al. 2000a and 2000b, DeRuiter and Doukara 2012) have been reported for sea turtles in response to airgun noise. McCauley *et al.* (2000) noted that decibel levels of 166 dB re 1 μPa RMS were required before any behavioral reaction (e.g., increased swimming speed) was observed. Based on this information, NMFS expects any sea turtles exposed to underwater noise greater than 166 dB re 1μPa RMS may experience behavioral disturbance and that sea turtles may actively avoid any area with noise levels greater than 166 dB re 1μPa RMS. While there is some information suggesting the noise levels that might result in injury to sea turtles from exposure to underwater explosives, no such information is available for non-explosive sound sources. However, all available information indicates that injury is not expected upon exposure to impulsive noises less than 180 dB re 1μPa RMS.

Summary of Available Information on Underwater Noise and Sturgeon

Sturgeon have swim bladders, but they are not located very close to the ear; thus, they are assumed to detect primarily particle motion rather than pressure and rely primarily on particle motion to detect sounds (Lovell *et al.* 2005). While there are no data both in terms of hearing sensitivity and structure of the auditory system for shortnose or Atlantic sturgeon, there are data for the closely related lake sturgeon (Lovell *et al.* 2005; Meyer *et al.* 2010), which for the purpose of considering acoustic impacts can be considered as a surrogate for Atlantic sturgeon. The available data suggest that lake sturgeon can hear sounds from below 100 Hz to 800 Hz

(Lovell *et al.* 2005; Meyer *et al.* 2010). However, since these two studies examined responses of the ear and did not examine whether fish would behaviorally respond to sounds detected by the ear, it is hard to determine thresholds for hearing (that is, the lowest sound levels that an animal can hear at a particular frequency) using information from these studies.

Criteria for Assessing the Potential for Physiological Effects of Sound on Fish

The Fisheries Hydroacoustic Working Group (FHWG) was formed in 2004 and consists of biologists from NMFS, USFWS, FHWA, and the California, Washington and Oregon DOTs, supported by national experts on sound propagation activities that affect fish and wildlife species of concern. In June 2008, the agencies signed an MOA documenting criteria for assessing physiological effects of pile driving on fish. The criteria were developed for the acoustic levels at which physiological effects to fish could be expected. It should be noted, that these are onset of physiological effects (Stadler and Woodbury, 2009), and not levels at which fish are necessarily mortally damaged. These criteria were developed to apply to all species, including listed green sturgeon, which are biologically similar to Atlantic sturgeon and for these purposes can be considered a surrogate. The interim criteria are:

- Peak SPL: 206 decibels relative to 1 micro-Pascal (dB re 1 μPa).
- cSEL: 187 decibels relative to 1 micro-Pascal-squared second (dB re 1μPa^2-s) for fishes above 2 grams (0.07 ounces).
- cSEL: 183 dB re 1μPa^2-s for fishes below 2 grams (0.07 ounces).

At this time, they represent the best available information on the thresholds at which physiological effects to sturgeon from impulsive sounds are likely to occur. The swim bladder of sturgeon is relatively small compared to other species (Beregi et al. 2001). While there are no data that correlate effects of noise on fishes and swim bladder size, the physiological effects of impulsive noises on sturgeon may actually be less than on other species due to the small size of their swim bladder. It is important to note that physiological effects may range from minor injuries from which individuals are anticipated to completely recover with no impact to fitness to significant injuries that will lead to death. The severity of injury is related to the distance from the sound source and the duration of exposure; therefore, the closer to the source and the greater the duration of the exposure, the higher likelihood of significant injury.

Based on the available information, we consider the potential for physiological effects upon exposure to impulsive noise of 206dB re 1 μPa peak and 187 dB re 1 μPa^2-s cSEL. Use of the 183 dB re 1 μPa^2-s cSEL threshold, is not appropriate for this consultation because all Atlantic sturgeon in the action area will be larger than 2 grams. As explained here, physiological effects could range from minor injuries that a fish is expected to completely recover from with no impairment to survival to major injuries that increase the potential for mortality, or result in death.

Available Information for Assessing Behavioral Effects

Results of empirical studies of hearing of fishes, amphibians, birds, and mammals (including humans), in general, show that behavioral responses vary substantially, even within a single species, depending on a wide range of factors, such as the motivation of an animal at a particular time, the behavior of the animal at the time it detects a new stimulus, the hearing capabilities of an animal or species, and numerous other factors (Brumm and Slabbekoorn 2005). Thus, it may be difficult to assign a single criterion above which behavioral responses to noise would occur.

In order to be detected, a sound must be above the "background" level. Additionally, results from some studies suggest that sound may need to be biologically relevant to an individual to elicit a behavioral response. For example, in an experiment on responses of American shad to sounds produced by their predators (dolphins), it was found that if the predator sound is detectable, but not very loud, the shad will not respond (Plachta and Popper 2003). But, if the sound level is raised an additional 8 or 10 dB, the fish will turn and move away from the sound source. Finally, if the sound is made even louder, as if a predator were nearby, the American shad go into a frenzied series of motions that probably helps them avoid being caught. It was speculated by the researchers that the lowest sound levels were those recognized by the American shad as being from very distant predators, and thus, not worth a response. At somewhat higher levels, the shad recognized that the predator was closer and then started to swim away. Finally, the loudest sound was thought to indicate a very near-by predator, eliciting maximum response to avoid predation. Similarly, results from Doksaeter *et al.* (2009) suggest that fish will only respond to sounds that are of biological relevance to them. This study showed no responses by free-swimming herring (*Clupea* spp.) when exposed to sonars produced by naval vessels; but, sounds at the same received level produced by major predators of the herring (killer whales) elicited strong flight responses. Sound levels at the fishes from the sonar in this experiment were from 197 dB to 209 dB (rms) re 1 μPa at 1,000 to 2,000Hz.

Mueller-Blenke *et al.* (2010), attempted to evaluate response of Atlantic cod (*Gadus morhua*) and Dover sole (*Solea solea*) held in large pens to playbacks of pile driving sounds recorded during construction of Danish wind farms. The investigators reported that a few representatives of both species exhibited some movement response, reported as increased swimming speed or freezing to the pile-driving stimulus at peak sound pressure levels ranging from 144 to 156 dB re 1 μPa for sole and 140 to 161 dB re 1 μPa for cod. These results must be interpreted cautiously as fish position was not able to be determined more frequently than once every 80 seconds.

Feist (1991) examined the responses of juvenile pink (*Oncorhyncus gorbuscha*) and chum (*O. keta*) salmon behavior during pile driving operations. Feist had observers watching fish schools in less than 1.5 m water depth and within 2 m of the shore over the course of a pile driving operation. The report gave limited information on the types of piles being installed and did not give pile size. Feist did report that there were changes in distribution of schools at up to 300 m from the pile driving operation, but that of the 973 schools observed, only one showed any overt startle or escape reaction to the onset of a pile strike. There was no statistical difference in the number of schools in the area on days with and without pile driving, although other behaviors changed somewhat.

Anderson *et al.* (2007) presents information on the response of sticklebacks (*Gasterosteus aculeatus*), a hearing generalist, to pure tones and broadband sounds from wind farm operations. Sticklebacks responded by freezing in place and exhibiting startle responses at SPLs of 120 dB (re: 1μPa) and less. Purser and Radford (2011) examined the response of three-spined sticklebacks to short and long duration white noise. This exposure resulted in increased startle responses and reduced foraging efficiency, although they did not reduce the total number of prey ingested. Foraging was less efficient due to attacks on non-food items and missed attacks on food items. The SPL of the white noise was reported to be similar (at frequencies between 100 and 1000 Hz) to the noise environment in a shoreline area with recreational speedboat activity. While this does not allow a comparison to the 150 dB re 1 μPa RMS guideline, it does demonstrate that significant noise-induced effects on behavior are possible, and that in addition to avoidance, fish may react to increased noise with a startle response or reduced foraging efficiency during the time of sound exposure.

For the purposes of this consultation, we will use 150 dB re 1 μPa RMS as a <u>conservative</u> indicator of the noise level at which there is the potential for behavioral effects, provided the operational frequency of the source falls within the hearing range of the species of concern. That is not to say that exposure to noise levels of 150 dB re 1 μPa RMS will always result in behavioral modifications or that any behavioral modifications will rise to the level of "take" (i.e., harm or harassment) but that there is a potential, upon exposure to noise at this level, to experience some behavioral response. We expect that behavioral responses could range from a temporary startle to avoidance of an area with disturbing levels of sound. The effect of any anticipated response on individuals will be considered in the effects analysis below.

<u>Effects of Noise Exposure from Geophysical Surveys</u>

Whales

The only geophysical surveys that operate in the hearing range of whales are the chirp and boomer. As noted above, there is the potential for injury of whales upon exposure to noise greater than 180 dB re 1μPa RMS and potential for behavioral disturbance upon exposure to noise greater than 160 dB re 1μPa RMS. Consistent with recent sound source verification studies on these active sources, threshold radii to 160 dB re 1 μPa (rms SPL) are expected to be less than 328 feet (100 m) because of the beam pattern characteristics and downward directivity. Moreover, the chirp towfish would be towed as close to the seafloor as possible to further reduce the zone of ensonification.

Most surveys are expected to occur during daylight hours. During these surveys, observers will be able to monitor the area extending 100 meters from the survey equipment to ensure that there are no whales present. If surveys occur at night, a combination of visual observations and PAM will be carried out to detect whales that may be within 100 meters of the survey equipment and will ensure that survey equipment can be shutdown if whales are close enough to be potentially negatively impacted by exposure to survey noise.

The source level (i.e., within 1 meter) for the equipment that can be heard by whales is less than 220 dB re 1μPa (peak); the sound attenuates with distance so noise levels are greatest closest to the source and diminish the further from the source. As noted above, injury can result to whales upon exposure to impulsive noises, such as the geophysical survey equipment, above 180 dB re 1μPa RMS. According to the best available information provided by BOEM, noise levels greater than 180 dB re 1μPa RMS will be experienced only very close to the source with noise attenuating to less than 150 dB re 1μPa RMS within 100 meters of the source. The 100 m exclusion zone will be monitored for at least 30 minutes prior to power up of the survey equipment. The equipment will not be started until the exclusion zone is free of whales for at least 30 minutes. Given the small area of the exclusion zone and the shallow depths and the dive time of whales in the area, it is reasonable to expect that monitoring the exclusion zone for at least 30 minutes will allow the PSO to detect any whales that may be submerged in the exclusion zone. Once the equipment is turned on, should a whale be detected within 100 meters of the survey vessel, all operations will be halted or delayed until the exclusion zone is clear of whales for at least 30 minutes. Based on this, it is extremely unlikely that a whale will be present within 100 m of the source while the geophysical survey equipment is operating; therefore, it is extremely unlikely that any whale will be exposed to noise that could cause injury.

Available information suggests that impulsive noise above 160 dB re 1μPa RMS may trigger a behavioral response in whales; behavioral responses could range from a startle with immediate resumption of normal behaviors to complete avoidance of the area where noise is elevated above 160 dB re 1μPa RMS and could also include changes in foraging behavior. The 160 dB re 1 μPa RMS isopleth (radius) would extend no more than 100 meters from the boomer or chirper. The surveys will take place in an open ocean environment with no impediments to movement. Assuming the worst case behaviorally, that those individuals would avoid any area with underwater noise greater than 160 dB re 1 μPa, there would never be an area larger than $0.03 km^2$ (0.01 square miles; less than 0.0001% of the action area) that whales might actively avoid. Additionally, because the boomer and chirp is towed behind a moving vessel and the pulse length is so short, any one area is impacted for less than a second. Thus, the time period when an individual whale could be expected to react behaviorally in an area is only momentary. Any individual whales that change course to avoid the area with potentially disturbing levels of noise may make small adjustments in their course; however, the furthest a whale would need to swim to avoid the area where noise would be above 160 dB re 1μPa RMS would be 100 meters. Similarly, any disruption to foraging behavior would be extremely brief and limited to only the few seconds that the area had noise levels above 160 dB re 1μPa RMS . We expect that foraging behavior would quickly resume once the disturbance had passed.

Based on this analysis, we have determined that it is extremely unlikely that any minor changes in behavior resulting from exposure to increased underwater noise associated with boomer and chirp surveys will preclude any individual whale from completing any normal behaviors such as resting, foraging or migrating or that the fitness of any individuals will be affected. Additionally, there is not expected to be any increase in energy expenditure that has any detectable effect on the physiology of any individuals or any future effect on growth, reproduction, or general health. Because any changes in movements would be limited to momentary avoidance of an extremely small area, any disturbance is likely to have an insignificant effect on the individual.

Masking

Masking is a natural phenomenon which marine mammals must cope with even in the absence of man-made noise (Richardson et al. 1995). Since the sound produced by the surveys would be intermittent and transient in nature, masking would not be a continuous phenomenon, but would occur for only a few seconds at a time in a small area. Marine mammals demonstrate strategies for reducing the effects of masking, including changing the source level of calls, increasing the frequency or duration of calls, and changing the timing of calls (NRC 2003). Although these strategies are not necessarily without energetic costs, the consequences of temporary and localized increases in background noise level are impossible to determine from the available data (Richardson et al. 1995; NRC 2005). However, one relevant factor in attempting to consider the effect of elevated noise levels on marine mammal populations is the size of the area affected versus the habitat available. The proposed surveys will take place in an open ocean environment with few, if any, impediments to the movement of whales. Other sound in the area is a result of natural (e.g., waves, storms) and anthropogenic (e.g., other vessel traffic) sources. Whales must cope with natural sound sources constantly and we expect that they are habituated to them. Other sound sources in the area would similarly be transient and limited to the time that a ship passes through the area. Because the potential for masking is limited to the time and space where the boomer and chirp survey equipment is operational, which we established above is a small, transient area, the potential for masking in any one area is limited to short time periods (seconds) in small areas (limited to a radius of no more than 100 meters). As such, although some whales are likely to be subject to occasional masking as a result of survey activity, temporary shifts in calling behavior to reduce the effects of masking, on the scale of no more than a few minutes, are likely to result in only insignificant effects to individuals.

Acoustically Induced Stress

Generally, stress is a normal, adaptive response, and the body returns to homeostasis with minimal biotic cost to the animal. However, stress can turn to "distress" or become pathological if the perturbation is frequent, outside of the normal physiological response range, or persistent (NRC 2003). In addition, an animal that is already in a compromised state may not have sufficient reserves to satisfy the biotic cost of a stress response, and then must divert resources away from other functions Typical adaptive responses to stress include changes in heart rate, blood pressure, or gastrointestinal activity. Stress can also involve activation of the pituitary-adrenal axis, which stimulates the release of more adrenal corticoid hormones. Acute noise exposure may cause inhibited growth (in a young animal), or reproductive or immune responses. Stress-induced changes in the secretion of pituitary hormones have been implicated in failed reproduction(Moberg 1987, Rivest and Rivier 1995) and altered metabolism (Elasser *et al.* 2000), immune competence (Blecha 2000) and behavior.

There are very few studies on the effects of stress on marine mammals, and even fewer on noise-induced stress in particular. One controlled laboratory experiment on captive bottlenose dolphins showed cardiac responses to acoustic playbacks, but no changes in the blood chemistry parameters measured (Miksis et al. 2001 in NRC 2003). Beluga whales exposed to playbacks of drilling rig noise (30 minutes at 134-153 dB re 1μPa) exhibited no short term behavioral responses and no changes in catecholamine levels or other blood parameters (Thomas et al. 1990 in NRC 2003). However, techniques to identify the most reliable indicators of stress in natural marine mammal populations have not yet been fully developed, and as such it is difficult to draw conclusions about potential noise-induced stress from the limited number of studies conducted.

There have been some studies on terrestrial mammals, including humans, that may provide additional insight on the potential for noise exposure to cause stress. Jones and Broadbent (1998) reported on reductions in human performance when faced with acute, repetitive exposures to acoustic disturbance. Trimper *et al.* (1998) reported on the physiological stress responses of osprey to low-level aircraft noise while Krausman *et al.* (2004) reported on the auditory and physiological stress responses of endangered Sonoran pronghorn to military overflights.

These studies on stress in terrestrial mammals lead us to believe that this type of stress is likely to result from chronic acoustic exposure. Due to the localized, transient acoustic impacts of the surveys, we do not expect any chronic acoustic exposure to any individuals from the proposed surveys; therefore, we do not anticipate this type of stress response from the survey activities.

Effects to Sea Turtles

As noted above, the only geophysical survey equipment that operates in a range that can be heard by sea turtles is the boomer and chirp. The source level (i.e., within 1 meter) for the boomer and chirp is less than 220 dB re 1µPa; the sound attenuates with distance so noise levels are greatest closest to the source and diminish the further from the source. Based on acoustic monitoring of similar surveys, at a distance of 100 m from the source, noise is expected to attenuate to below 150 dB re 1µPa RMS. As noted above, we do not expect injury to sea turtles upon exposure to impulsive noises, such as the boomer or chirp, less than 180 dB re 1µPa RMS. BOEM has previously estimated that, within the action area, noise levels greater than 180 dB re 1µPa RMS would not be expected beyond 45 meters of the boomer and not beyond 42 meters from the chirp (BOEM 2012). BOEM is requiring the maintenance of a 100-meter exclusion zone during the survey and that this exclusion zone be monitored for at least 30 minutes prior to start up of the survey equipment. The equipment will not be started until the exclusion zone is free of sea turtles for at least 30 minutes. The normal duration of sea turtle dives ranges from 5-40 minutes depending on species, with a maximum duration of 45-66 minutes depending on species (Spotila 2004). Given the small area encompassed by the exclusion zone (i.e., extending only 100 m from the source) and the relatively shallow depths in the action area (i.e., less than 30 meters), it is reasonable to expect that monitoring the exclusion zone for at least 30 minutes will allow the endangered species monitor to detect any sea turtles that may be submerged in the exclusion zone. Once the equipment is turned on, should a sea turtle be detected within 100 meters of the survey vessel, all operations will be halted or delayed until the exclusion zone is clear of turtles for at least 30 minutes. Based on this, it is extremely unlikely that sea turtle will be present within 45 m of the source while the chirp or boomer is operating. Additionally, given the noise levels produced by the survey equipment and given the expected behavioral response of avoiding noise levels greater than 166 dB, it is extremely unlikely that any sea turtles would swim towards the survey vessel while the chirp sonar or boomer is operational. Any sea turtles within 45 meters of the equipment at the beginning of the survey are expected to move away during power upand not be injured. As explained above, if the boomer or chirp are used at night, they will be only operated at frequencies that cannot be perceived by sea turtles; therefore there is no risk of exposure to potentially injurious or disturbing noise at times when visual observation would not be effective at maintaining the exclusion zone.

As explained above, the best available information indicates that sea turtles will respond behaviorally to impulsive noises greater than 166 dB re 1µPa and will actively avoid areas with noise levels greater than 166 dB. It is reasonable to assume that sea turtles, on hearing the sound emitted by the boomer or chirp, would either not approach the source or would move around it. When considering the potential for behavioral effects, we need to consider the geographic and temporal scope of any impacted area. For this analysis, we consider the area where noise levels greater than 166 dB re 1 μPa RMS will be experienced and the duration of time that those underwater noise levels could be experienced. Behavioral responses could range from a startle with immediate resumption of normal behaviors to complete avoidance of the area and could also include changes in diving patterns or changes in foraging behavior.

The 166 dB re 1 μPa RMS isopleth (radius) would extend less than 100 meters from the boomer or chirp and any given area will have elevated noise for an extremely short period of time (seconds). Any disruption to foraging behavior would be extremely brief and limited to only the few seconds that the area was ensonified above166 dB re 1 μPa RMS. We expect that foraging behavior would quickly resume once the disturbance had past. Similarly, any changes in diving or swimming patterns would be very brief.

Assuming the worst case behaviorally, that individuals would avoid an area with underwater noise greater than 166 dB re 1 μPa, there would never be an area larger than 0.03km^2 (0.01 square miles; less than 0.0001% of the action area) from which sea turtles might be temporarily excluded. Additionally, because the boomer is towed behind a moving vessel and the pulse length is so short, any one area is impacted for less than a second. Thus, the time period when an individual sea turtle could be expected to react behaviorally in an area is only momentary. The surveys will take place in an open ocean environment with no impediments to movement; therefore, we do not expect any instances where a sea turtle would not be able to avoid the sound source.

Individual sea turtles in the action area are likely to be migrating through the area and may forage opportunistically while migrating. An individual migrating through the area being surveyed may change course to avoid the area where noise levels are above 166 dB re 1 μPa RMS; however, the furthest a turtle would need to swim to avoid the ensonified area would be 100 meters.

Based on this analysis, we have determined that it is extremely unlikely that any minor changes in behavior resulting from exposure to increased underwater noise associated with boomer surveys will preclude any individual sea turtle from completing any normal behaviors such as resting, foraging or migrating or that the fitness of any individuals will be affected. Additionally, there is not expected to be any increase in energy expenditure that has any detectable effect on the physiology of any individuals or any future effect on growth, reproduction, or general health. Because any changes in movements would be limited to momentary avoidance of an extremely small area, any disturbance is likely to have an insignificant effect on the individual.

Effects to Sturgeon

Sturgeon are only expected to be able to perceive the noise associated with the boomer and chirp. All other survey equipment operates at frequency higher than sturgeon can hear, therefore we do not expect any effects to sturgeon exposed to increased underwater noise from the other higher frequency survey equipment. As noted above, the available information on effects of fish to exposure of sound is extremely limited. There are no known studies examining the effects of boomers or chirpers on fish generally, or sturgeon specifically. However, based on the available information summarized above, we expect fish to react to noise that is disturbing by moving away from the sound source and avoiding further exposure. Injury and mortality is only known to occur when fish are very close to the noise source and the noise is very loud and typically associated with pressure changes (i.e., impulsive pile driving or blasting).

Given the location of the areas to be surveyed, we do not expect sturgeon to occur in dense aggregations in the survey areas. We expect any sturgeon that are in the survey areas to be individuals migrating through that may forage opportunistically. The available information suggests that for pile driving, peak noise levels need to be at least 206 dB re 1µPa before physiological impacts are likely. In order to be exposed to peak energy of 206 dB re 1µPa from the boomer or chirp, a sturgeon would need to be within 1 meter of the source. Due to the disperse distribution of Atlantic sturgeon in the action area, this is extremely unlikely to occur.

Available information suggests that noise above 150 dB re 1µPa RMS may trigger a behavioral response in fish. In the worst case, we expect that sturgeon would completely avoid the area with noise levels above 150 dB re 1µPa RMS.

The 150 dB re 1 µPa RMS isopleth (radius) would extend 100 meters from the boomer. The surveys will take place in an open ocean environment with no impediments to movement. Assuming the worst case behaviorally, those individuals would avoid an area with underwater noise greater than 150 dB re 1 µPa, there would never be an area larger than 0.03km^2 (0.01 square miles; less than 0.0001% of the action area) from which Atlantic sturgeon might be excluded. Additionally, because the boomer is towed behind a moving vessel and the pulse length is so short, any one area is impacted for less than a second. Thus, the time period when an individual sturgeon could be expected to react behaviorally in an area is only momentary. Individual sturgeon in the action area are likely to be migrating through the area and may forage opportunistically while migrating. An individual migrating through the area being surveyed may change course to avoid the area where noise levels are greater than 150 dB re 1uPa RMS; however, the furthest a sturgeon would need to swim to avoid this area would be 100 meters.

Based on this analysis, we have determined that it is extremely unlikely that any minor changes in behavior resulting from exposure to increased underwater noise associated with boomer and chirp surveys will preclude any individual sturgeon from completing any normal behaviors such as resting, foraging or migrating or that the fitness of any individuals will be affected. Additionally, there is not expected to be any increase in energy expenditure that has any detectable effect on the physiology of any individuals or any future effect on growth, reproduction, or general health. Because any changes in movements would be limited to momentary avoidance of an extremely small area, any disturbance is likely to have an insignificant effect on the individual.

Vibracore

There is no noise associated with collecting grab samples. The vibratory mechanism of the vibracore produces a short-duration broadband noise with peak frequency less than 1 kHz. Source levels are expected to be less than 180-190 dB re 1µPa at 1 m RMS SPL (Reiser et al. 2011 in BOEM 2013). The noise would be generated continuously at a sample location for 5 to 15 minutes. Any exposure to noise from the vibracore would therefore be of extremely short duration. Noise is expected to attenuate rapidly and decrease to below 150 dB re 1µPa within 100 meters.

As noted above, a 100 meter exclusion zone around the survey vessel will be maintained such that no vibracoring will occur should a listed species be observed within 100 meters of the survey vessel. The source level is below the level that could potentially result in injury to whales, sea turtles and listed fish. Therefore, no listed species will be exposed to noise that could result in injury. We expect that whales, sea turtles and listed fish that hear the vibracore will swim away from the noise or around the noise. However, given the short duration of vibracore operations (no more than 15 minutes), we do not expect any negative impacts to any individuals that respond to this noise as normal behaviors would resume as soon as the operations cease. Given this analysis, we expect all effects to listed species from exposure to the vibracore noise to be insignificant and discountable.

Vessel Noise

Survey vessel transits will occur throughout the action area over the two-year study period (total of up to 330 study days). Vessels transmit noise through water; the dominant source of vessel noise from the proposed action is propeller cavitation, although other ancillary noises may be produced. Vessel traffic associated with the proposed action would produce levels of noise of 150 to 170 dB re 1 μPa-m at frequencies below 1,000 Hz.

Exposure to individual vessel noise by ESA-listed marine mammals, sea turtles, and fish within the action area would be transient and temporary as vessels moved along the survey tracks. ESA-listed marine mammal, sea turtle, and fish behavior and use of the habitat would be expected to return to normal following the passing of a vessel. Therefore, impacts from vessel noise would be short term and negligible. The dominant source of vessel noise from the proposed action is propeller cavitation, although other ancillary noises may be produced. Sound sources associated with the operation of the survey vessels are in the range of 150-170 dB re 1μPa RMS (Richardson et al. 1995 in BOEM 2013). Sounds levels may be less during the surveys when the vessels are carrying out the surveys as they will be moving very slowly during that time. Restrictions on vessel approaches near whales will ensure that the survey vessels are never within 500 meters of right whales and 100 meters from all other whales; this is a sufficient separation distance to avoid any exposure of whales to potentially disturbing noise associated with the operation of all project related vessels Based on the operating procedures which limit vessels from approaching within 100 meters of any whale and 500 meters of a right whale, it is extremely unlikely that any project vessel would come close enough to a whale in a manner that would result in exposure to potentially disturbing levels of noise. As such, no whales are expected to be exposed to injurious or disturbing levels of sound. As no avoidance behaviors are anticipated, the distribution, abundance and behavior of whales in the action area is not likely to be affected by noise associated with project related vessels and any effects will be insignificant or discountable.

Sea turtles and sturgeon may exhibit behavioral reactions to noise sources at levels of 166 dB re 1uPa RMS and 150 dB re 1μPa RMS, respectively. These noise levels will only be experienced within several meters of the project related vessels. We do not expect sea turtles or listed fish to be that close to the survey vessels; therefore, we do not anticipate any behavioral disturbance from noise associated with the operations of the project vessels.

Effects to Benthic Habitat
Activities that disturb the sea floor will also affect benthic communities and can cause effects to listed species by reducing the numbers or altering the composition of the species upon which these species prey. Activities that may affect the sea floor and result in the loss of foraging resources for listed species are limited to vibracores and grab samples. Both of these survey methods will result in temporary disturbance of the benthos and a temporary loss of benthic resources. Effects to benthic resources and habitat will be restricted to no more than 500 small-footprint locations within the study area where geotechnical samples will be taken. While the vibracore and grab sampler will take a portion of the benthos that will be brought onto the ship, because of the small size of the sample and the nature of the removal, there is no sediment plume associated with the sampling.

The vibracores and grab samples will affect an extremely small area (3-4 inches to no more than 9 square feet, when accounting for the sampling platform) at each sampling location. While there will be some loss of benthic species at the sample sites, including potential forage items for Atlantic sturgeon, loggerhead, and Kemp's ridley sea turtles, the amount of benthic resources potentially lost will be extremely small and limited to immobile individuals that cannot escape capture during sampling. Only 500 samples will be taken over an 8.5 million acre area; the amount of potential forage lost is extremely small and will be temporary. As such a small area will be disturbed and there will be a large distance between disturbed areas, recolonization is expected to be rapid. These temporary, isolated reductions in the amount of benthic resources are not likely to have a measurable adverse impact on any foraging activity or any other behavior of listed species; this is due to the small size of the affected areas and the temporary nature of any disturbance. Based on this analysis, any effects to listed species resulting from benthic disturbance during the proposed surveys are discountable.

Vessel Traffic

Collision with vessels remains a source of anthropogenic mortality for sea turtles, whales and Atlantic sturgeon. The proposed project will lead to increased vessel traffic in the action area that would not exist but for the proposed action. This increase in vessel traffic will result in some increased risk of vessel strike of listed species. However, due to the limited information available regarding the incidence of ship strike and the factors contributing to ship strike events, it is difficult to determine how a particular number of vessel transits or a percentage increase in vessel traffic will translate into a number of likely ship strike events or percentage increase in collision risk. In spite of being one of the primary known sources of direct anthropogenic mortality to whales, and to a lesser degree, sea turtles, ship strikes remain relatively rare, stochastic events, and an increase in vessel traffic in the action area would not necessarily translate into an increase in ship strike events. As outlined above, several measures will be implemented to further reduce the likelihood of a project vessel interacting with a whale or sea turtle. These include mandatory adherence to any DMA associated speed restrictions, a requirement to have a dedicated lookout maintain vigilant watch for marine mammals and sea turtles during all transits.

Vessel traffic will increase during survey activities; however, the increase in vessel activity will be limited to one to three vessels. These vessels are expected to operate at speeds of no more than 5 knots during survey activities. The vessels will be required to maintain a distance of at least 500 yards (457 m) from right whales, at least 100 yards (91 m) from all other whales and at least 50 yards (46 m) from dolphins and all sea turtles. Dedicated lookouts will be posted on all vessels and will communicate with the captain to ensure that all measures to avoid whales and sea turtles are taken.

Whales

The majority of whale interactions with vessels that have been reported as lethal are with vessels greater than 260 feet (80 meters). However, whale strikes can occur with any size vessel from large tankers to small recreational boats (Jensen and Silber, 2004). Vessels associated with the proposed action are not anticipated to be greater than 80 m, therefore reducing the potential for a lethal vessel-whale interaction. Strikes have been reported for vessels traveling between 2 and 51 knots (2 and 59 miles per hour [mph]), with most lethal or severe injuries occurring when vessels are traveling 14 knots (16 mph) or more (Jensen and Silber, 2004; Laist *et al.,* 2001; Vanderlaan and Taggart, 2006). Given the size and speed that the survey vessels will operate at combined with the expected operating conditions (majority of surveys daylight only), the required separation distances and the vigilant watch of dedicated lookouts who will be able to communicate with the captain regarding the presence of whales, the potential for vessel collisions is extremely low. Therefore, effects to whales from the survey vessels are discountable. While the towed gear has the potential to result in interaction with listed species, the speed of towing (less than 5 knots) minimizes the potential for entanglement during the survey, as whales would be able to avoid the slow moving gear and survey vessel. Further, BOEM is limiting the towline length for source and hydrophone deployment. Therefore, we do not anticipate any whales will be entangled or otherwise contact the towed survey gear.

Based on the measures in place, and the intermittent travel of vessels associated with the proposed action, the potential for a vessel strike is greatly reduced. The risk of a strike is further reduced by the required separation distances and the posting of a lookout to communicate with the captain regarding the presence of whales. While vessels may travel over 10 knots while transiting between the survey area and the shore, these trips will be short and intermittent and represent an extremely small increase in vessel traffic in the action area. Vigilant watches will be maintained and all available information on whale presence will be monitored. Based on the information presented here, we have determined that the potential for survey vessel collisions with whales is extremely low. Therefore, effects to whales from these vessels are discountable.

Sea Turtles

Similar to marine mammals, sea turtles have been killed or injured due to collisions with vessels. Hatchlings and juveniles may be more susceptible to vessel interactions than adults due to their limited swimming ability. The small size and darker coloration of hatchlings also makes them difficult to spot from transiting vessels. While adults and juveniles are larger in size and may be easier to spot when at the surface than hatchlings, they often spend time below the surface of the water, which makes them difficult to spot from a moving vessel. During survey activities the survey vessel will travel at speeds between 3 and 5 knots. Hazel *et al.,* (2007) reported that green sea turtles ability to avoid an approaching vessel decreases significantly as the vessel speed increases. While transiting to and from the survey area, the survey vessel may travel at higher speeds. However, the vessel traffic associated with this activity is limited to one survey vessel. It is extremely unlikely that the addition of one vessel to the action area will increase the risk of vessel strikes. Therefore, potential for vessel collisions is discountable.

Atlantic sturgeon

The factors relevant to determining the risk to Atlantic sturgeon from vessel strikes are currently unknown, but they may be related to size and speed of the vessels, navigational clearance (*i.e.*, depth of water and draft of the vessel) in the area where the vessel is operating, and the behavior of Atlantic sturgeon in the area (e.g., foraging, migrating, etc.). It is important to note that vessel strikes have only been identified as a significant concern in the upper Delaware and James rivers and current thinking suggests that there may be unique geographic features in these areas (e.g., potentially narrow migration corridors combined with shallow/narrow river channels) that increase the risk of interactions between vessels and Atlantic sturgeon. The risk of vessel strikes between Atlantic sturgeon and vessels operating in the action area is likely to be low given that the vessels are operating in the open ocean and there are no restrictions forcing Atlantic sturgeon into close proximity with the vessel as may be present in some rivers. We also expect Atlantic sturgeon in the action area to be at or near the bottom. Given the depths in the action area, interactions between surface vessels and fish at or near the bottom are extremely unlikely. Based on these factors, effects to Atlantic sturgeon from the increase in vessel traffic are likely to be discountable.

Effects of the Action on Critical Habitat

We have considered whether the surveys would have any direct or indirect effects to right whale critical habitat. No survey activities are proposed within the Cape Cod Bay critical habitat area. Surveys may occur in the Great South Channel and Southeastern US critical habitat areas. Right whales use the Great South Channel area for foraging. North Atlantic right whales use the SEUS area as a calving ground, generally from December through March (Mate et al. 1997, Patrician et al. 2009, Keller et al. 2012). Keller et al. (2012) examined conditions, including water temperature and depth, associated with the sighting of 520 pregnant females and mother-calf pairs between 1992 and 2002. The authors report that peak sightings were in waters with temperatures of 13-15°C and depths of 10-20 meters. These results are also reported by Garrison (2007). Calving is thought to occur in these areas because calves have less blubber and are less insulated against cold temperatures and because there may be less predation, calmer wind/waves and fewer storms (Keller et al. 2012; Garrison 2007).

We have considered whether the proposed survey activities would affect the ability of right whales to use the SEUS area for calving or the GSC area for foraging. BOEM has committed to not conduct any geophysical surveys that operate within the right whale hearing range at the time of year when right whales would be present in these critical habitat areas. If surveys occur during the time of year when right whales are present in these areas, right whales will not be able to perceive the acoustic sources otherwise allowable. Therefore, there is no potential for disruption of behaviors including foraging (in Great South Channel), or nursing or other mother-calf interactions (Southeastern US). Surveys in these areas at times of year when whales are present would be limited to one slow moving vessel. The use of dedicated lookouts that will communicate with the captain to avoid right whales and required use of all available information on right whale presence (Early Warning System, Sighting Advisory System, and Mandatory Ship

Reporting System) and the slow speed of the survey vessel make it extremely unlikely that any whales will be hit by the survey vessel or that the presence of the vessel would disrupt any whales. It is possible that vibracores or grab samples may occur within critical habitat. These activities would not impact foraging right whales in the GSC. This is because the vibracore and grab samples would not result in any reduction in copepods. Copepods in the action area are present in the water column, not at the ocean bottom[2]; therefore, copepods will not be impacted by the sampling equipment which only impacts the ocean bottom. Vibracores and grab samples will not affect the suitability of habitat for calving. The characteristics that make the SEUS area suitable for calving include depth and water temperature and these characteristics will not be affected by any of the surveys that may be carried out in the area. The surveys will also not affect any of the physical or oceanographic conditions that serve to aggregate copepods in the Great South Channel. For these reasons, we have determined that the surveys proposed by BOEM will have no effect on right whale critical habitat.

Conclusions

NMFS has reviewed BOEM's proposed action and agrees that activities to be carried out as described herein are not likely to adversely affect any NMFS listed species. We have also determined that the proposed activities will have no effect on right whale critical habitat, staghorn and elkhorn corals, sei, sperm and blue whales, shortnose sturgeon, smalltooth sawfish and the GOM DPS of Atlantic salmon.

Re-initiation of consultation is required and shall be requested by BOEM or by NFMS where discretionary federal involvement or control over the action has been retained or is authorized by law and (a) if new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in the consultation; (b) if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the consultation; or, (c) if a new species is listed or critical habitat designated that may be affected by the identified action. No take is anticipated or exempted; take is defined in the ESA as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." If there is any incidental take of a listed species, reinitiation would be required. All observations of dead or injured whales, sea turtles or Atlantic sturgeon should be reported to us immediately.

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[2] Copepods occur in the water column except when diapausing (overwintering) when they occur near the bottom. This behavior does not occur in the action area because it is too shallow (less than 28m); copepods diapause in waters at least 100 m deep (see Hind et al. 2000; Baumgartner et al. 2003).

Coordination with you regarding Essential Fish Habitat (EFH) was completed with our issuance of a letter addressed to you on December 10, 2013. In this letter, we concur with your determination that impacts to EFH as a result of the proposed G&G survey work will be negligible to minor. We did not provide any additional EFH conservation recommendations. We look forward to continuing to work cooperatively with BOEM as these surveys move forward. Should you have any questions regarding this consultation, please contact Julie Crocker of my staff at (978)282-8480 or by e-mail (Julie.Crocker@Noaa.gov).

Sincerely,

for John K. Bullard
Regional Administrator

CC: Hooker, BOEM
Wikel, BOEM
Boelke - F/NER4

File Code: Sec 7 BOEM OCS Sand Survey
PCTS: NER-2013-10462

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
300 Westgate Center Drive
Hadley, MA 01035-9589

In Reply Refer To:
FWS/Region 5 /ES-TE

DEC 17 2013

Ms. Jill K. Lewandowski
Chief, Environmental Consultation Branch
Office of Environmental Programs
Bureau of Ocean Energy Management
381 Elden Street, HM3107
Herndon, Virginia 20171

Dear Ms. Lewandowski:

On November 8, 2013, we received your consultation request for the Bureau of Ocean Energy Management's (BOEM's) proposed funding of geophysical and geological surveys (G&G) along the Atlantic Coast from Florida to Maine. The proposed activities are between 3 and 8 nautical miles offshore (with a focus on New Jersey and New York) and will identify Atlantic Outer Continental Shelf (OCS) sand resources for potential use in coastal resiliency efforts, such as beach, barrier island, and coastal habitat restoration.

Your consultation package and draft Environmental Assessment (EA) addressed the effects of your preferred action alternative on the following listed species: Bermuda petrel (*Pterodroma cahow*), black-capped petrel (*Pterodroma hasitata*), roseate tern (*Sterna dougallii*), piping plover (*Charadrius melodus*), West Indian manatee (*Trichechus manatus latirostris*), Bermuda petrel (*Pterodroma cahow*), and Kirtland's warbler (*Dendroica kirtlandii*). In addition, BOEM included a discussion of the potential effects of the action on the red knot (*Calidris canutus rufa*) and the northern long-eared bat (*Myotis septentrionalis*) both have been recently proposed for listing under the Endangered Species Act (ESA) and are located within the action area.

In response to your consultation request, the U. S. Fish and Wildlife Service (Service) coordinated your consultation package with all of our affected Field Offices in the Northeast and Southeast Regions. In your concurrence request letter of November 8, 2013, BOEM has concluded that the proposed G&G survey activities would have no effect or would not be likely to adversely affect any of the federally listed species, proposed species, or critical habitats. As a part of the proposed action, BOEM has included a number of conservation measures including standard operating procedures, time-of-year restrictions, and mitigating measures to reduce the likelihood that listed species, proposed species, or designated critical habitats would be adversely affected. Based on numerous factors explained in the draft EA and summarized in the

November 8 letter, the Service concurs with the determination that the proposed action is not likely to adversely affect any of the listed or proposed species or critical habitat. We have attached some suggested modifications to the final EA for your consideration.

While this phase of the proposed G&G surveys has been determined to have insignificant and discountable impacts to these species and critical habitat, the Service encourages close coordination between the agencies and the Army Corps of Engineers (Corps) throughout the planning and formulation of any subsequent projects that ultimately utilize any of the sand resources identified through this action. Many of these shoreline restoration and resiliency projects potentially using these sand resources have the potential to have significant impacts on several of the species included in this consultation, as well as additional species that would appear on most shoreline project species lists.

To most efficiently complete any subsequent consultations, the Service recommends that, after completion of the G&G surveys, BOEM, the Corps, and the Service convene a coordination meeting to discuss development of a programmatic approach to completing subsequent consultations that will facilitate both an efficient consultation process and effective conservation of listed species.

Thank you for your close coordination in this interagency cooperation process. We look forward to working with BOEM on any future projects arising from this proposed action.

Sincerely,

Martin Miller
Chief, Division of Endangered Species
Northeast Region

Enclosure

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

DEC 10 2013

Jill Lewandowski, Chief
Environmental Consultation Branch
Bureau of Ocean Energy Management
381 Elden Street, HM 1328
Herndon, Virginia 20170-4817

Dear Ms. Lewandowski:

We have reviewed the *Proposed Geophysical and Geotechnical Activities in the Atlantic OCS to Identify Sand Resources and Borrow Areas; North Atlantic, Mid-Atlantic, and South Atlantic – Straits of Florida; Draft Environmental Assessment* (OSC EIS/EA BOEM 2013). The draft environmental assessment (DEA) contains a programmatic essential fish habitat assessment prepared by the Bureau of Ocean Energy Management (BOEM) in accordance with the requirements of Section 305 (b)(2) of the 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The EFH assessment evaluates the potential effects of the proposed geophysical and geological (G&G) surveys to be funded by BOEM to identify sand resources and potential sand borrow areas on the Outer Continental Shelf (OCS) that could be used for future beach nourishment, coastal restoration, and resiliency projects.

You are proposing to use approximately $8.3 million from the Disaster Relief Appropriations Act of 2013 (Public Law 113-2) to identify and delineate additional sand resources on the OCS. Forty-percent of the funds are required to be spent on recovery/resiliency efforts offshore New Jersey and New York, and all funding must be spent within 24 months of obligation. To determine which OCS areas contain appropriate sand resources (e.g., sediment grain size, shape, sorting size, color, sediment volume, and proximity to project sites), you plan to fund a contractor to undertake reconnaissance-level and site-specific G&G to map OCS sand resources and delineate potential sand resources for future projects.

The proposed G&G surveys will occur within the North Atlantic Planning Area, Mid-Atlantic Planning Area, and the South Atlantic-Straits of Florida Planning Areas of the OCS. This Study Area is approximately 8.5 million acres and extends from approximately 3 to 8 nautical miles (4.8 to 12.9 kilometers (km)) from the shore and to depths of about 90 feet (27.5 meters (m)). You anticipate that G&G activities would occur in a small fraction of that overall footprint, approximately 50,000 to 450,000 acres (200–1,800 km2) or less than 5 percent of the overall Study Area. It is anticipated that almost half of the G&G activities within the Study Area would be concentrated offshore New Jersey and New York.

Once beach quality sand resource areas have been identified and delineated, the sand resources could be made available to Federal agencies for future projects. However, because it is not possible to foresee which sand resources will be used and or any subsequent projects that may occur, the effects of these potential future uses are not considered in this DEA or the programmatic EFH assessment. Any future uses of identified sand resources for renourishment projects will be considered separately in a subsequent environmental review and will require additional consultations.

The programmatic EFH assessment provided with the DEA evaluates the potential effects of several alternatives including no action, the proposed G&G survey work and the survey work with additional operation restrictions and time-area closures. You have concluded that the most likely impacts to EFH and federally managed species from the proposed G&G survey work would be from noise (active sources, vessel and equipment noise including vibracoring), vessel waste and accidental discharges, and sea floor disturbance to soft bottom demersal habitats. Mitigation measures have been included in the proposed action to reduce the potential impacts.

Our Habitat Conservation Divisions from the Northeast and Southeast Region concur with your determination that impacts to EFH as a result of the proposed G&G survey work will be negligible to minor. Additional EFH conservation recommendations are not necessary. However, please note that a distinct and further EFH consultation must be reinitiated pursuant to 50 CRF 600.920 (j) if new information becomes available, or if the project is revised in such a manner that affects the basis for the above EFH determination. Our Protected Resources Divisions from the Northeast and Southeast Region are in the process of preparing a coordinated response and will be sent to you under separate cover.

We look forward to continuing coordination with you as these surveys move forward. Should you have any questions regarding this consultation or need additional information, please contact Karen Greene of my staff at (732) 872-3023 or by e-mail at karen.greene@noaa.gov.

Sincerely,

Louis A. Chiarella

Louis A. Chiarella
Assistant Regional Administrator
for Habitat Conservation

cc: M. Butterworth - BOEM
V. Fay – SERO HCD
D. Dale - SERO HCD
J. Crocker -PRD

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under US administration.

The Bureau of Ocean Energy Management Mission

The Bureau of Ocean Energy Management (BOEM) promotes energy independence, environmental protection and economic development through responsible, science-based management of offshore conventional and renewable energy resources.