Application to Request for the Harassment Authorization of Marine Mammals Incidental to Site Characterization of Lease Area OCS-A 0508

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ACRONYMS AND ABBREVIATIONS

°C	degree Celsius
Applicant	Kitty Hawk Wind, LLC
Application	Application to Request for the Taking of Marine Mammals Incidental to Site Characterization of Lease Area OCS-A 0508
BOEM	Bureau of Ocean Energy Management
dB	decibel
EA	Environmental Assessment
ECC	export cable corridor
ESA	Endangered Species Act
HF	High-frequency
HRG	high-resolution geophysical
Hz	hertz
J	joule
IHA	Incidental Harassment Authorization
IR	infrared
kHz	kilohertz
km	kilometers
km^2	square kilometers
km/hr	kilometers per hour
knot	nautical mile per hour
Lease	Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0508)
LF	Low-frequency
line-kms	Line kilometers
m	meter
MBES	multibeam echo sounder
MCS	Multi-channel sparker
MF	mid-frequency
MMPA	Marine Mammal Protection Act
NNCESS	Northern North Carolina Estuarine System Stock
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	National Oceanic and Atmospheric Administration's National Marine Fisheries Service
OCS	Outer Continental Shelf
Project	Kitty Hawk South Offshore Wind Project
PSO	Protected Species Observer
PTS	permanent threshold shift

RMS	root mean square
right whale	North Atlantic right whale
SAR	Stock Assessment Report
SEL_{cum}	cumulative sound exposure level
SMA	U.S. Seasonal Management Area
SNCESS	Southern North Carolina Estuarine System Stock
SSS	sidescan sonar
Survey Area	Kitty Hawk South Wind Development Area within the southeastern 60 percent of the Lease Area and offshore export cable corridor
TTS	temporary threshold shift
UME	Unusual Mortality Event
U.S.	United States
U.S. Navy	United States Department of the Navy
USBL	ultra-short baseline positioning system
WDA	Wind Development Area
WNAOS	Western North Atlantic Offshore Stock
WNASMCS	Western North Atlantic Southern Migratory Coastal Stock
ZOI	Zone of Influence
µPa	microPascal

1.0 DESCRIPTION OF SPECIFIED ACTIVITY

Kitty Hawk Wind, LLC (the Applicant or Kitty Hawk Wind), a wholly owned subsidiary of Avangrid Renewables, LLC, is proposing to conduct marine site characterization surveys off the coast of North Carolina as part of the Kitty Hawk South Offshore Wind Project (the Project) in the area of the Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS, OCS-A 0508) (Lease) and coastal waters where an offshore export cable corridor will be established (Figure 1). The Applicant submits this request for Incidental Harassment Authorization (IHA) pursuant to Section 101(a)(5) of the Marine Mammal Protection Act (MMPA), and 50 Code of Federal Regulations § 216 Subpart I to allow for the incidental harassment of small numbers of marine mammals resulting from the implementation of marine site characterization surveys. Specifically, surveys are associated with the operation of high-resolution geophysical (HRG) survey equipment (e.g., sidescan sonar [SSS], magnetometer, multibeam echo sounder [MBES], multi-channel sparker [MCS], and sub-bottom profiler) during upcoming field activities. Both the National Oceanic and Atmospheric Administration (NOAA) and the Bureau of Ocean Energy Management (BOEM) have advised that sound-producing survey equipment operating below 200 kilohertz (kHz) (e.g., sub-bottom profilers) has the potential to cause acoustic harassment to marine species in particular marine mammals. This request is being submitted to specifically address survey sound-producing data acquisition equipment that operates below 200 kHz.

The regulations set forth in Section 101(a) (5) of the MMPA and 50 Code of Federal Regulations § 216 Subpart I allow for the incidental taking of marine mammals by a specific activity, if the activity is found to have a negligible impact on the species or stock(s) of marine mammals and will not result in immitigable adverse impact on the availability of the marine mammal species or stock(s) for certain subsistence uses. In order for the NOAA National Marine Fisheries Service (NOAA Fisheries) to consider authorizing the taking by United States (U.S.) citizens of small numbers of marine mammals, incidental to a specified activity (other than commercial fishing), or to make a finding that incidental take is unlikely to occur, a written request must be submitted to the Assistant Administrator. Such a request is detailed in the following sections.

1.1 Survey Activities

The Applicant intends to develop 60 percent of the Lease Area in the southeast portion farthest from shore (approximately 297 square kilometers[km^2]; the Kitty Hawk South Wind Development Area [WDA]), which will be described in a forthcoming Construction and Operations Plan to be submitted to BOEM. The Applicant will conduct the 2022 HRG survey campaign in the marine environment of the Kitty Hawk South WDA and offshore export cable corridor (ECC). The Lease Area is approximately 495 km^2 and is located approximately 44 kilometers (km) offshore of Corolla, North Carolina, in federal waters of the U.S. (see Figure 1). It extends approximately 47.6 km in a general southeasterly direction and contains approximately 21.5 OCS blocks. For the purpose of this Application, the Survey Area is designated as the Kitty Hawk South WDA; (the southeastern 60 percent of the Lease Area) and the coastal waters where the offshore ECC will be established. The Company maintains the flexibility to modify the export cable route identified in Figure 1 (within the overall identified Survey Area) but has provided an initial export cable route (base case) as well as an alternative offshore export cable route for BOEM's review.

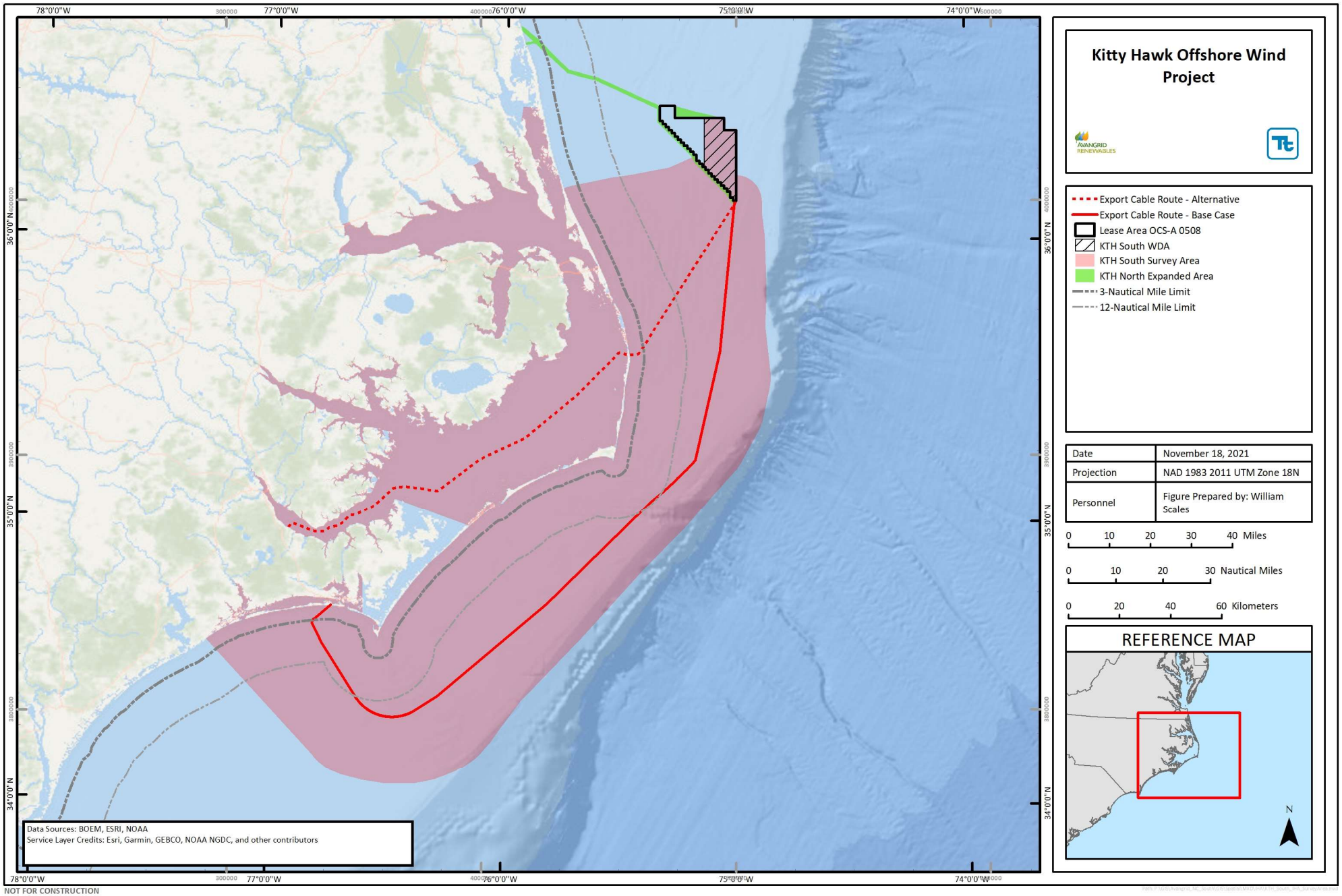

Figure 1. Survey Area

Water depths across the Survey Area range from shallow water areas (0 m) near the offshore ECC landfall to approximately 20 to 50 meters (m) in the Lease Area. The purpose of the marine site characterization survey is to:

- Provide a more detailed understanding of the seabed and sub-surface conditions;
- Support the development of the Construction and Operations Plan; and,
- Meet the BOEM data quality guidelines for the HRG, archaeological, and benthic resources surveys.

In addition to the aforementioned survey campaign, there will be a small amount of residual survey effort from the Kitty Hawk North WDA and ECC included in this survey effort due to previous incompletion as a result of unsuitable weather.

1.1.1 HRG Survey

HRG surveys under the purview of this Application are anticipated to commence no earlier than 01 Apr 2022 and finish in approximately 270 days, not including non-noise-generating days likely needed for weather down time. Note that surveys would be conducted concurrently by up to five vessels at any time, and therefore the survey days would be distributed amongst multiple vessels. The survey equipment will be equivalent to the representative survey equipment identified in Table 1. The make and model of the listed HRG equipment may vary depending on availability but will be finalized as part of the survey preparations and contract negotiations with the survey contractor. The surveys will cover approximately 57,785 line-kilometers (line kms) between the WDA, ECC, overlapping areas, and within several inshore sounds, including Bouge, Pamlico, Albemarle, and Currituck Sounds (as part of the ECC, Table 2). During the surveys, Vessel A would initially collect data using the Multi-channel sparker (MCS) within the WDA. Two MCS options are currently under consideration, as noted in Table 1. In order to maintain flexibly both will be analyzed in this application and the MCS with the largest potential harassment zone, as modeled in Section 6, will be considered for the purposes of Level B harassment take assessment. Vessel A would then demobilize the MCS and remobilize data collection within both the WDA and ECC using the Triple Plate Boomer (boomer). Vessel A would also employ other equipment including the ultra-short baseline positioning system (USBL), sidescan sonar (SSS), shallow penetration sub-bottom profiler (Innomar), and multibeam echo sounder (MBES). However, this equipment either would be expected to have a smaller disturbance zone than the MCS or boomer, have frequency ranges above 200 kHz and outside of the hearing range of marine mammals, or are otherwise exempt for the remainder of the time. Vessels B and C would perform data collection within both the WDA and ECC using the boomer. Vessels D and E would collect data in the inshore sounds using the SSS, MBES, and Innomar. The SSS and MBES have frequency ranges above 200 kHz and outside of the hearing range of marine mammals. In addition, NOAA Fisheries has previously indicated that the potential ensonified area around the Innomar is so small (<0.5 meter) as to be negligible. Thus, the 7,574 line kms and 48 days of survey effort in the inshore sounds are excluded from the take request, as outlined in this Application, as impacts are not anticipated during this portion of the survey.

Table 1. Measured Source Levels of Representative HRG Survey Equipment

HRG System	Representative HRG Survey Equipment	Operating Frequencies kilohertz (kHz)	Peak Source Level decibels dB_{peak} re 1 µPa	RMS Source Level dB_{RMS} re 1 µPa	Pulse Duration (ms)	Beam Width (degree)	Signal Type
Subsea Positioning/ ultra-short baseline positioning system (USBL) a/	Sonardyne Ranger 2 USBL	35-50	200	188	16	180	FM Chirp
Sidescan Sonar (SSS) b/	Klein 3900 Sidescan Sonar	445 / 900	226	220	0.016 to 0.100	1 to 2	Impulse
Shallow penetration sub-bottom profiler	EdgeTech 512i	0.4 to 12	186 e/	180 e/	1.8 to 65.8	51 to 80	FM Chirp
Parametric Shallow penetration sub-bottom profiler	Innomar parametric SES-2000 Medium	85 to 115	247	241 f/	0.07 to 2	1	FM Chirp
Medium penetration sub-bottom profiler c/	Applied Acoustics S-Boom 750J (Triple Plate Boomer)	0.9 to 1.4	206 g/	198 g/	0.8	30 h/	Impulse
Multi-channel Sparker (MCS) in flip/flop configuration d/	Applied Acoustics Dura-Spark 1000J	3.2	223 i/	213 i/	0.5 to 3 i/	180	Impulse
Multi-channel Sparker (MCS) in flip/flop configuration	GeoMarine Geo-Source 800J	0.05 to 5	215	206	5.5 j/	180	Impulse
Multibeam Echo Sounder (MBES) b/	Reson T20-P	200/300/400	227	221	2 to 6	1.8 ±0.2	Impulse

HRG System	Representative HRG Survey Equipment	Operating Frequencies kilohertz (kHz)	Peak Source Level decibels dB_{peak} re 1 µPa	RMS Source Level dB_{RMS} re 1 µPa	Pulse Duration (ms)	Beam Width (degree)	Signal Type

Notes:

a/ Based on previous conversations with NOAA regarding USBL operations, potential harassment from operation of this device is not anticipated.

b/ Operating frequencies are above all relevant marine mammal hearing thresholds and outside standard underwater test equipment measurement ranges.

c/ While three operational powers (500/750/1000J) were modeled for the Applied Acoustics S-Boom for comparison purposes, only the 750 joules (J) operational power is anticipated to be used and thus this Level B isopleth is presented.

d/ Although the entire MCS array would be mobilized, the sparker sources would be activated in an alternating flip/flop sequence.

e/ The source levels are based on data from Crocker and Frantantonio (2016) for the EdgeTech 512i for 75% power with a bandwidth of 0.5 to 8 kHz.

f/ The equipment specification sheets indicate a peak source level of 247 dB re 1 µPA m. The average difference between the peak and SPLRMS source levels for sub-bottom profilers measured by Crocker and Fratantonio (2016) was 6 dB. Therefore, the estimated SPLRMS sound level is 241 dB re 1 µPA m.

g/ The source levels are based on data from Crocker and Frantantonio (2016) for the Applied Acoustics S-Boom for source setting of 750J.

h/ The beamwidth was provided in email correspondence with Neil MacDonald of Modulus Technology Ltd.

i/ The source levels are based on data from Crocker and Frantantonio (2016).

j/ Federal Register Vol 84 No 191, Wednesday October 2, 2019 Notices

Table 2. Survey Segment Details

Vessel	Location and Line Kms	Predominant HRG System	Operations	Duration
Vessel A	WDA: 7,562 line km Base Case: 400 line km Alternative A (offshore): 70 line km Expanded OECC: 120 line km	Multi-channel Seismic (Sparker)	24 hours	WDA: 42 days Bae Case: 3 days Alternative ECC: <1 day Expanded OECC: <1 day
Vessel A	Alternative A (offshore): 3,107 line km	Single Channel Seismic (Boomer)	24 hours	17 days
Vessel A	Expanded OECC: 5,843 line km	Single Channel Seismic (Boomer)	24 hours	33 days
Vessel B	WDA: 17,038 line km	Single Channel Seismic (Boomer)	24 hours	80 days
Vessel C	Base Case: 16,071 line km	Single Channel Seismic (Boomer)	24 hours	96 days
Vessels D and E	Alternative A (inshore sounds): 7,574 line km	Parametric Shallow penetration sub-bottom profiler (Innomar)	12 hours	48 days

The survey activities will be supported simultaneously by five vessels, all capable of maintaining course and a survey speed of approximately 4 knots (7.4 kilometers per hour [km/hr]) while transiting survey lines. Vessels will maintain at least 2 km separation from each other at all times. Given the very limited fleet of vessels that exists to service a growing number of projects along the U.S. East Coast, the number of vessels to be used is completely dependent on vessel availability during the proposed survey period, and the need to complete the survey in a timely manner. The Applicant desires the flexibility to (1) utilize vessels available during the survey period, and (2) have the ability to include additional vessels should the need arise, or as survey vessels become available. The Applicant understands the need to evaluate vessel transits associated with the proposed survey and anticipates up to three vessels may be necessary at a time. Concurrently operating vessels would remain at least 2 km apart. Final vessel choices will vary depending on the final survey design, vessel availability, and survey contractor selection.

For ease of take estimation, these have been grouped accordingly:

- Kitty Hawk South Offshore-MCS: 4 days (Base Case and Alternative A [offshore]);
- Kitty Hawk South Offshore-Boomer: 193 days (Alternative A, WDA, and Base Case);
- Kitty Hawk South WDA-MCS: 42 days;
- Kitty Hawk North Boomer: 33 days; and
- Kitty Hawk South MCS: 1 day.

To minimize cost, the duration of survey activities, and the period of potential impact on marine species while surveying, the Applicant has proposed conducting continuous HRG survey operations 24 hours per day, except for daylight only surveys (12 hours) within the inshore sounds. Based on 24-hour operations, the estimated duration of the HRG survey activities (excluding those in inshore sounds) would be 273 days, distributed among concurrently operating vessels and not including non-noise-generating days and weather down time.

1.2 Survey Activities Resulting in the Potential Incidental Taking of Marine Mammals

The potential effects of underwater noise resulting in takes on marine mammals are federally managed by NOAA Fisheries, under the MMPA, to minimize the potential for both harm and harassment. Under the MMPA, Level A harassment is statutorily defined as any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild. However, the actionable sound pressure level is not identified in the statute. Level B harassment is defined as any act of pursuit, torment, or annoyance that has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

In July of 2016, NOAA Fisheries finalized the *Technical Guidance for Assessing the Effect of Anthropogenic Sound on Marine Mammals - Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts* (NOAA Fisheries 2016). Under this guidance, Level A harassment is said to occur as a result of exposure to high noise levels and at the onset of permanent hearing sensitivity loss, known as a permanent threshold shift (PTS). This revision to earlier NOAA Fisheries guidelines is based on findings published by the Noise Criteria Group (Southall et al. 2007). For transient and continuous sounds, it was concluded that the potential for injury is not just related to

the level of the underwater sound and the hearing bandwidth of the animal but is also influenced by the duration of exposure. The evaluation of the onset of PTS and temporary threshold shift (TTS) provides additional species-specific insight on the potential for effect that is not captured by evaluations completed using the previous NOAA Fisheries thresholds for Level A and Level B harassment alone. The June 2018 Revision (NOAA Fisheries 2018a) to its 2016 Technical Guidance largely reaffirmed these acoustic criteria.

Frequency weighting provides a sound level referenced to an animal's hearing ability, either for individual species or classes of species. Therefore, it is a measure of the potential of the sound to cause an effect. The measure that is obtained represents the perceived level of the sound for that animal. This is an important consideration, because even apparently loud underwater sound may not affect an animal if it is at frequencies outside of the animal's hearing range. In the NOAA Fisheries final Guidance document, there are five hearing groups: Low-frequency (LF) cetaceans (baleen whales), Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales), High frequency (HF) cetaceans (true porpoises, Kogia, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* and L. *australis*), Phocid pinnipeds (true seals), and Otariid pinnipeds (sea lions and fur seals). It should be noted that Otariid pinnipeds do not occur in the Survey Area.

There are specific hearing criteria thresholds provided by NOAA Fisheries for each of these groups (Table 3). These criteria apply hearing adjustment curves for each animal group known as M-weighting.

Table 3. M-Weighted PTS and TTS Acoustic Criteria and Metrics for Marine Mammals

Functional Hearing Group	PTS Onset Impulsive	PTS Onset Non Impulsive	Functional Hearing Range
LF cetaceans	219 dB peak & 183 dB SEL_{cum}	199 dB SEL_{cum}	7 Hz to 35 kHz
MF cetaceans	230 dB peak & 185 dB SEL_{cum}	198 dB SEL_{cum}	150 Hz to 160 kHz
HF cetaceans	202 dB peak & 155 dB SEL_{cum}	173 dB SEL_{cum}	275 Hz to 160 kHz
Phocid pinnipeds	218 dB peak & 185 dB SEL_{cum}	201 dB SEL_{cum}	50 Hz to 86 kHz
Otariid pinnipeds a/	232 dB peak & 203 dB SEL_{cum}	219 dB SEL_{cum}	60 Hz to 39 kHz

Notes:
Sources: NOAA Fisheries 2016, 2018a
SEL_{cum}: Cumulative sound exposure level
a/ Do not occur in the Survey Area

NOAA Fisheries has defined the threshold level for Level B harassment at 120 dB_{RMS} re 1 μPa for continuous, non-impulsive noise and 160 dB_{RMS}90% re 1 μPa for non-continuous, pulsed noise (NOAA Fisheries 2016). The sound produced by the site investigation equipment may approach or exceed ambient sound levels (i.e., level of existing noise in an area) and may approach or exceed their zone of audibility, or the level of perception for marine mammals, defined as the range at which animals may only just detect anthropogenic sound sources. However, actual perceptibility will be

dependent on a variety of factors, including the hearing thresholds of the species under consideration and the inherent masking effects of ambient sound levels.

PTS criteria thresholds were assigned as prescribed in the *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammals* (NOAA Fisheries 2016) and reaffirmed in the *2018 Revision to the Technical Guidance* (NOAA Fisheries 2018a). NOAA Fisheries' threshold level for Level B harassment remains 160 dB_{RMS}90% re 1 µPa.

2.0 DATES, DURATION, AND SPECIFIC GEOGRAPHIC REGION

2.1 Dates and Duration

HRG Surveys under the purview of this Application are anticipated to commence no earlier than 01 Apr 2022 and could take up to a year to complete when accounting for weather delays, down-time, etc. Based on 24-hour operations, the estimated duration of the HRG survey activities (excluding those in inshore sounds) will be 273 days, not including non-noise-generating days likely needed for weather down time (Table 2). Therefore, surveys would occur in all seasons (February [winter] through November [fall]). Note that HRG surveys will also utilize survey equipment that operates above 200 kHz. This is not anticipated to result in take and is thus not included in this Application.

2.2 Specific Geographic Region

The Applicant's survey activities will occur within the Kitty Hawk South WDA (approximately 297 km^2 of the approximately 495 km^2 Lease Area) and along the offshore ECC shown in Figure 1.

3.0 SPECIES AND NUMBERS OF MARINE MAMMALS

The Mid-Atlantic Environmental Assessment (EA, BOEM 2012) reports 35 species of marine mammals (whales, dolphins, porpoise, manatee, and seals) that may occur in the Northwest Atlantic OCS region that are protected by the MMPA. Six of these are listed under the Endangered Species Act (ESA) and are known to be present, at least seasonally, in the Lease Area (See Table 4). The North Carolina EA (BOEM 2015) reports 16 species of marine mammals that may occur off the North Carolina coast that are protected by the MMPA. Five of these are listed under the ESA. A description of the status and distribution of these species are discussed in detail in Section 4.0.

Table 4. Marine Mammals Known to Occur in the Marine Waters in Coastal Offshore North Carolina

Common Name	Scientific Name	MMPA and ESA Status	Estimated Population	Stock a/
Mysticetes (Baleen Whales)				
Balaenidae (Right and Bowhead Whales)				
North Atlantic Right Whale	*Eubalaena glacialis*	MMPA: Strategic ESA: Endangered	412	W. North Atlantic
Balaenopteridae (Rorquals)				
Humpback Whale	*Megaptera novaeangliae*	MMPA: Non-Strategic	1,396	Gulf of Maine
Fin Whale	*Balaenoptera physalus*	MMPA: Strategic ESA: Endangered	6,802	W. North Atlantic

Table 4. Marine Mammals Known to Occur in the Marine Waters in Coastal Offshore North Carolina (continued)

Common Name	Scientific Name	MMPA and ESA Status	Estimated Population	Stock a/
Sei Whale	*Balaenoptera borealis*	MMPA: Strategic ESA: Endangered	6,292	Nova Scotia
Minke Whale	*Balaenoptera acutorostrata*	MMPA: Non-Strategic	21,968	Canadian East Coast
Blue Whale	*Balaenoptera musculus*	MMPA: Strategic ESA: Endangered	Unknown	W. North Atlantic
Odontocetes (Toothed Whales)				
Delphinidae (Dolphins)				
Atlantic Spotted Dolphin	*Stenella frontalis*	MMPA: Non-Strategic	39,921	W. North Atlantic
Risso's Dolphin	*Grampus griseus*	MMPA: Non-Strategic	35,493	W. North Atlantic
Long-Finned Pilot Whale	*Globicephala melas*	MMPA: Non-Strategic	39,215	W. North Atlantic
Short-Finned Pilot Whale	*Globicephala macrorhynchus*	MMPA: Non-Strategic	28,924	W. North Atlantic
Fraser's Dolphin	*Lagenodelphis hosei*	MMPA: Non-Strategic	Unknown	W. North Atlantic
White-Sided Dolphin	*Lagenorhynchus acutus*	MMPA: Non-Strategic	93,233	W. North Atlantic
White-Beaked Dolphin	*Lagenorhynchus albirostris*	MMPA: Non-strategic	536,016	W. North Atlantic
Common Dolphin	*Delphinus delphis*	MMPA: Non-Strategic	172,974	W. North Atlantic
Bottlenose Dolphin	*Tursiops truncatus*	MMPA: Non-Strategic	3,751	W. North Atlantic, Southern Migratory Coastal
			62,851 b/	W. North Atlantic Offshore
			823	N. North Carolina Estuarine System
			unknown	S. North Carolina Estuarine System Stock
Clymene Dolphin	*Stenella clymene*	MMPA: Non-Strategic	4,237	W. North Atlantic
Pan-Tropical Spotted Dolphin	*Stenella attenuata*	MMPA: Non-Strategic	6,593	W. North Atlantic
Striped Dolphin	*Stenella coeruleoalba*	MMPA: Non-Strategic	67,036	W. North Atlantic
Spinner Dolphin	*Stenella longirostris*	MMPA: Non-Strategic	4,102	W. North Atlantic
Rough-Toothed Dolphin	*Steno bredanensis*	MMPA: Non-Strategic	136	W. North Atlantic

Table 4. Marine Mammals Known to Occur in the Marine Waters in Coastal Offshore North Carolina (continued)

Common Name	Scientific Name	MMPA and ESA Status	Estimated Population	Stock a/
Killer Whale	*Orcinus orca*	MMPA: Non-Strategic	Unknown	W. North Atlantic
False Killer Whale	*Pseudorca crassidens*	MMPA: Strategic	1,791	W. North Atlantic
Pygmy Killer Whale	*Feresa attenuate*	MMPA: Non-Strategic	Unknown	W. North Atlantic
Melon-Headed Whale	*Peponocephala electra*	MMPA: Non-Strategic	Unknown	W. North Atlantic
Sperm Whale	*Physeter macrocephalus*	MMPA: Strategic ESA: Endangered	4,349	North Atlantic
Dwarf Sperm Whale	*Kogia sima*	MMPA: Non-Strategic	7,750 c/	W. North Atlantic
Pygmy Sperm Whale	*Kogia breviceps*	MMPA: Non-Strategic	7,750 c/	W. North Atlantic
Phocoenidae (Porpoises)				
Harbor Porpoise	*Phocoena*	MMPA: Non-Strategic	95,543	Gulf of Main/Bay of Fundy
Ziphiidae (Beaked Whales)				
Blainville's Beaked Whale	*Mesoplodon densirostris*	MMPA: Non-Strategic	10,107 d/	W. North Atlantic
True's Beaked Whale	*Mesoplodon mirus*	MMPA: Non-Strategic	10,107 d/	W. North Atlantic
Gervais' Beaked Whale	*Mesoplodon europaeus*	MMPA: Non-Strategic	10,107 d/	W. North Atlantic
Cuvier's Beaked Whale	*Ziphius cavirostris*	MMPA: Non-Strategic	5,744	W. North Atlantic
Sowerby's Beaked Whale	*Mesoplodon bidens*	MMPA: Non-Strategic	10,107 d/	W. North Atlantic
Pinnipeds (Eared and Earless Seals)				
Phocidae (Earless Seals)				
Harbor Seal	*Phoca vitulina*	MMPA: Non-Strategic	75,834	W. North Atlantic
Gray Seal	*Halichoerus grypus*	MMPA: Non-Strategic	27,131	W. North Atlantic
Harp Seal	*Pagophilus groenlandicus*	MMPA: Non-Strategic	Unknown	W. North Atlantic
Hooded Seal	*Cystophora cristata*	MMPA: Non-Strategic	Unknown	W. North Atlantic

Table 4. Marine Mammals Known to Occur in the Marine Waters in Coastal Offshore North Carolina (continued)

Common Name	Scientific Name	MMPA and ESA Status	Estimated Population	Stock a/
Sirenia (Sea Cows)				
Trichechidae (Manatees)				
West Indian Manatee	*Trichechus manatus*	MMPA: Strategic ESA: Threatened	Unknown	Florida

Notes:
a/ A strategic stock is defined as any marine mammal stock: 1) for which the level of direct human-caused mortality exceeds the potential biological removal level; 2) which is declining and likely to be listed as threatened under the ESA; or 3) which is listed as threatened or endangered under the ESA or as depleted under the MMPA (NOAA Fisheries 2021).
b/ Estimates may include sightings of the coastal form.
c/ This estimate includes both the dwarf and pygmy sperm whales.
d/ This estimate includes Gervais' beaked whales and Blainville's beaked whales for the Gulf of Mexico stocks and all species of Mesoplodon in the Atlantic.
Sources: Hayes et al. 2021; Pace et al. 2017.

4.0 AFFECTED SPECIES STATUS AND DISTRIBUTION

As described in Section 3.0, there are up to 35 marine mammal species (whales, dolphins, porpoise, manatee, and seals) that are known to be present (some year-round, and some seasonally or incidentally) in the Mid-Atlantic OCS region. NOAA Fisheries uses Marine Species Density Data Gap Assessments, developed by Roberts et al. (2018, 2020), which built upon models originally developed by the U.S. Department of the Navy (U.S. Navy), to estimate marine mammal abundance (U.S. Navy 2007). The current estimates provided by Roberts et al. (2018, 2020) are supplemented by data derived from several sources and independent studies and are used where feasible to update the species Stock Assessment Reports (SAR, Hayes et al. 2021). The Roberts et al. (2018, 2020) data suggests that marine mammal density in the Mid-Atlantic region is patchy and seasonally variable. Currently, there are a number of Unusual Mortality Events (UMEs) that NOAA Fisheries has evaluated and declared (NOAA Fisheries 2021). Under the MMPA, a UME is defined as "a stranding that is unexpected; involves a significant die-off of any marine mammal population; and demands immediate response." Current UMEs include several of the species found in North Carolina (minke whale, North Atlantic right whale [right whale], humpback whale, bottlenose dolphin [nonactive, closure pending], manatee, and harbor or gray seals [nonactive, closure pending]). Of these, the most relevant for this Project are UMEs affecting the minke whale, right whale, and humpback whale. While bottlenose dolphins are abundant in the Survey Area, the UME area of effect does not currently overlap.

All 35 marine mammal species identified in Table 4 are protected by the MMPA and some are also listed under the ESA. The six ESA-listed marine mammal species known to be present year-round or seasonally in the waters of the Mid-Atlantic are the sperm whale, right whale, fin whale, blue whale, sei whale, and the West Indian manatee. The humpback whale stock that inhabits the Mid-Atlantic region, and which may occur year-round, was recently delisted as an endangered species. Generally, many of these species are migratory, and as such were historically thought to be present seasonally. However, they increasingly will be seen foraging throughout the summer and fall months and in the winter during their migrations to warmer waters. Additionally, some individuals from the larger

whale species (including right whales) are known to remain year-round (Salisbury et al. 2018). Dolphins, especially bottlenose, are known to be residents in estuarine regions (Gubbins 2002).

The offshore waters of North Carolina, including the Survey Area, are primarily used as a migration corridor for these species, particularly by right whales, during seasonal movements north or south between important feeding and breeding grounds (Firestone et al. 2008; Knowlton et al. 2002). As of 26 Jan 2016, NOAA Fisheries expanded the North Atlantic Right Whale Critical Habitat Southeastern U.S. Calving Area from Cape Fear, North Carolina, southward to 29°N latitude (approximately 69 km north of Cape Canaveral, Florida). However, this expanded area is well south of the proposed Survey Area. While the fin, humpback, sei, and right whales have the potential to occur within the Survey Area, the sperm and blue whales are more pelagic and/or northern species, and their presence within the Survey Area is unlikely (Hayes et al. 2021). Aerial and vessel surveys conducted in waters off Norfolk Canyon in Virginia observed sperm, blue, and sei whales in April 2018 along the edge of the continental shelf, as well as right, fin, and humpback whales closer inshore (Cotter 2019). A juvenile blue whale sighting from a survey vessel was the first photographic record of this species in the nearshore area (U.S. Navy Marine Species Monitoring 2018a). It may be that prey availability, changing habitat from climate change, or other factors that are adjusting known distributions are refining previous findings.

While the North Carolina EA (BOEM 2015) indicates that Bryde's whale may be present during fall and winter, the majority of sightings of this species have occurred within the northeastern Gulf of Mexico (Waring et al. 2016). It is possible that the rare Bryde's whale sightings off southeastern U.S. states are strays from the Gulf of Mexico, and their presence in the Survey Area is unlikely during the summer and fall (BOEM 2015). The West Indian manatee has been sighted in North Carolina waters. However, such events are infrequent. Because the potential for the sperm whale, blue whale, Bryde's whale, and West Indian manatee to occur within the Survey Area is unlikely, these species will not be described further in this analysis. In addition, Atlantic white-sided dolphins are most common in shelf waters from the Hudson Canyon north to Georges Bank, the Gulf of Maine, and waters of the Gulf of St. Lawrence (Hayes et al. 2021). Therefore, any presence of Atlantic white-sided dolphins in the Survey Area would be so rare as to be discounted, and they are not further addressed in this analysis.

Historical strandings data for harbor and gray seals along the Mid-Atlantic Coast south of New Jersey previously indicated their preference for colder, northern waters. Based on historical data, their presence in the Survey Area was considered unlikely during the summer and fall (Hayes et al. 2021). Winter haul-out sites for harbor seals have been identified within the Chesapeake Bay region and Outer Banks beaches, however the seals are only occasionally sited as far south as the Carolinas and (Hayes et al. 2021). More recent tagging and acoustic surveys in Virginia nearshore waters spanning two years of study are providing updated baseline data, which indicate that seals utilize the area more than previously thought. There is now regular seasonal occurrence of seals, including harbor and gray, between fall and spring (U.S. Navy Marine Species Monitoring 2018b; Jones and Dees 2020). Harbor seals are the predominantly observed seal species.

Until recently, coastal Virginia was thought to represent the southern extent of the habitat range for gray seals, with few stranding records reported for Virginia and sightings occurring only during winter months as far south as New Jersey (Waring et al. 2016). Similar to shifts in cetacean

occurrence, prey availability or changing habitat from climate change or other factors could be driving changes in distribution of seals. More focused survey effort for seals, such as the one presented in Jones and Dees (2020), are anticipated and may help refine and update previous findings. Because harp and hooded seals are not anticipated to occur in the Survey Area, these species will not be described further in this analysis. Gray and harbor seal distribution and status will not be further described.

The following subsections provide additional information on the biology, habitat use, abundance, distribution, and the existing threats to the ESA-listed and MMPA-listed marine mammals that are both common in North Carolina waters and have the likelihood of occurring, at least seasonally, in the Survey Area. These species include the right whale, humpback whale, fin whale, sei whale, minke whale, long-finned pilot whale, short-finned pilot whale, Atlantic spotted dolphin, Risso's dolphin, short-beaked common dolphin, bottlenose dolphin, and the harbor porpoise. In general, the range of the remaining non-ESA listed cetacean species listed in Table 4 is outside the Survey Area. These species are usually found in more pelagic shelf-break waters, have a preference for northern latitudes, or are so rarely sighted that their presence in the Survey Area is unlikely. Because the potential presence of these species in the Survey Area is considered extremely low, they are not further addressed in this analysis.

4.1 Baleen Whales (Mysticetes)

4.1.1 North Atlantic Right Whale (*Eubalaena glacialis*) – Endangered

The North Atlantic right whale (right whale) is considered one of the most critically endangered populations of large whales in the world and has been listed as a federal endangered species since 1970. The Western Atlantic stock is considered depleted under the MMPA (Hayes et al. 2021). There is a recovery plan (NOAA Fisheries 2017) for the right whale and recently there was a five-year review of the species (NOAA Fisheries 2017). The right whale had a 2.8 percent recovery rate between 1990 and 2011 (Hayes et al. 2021). This is a drastic difference from the stock found in the Southern Hemisphere, which has increased at a rate of seven to eight percent (Knowlton and Kraus 2001).

Right whales are generally black (although some individuals have white patches on their undersides), lack a dorsal fin and have a stocky build, a large head (about one quarter of the body length), strongly bowed margin of the lower lip, and callosities on the head region. The tail is broad, deeply notched, and all black with smooth trailing edge (Jefferson et al. 2015). Right whales are considered grazers, meaning they swim slowly with their mouths open. They are the slowest swimming whales and can only reach speeds up to 8.6 knots (16 km/hr). They can dive at least 300 m and stay submerged for typically 10 to 15 minutes, feeding on their prey below the surface (Jefferson et al. 2015). The species primarily preys on the copepod *Calanus finmarchicus*, along with other zooplankton, including *Centropages*, *Pseudocalanus*, and cyprids (Mayo and Marx 1990). Right whale hearing is in the LF range (Southall et al. 2007; NOAA Fisheries 2018b).

The right whale is a migratory large whale species that moves annually between high latitude feeding grounds and low latitude calving and breeding grounds, though recent studies indicate not all of the population undertakes seasonal migration (Davis et al. 2017) and recent data suggest that distributions and habitat use might be shifting (Pettis et al. 2021). Right whales are nonetheless

known to have extensive movements both within and between their winter and summer habitats. The present range of the western North Atlantic right whale population extends from the southeastern U.S., which is utilized for wintering and calving, to summer feeding and nursery grounds between New England, the Bay of Fundy, and more recently the Gulf of St. Lawrence (Kenney 2002; Hayes et al. 2021). Right whales may be found in feeding grounds within New England waters between February and May, with peak abundance in late March (Hayes et al. 2021). The winter distribution of right whales is largely unknown, although offshore surveys have reported detections annually in northeastern Florida and southeastern Georgia (Hayes et al. 2021), and there was a winter sighting in Jordan Basin in the Gulf of Maine which is speculated to be a potential winter mating ground (Carpenter 2011). Their calving grounds are thought to extend from Florida to as far north as Cape Fear, North Carolina (Hayes et al. 2021). A few events of right whale calving have been documented from shallow coastal areas and bays (Kenney 2002).

The offshore waters of North Carolina, including waters of the Survey Area, are used as part of the migration corridor for right whales. Right whales occur here during seasonal movements north or south between their feeding and breeding grounds (Firestone et al. 2008; Knowlton et al. 2002). Right whales have been observed in or near North Carolina waters from October through December, as well as in February and March, which coincides with the migratory timeframe for this species (Knowlton et al. 2002). They have been acoustically detected off Georgia and North Carolina in seven of eleven months monitored (Hodge et al. 2015) and other recent passive acoustic studies of right whales off the Virginia coast demonstrate their year-round presence in Virginia (Salisbury et al. 2018), with increased detections in fall and late winter/early spring. They are typically most common in the spring (late March) when they are migrating north and, in the fall (i.e., October and November) during their southbound migration (NOAA Fisheries 2017). There were sightings of up to eight right whales on two separate days in coastal Virginia in April of 2018 (09 and 11 Apr 2018; Cotter 2019). Currently, there are no marine mammal sanctuaries in the waters off Virginia and North Carolina pertaining to critical habitat for right whales (NOAA Fisheries 2017; Hayes et al. 2021). As of 26 Jan 2016, NOAA Fisheries expanded the North Atlantic Right Whale Critical Habitat Southeastern U.S. Calving Area from Cape Fear, North Carolina, southward to 29°N latitude (approximately 69 km north of Cape Canaveral, Florida; Hayes et al. 2021). Based on the current knowledge of right whale occurrences and the establishment of Seasonal Management Areas (SMA) around approaches to the Chesapeake Bay, Morehead City, and Wilmington, right whales have the potential to occur in the Survey Area, particularly during peak migration times, and overall likelihood of occurrence in the Survey Area is rated as high.

Some evidence provided through acoustic monitoring suggests that not all individuals of the population participate in annual migrations, with a continuous presence of right whales occupying their entire habitat range throughout the year, particularly north of Cape Hatteras (Davis et al. 2017). These data also recognize changes in population distribution throughout the right whale habitat range that could be due to environmental or anthropogenic effects, a response to short-term changes in the environment, or a longer-term shift in the right whale distribution cycle (Davis et al. 2017).

The best population estimate for right whales is 412 (Hayes et al. 2021). However, the Pace Methodology for determining the right whale population places the population for the end of 2019 at 365 whales (Pettis et al. 2021). The right whale was the first species targeted during commercial whaling operations and was the first species to be greatly depleted as a result of whaling operations

(Kenney 2009). Right whales were hunted until the early twentieth century. Abundance estimates for the right whale population vary. From the 2003 U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments, there were only 291 right whales in existence, which is less than what was reported in the Northern Right Whale Recovery Plan written in 1991 (NOAA Fisheries 2017; Waring et al. 2004). This is a tremendous difference from pre-exploitation numbers, which are thought to be more than 1,000 individuals in the 1600s (Hayes et al. 2021).

When the right whale was finally protected in the 1930s, it is believed that the right whale population was roughly 100 individuals (Waring et al. 2004). In 2015, the western North Atlantic population size was estimated to be at least 476 individuals (Waring et al. 2016). That population size estimate decreased to 451 individuals in 2018 (Hayes et al. 2020). Additional information provided by Pace et al. (2017) confirms that the probability that the right whale population has declined since 2010 is 99.99 percent. Data indicates that the number of adult females dropped from 200 in 2010 down to 186 in 2015, while the number of males dropped from 283 to 272 in the same timeframe.

Also cause for concern is the confirmed mortality of numerous individuals. In June 2017, NOAA Fisheries established a UME for right whales, which is still ongoing (NOAA Fisheries 2021). This UME for right whale strandings was declared in 2017 based on a high number of dead whales discovered in Canadian and U.S. waters, and is still considered active, with the current total whale strandings at 34 (NOAA Fisheries 2021). Contemporary anthropogenic threats to right whale populations, including fishery entanglements and vessel strikes, habitat loss, pollution, anthropogenic noise, and intensive commercial fishing, may also negatively impact their populations (Hayes et al. 2021; Kenney 2009).

Ship strikes of individuals can impact right whales on a population level due to the intrinsically small remnant population that persists in the North Atlantic (Laist et al. 2001). For the period of 2014 through 2018, the minimum rate of annual human-caused mortality and serious injury to right whales averaged 8.15 per year (Hayes et al. 2021). Records from 2014 through 2018 indicate there have been 43 confirmed injury events, including 18 mortalities (Hayes et al. 2021). From 2014 through 2018, the minimum rate of annual human-caused mortality and serious injury to this species from fishing entanglements averaged 6.85 per year, while ship strikes averaged 1.3 whales per year (Hayes et al. 2021). From 2012 through 2016, this rate decreased slightly to an average 5.56 per year, while ship strikes also decreased to an average 0.41 right whales per year (Hayes et al. 2021). However, a recent study noted that observed mortalities only accounted for 36 percent of estimated right whale mortalities (Pace et al. 2012). The study also noted that death determinations were not necessarily representative given that a large number of seriously injured whales from entanglement accounted for the unobserved mortality, with only 49 percent of necropsy deaths attributed to entanglement-related injuries whereas the fraction of entangle-related cryptic deaths was estimated at 87 percent (Pace et al. 2021).

Environmental fluctuations and anthropogenic disturbance may be contributing to a decline in overall health of individual right whales that has been occurring for the last three decades (Rolland et al. 2016). The most recent NOAA Fisheries marine mammal SAR states that the low annual reproductive rate of right whales, coupled with small population size, suggests anthropogenic mortality may have a greater impact on population growth rates for the species than for other whales, and that any single mortality or serious injury can be considered significant (Hayes et al. 2021).

Most ship strikes are fatal to the right whales (Jensen and Silber 2004). Right whales have difficulty maneuvering around boats and spend most of their time at the surface, feeding, resting, mating, and nursing, increasing their vulnerability to collisions (NOAA Fisheries 2020b). Mariners should assume that right whales will not move out of their way, as studies have indicated a lack of right whale response to vessels, possibly due to habitation, nor will they be easy to detect from the bow of a ship, for they are dark in color and maintain a low profile while swimming (NOAA Fisheries 2020b). Mid-Atlantic Bight as the Mid-Atlantic U.S. SMA for right whales in December 2008. NOAA Fisheries requires that all vessels 19.8 m or longer must travel at 10 knots (18.5 km/hr) or less within the right whale SMA from 01 Nov through 30 Apr, when right whales are most likely to pass through these waters (NOAA Fisheries 2018b). Studies by van der Hoop et al. (2015) have concluded that large whale vessel strike mortalities have decreased inside active SMAs but have increased outside inactive SMAs, even with the implementation of Dynamic Management Areas for right whales observed outside of an SMA. The proposed Survey Area has components located both within and outside of the right whale Chesapeake Bay SMA, located in the waters off the southern Virginia coast (marking the mouth of the Chesapeake Bay). Other SMAs in the region, but not within the proposed Survey Area, include the Delaware Bay SMA, Morehead City SMA and the North Carolina-Georgia Coast SMA.

4.1.2 Humpback Whale (*Megaptera novaeangliae*) – Non-Endangered / Non-Strategic for West Indies Distinct Population Segment

The humpback whale was listed as endangered in 1970 due to population decrease resulting from overharvesting (NOAA Fisheries 1991). A final recovery plan for the humpback whale was published in 1991 (NOAA Fisheries 1991). In September 2016, NOAA Fisheries revised the listing and identified 14 distinct population segments for humpback whales (81 Federal Register 62259). The Gulf of Maine stock is part of the West Indies distinct population segment, which is not ESA listed and is considered non-strategic under the MMPA (Bettridge et al. 2015; Hayes et al 2021); this stock is the one most likely to be found within the Survey Area.

North Atlantic humpback whale body coloration is primarily dark gray, but individuals can have variable amounts of white on their pectoral fins, flukes, and bellies. Their tail variation is so distinctive that the pigmentation patterns on the undersides of their flukes are used to identify individual whales (Katona and Whitehead 1981). Humpback whales feed on small prey that is often found in large concentrations, including krill and fish (e.g., herring and sand lance) (Bettridge et al. 2015). Humpback whales are thought to feed mainly while migrating and in summer feeding areas; little feeding is known to occur in their wintering grounds. Humpbacks consume roughly 95 percent small schooling fish and five percent zooplankton (i.e., krill), and they will migrate throughout their summer habitat to locate prey (Kenney and Winn 1986). They swim below the thermocline to pursue their prey, so even though the surface temperatures might be warm, they are frequently swimming in cold water (NOAA Fisheries 1991). Humpback whale hearing is in the LF range (NOAA Fisheries 2018a; Southall et al. 2007).

Humpback whales can occur within the Mid-Atlantic region during all seasons of the year (Hayes et al. 2019). They exhibit consistent fidelity to feeding areas within the northern hemisphere (Stevick et al. 2006). There are six subpopulations of humpback whales that feed in six different areas during spring, summer, and fall. These feeding populations can be found in the Gulf of Maine, the Gulf of St. Lawrence, Newfoundland/Labrador, western Greenland, Iceland, and Norway (Bettridge et al. 2015; Hayes et al. 2020). During winter, humpback whales migrate to mate and calve primarily in the West

Indies (including the Antilles, the Dominican Republic, the Virgin Islands, and Puerto Rico), calving the following year between January and March (NOAA Fisheries 1991; Blaylock et al. 1995, Bettridge et al. 2015; Hayes et al. 2020). While migrating, humpback whales utilize the Mid-Atlantic as a migration pathway between calving/mating grounds to the south and feeding grounds in the north (Hayes et al. 2020). Not all humpback whales migrate to the Caribbean during winter, and some individuals of this species, namely juveniles, are sighted in mid- to high-latitude areas during the winter (Swingle et al. 1993). The Mid-Atlantic area may also serve as important habitat for juvenile humpback whales, as evidenced by increased levels of juvenile strandings along the North Carolina coast (Wiley and Asmutis 1995).

The humpback whale population within the North Atlantic has been estimated to include approximately 11,570 individuals (Waring et al. 2016). According to the species SAR, the best estimate of abundance for the Gulf of Maine stock of humpback whales is 1,396 individuals (Hayes et al. 2021). Before whaling activities took place, it was thought that the abundance of whales in the North Atlantic stock was in excess of 15,000 (Nowak 2002). By 1932, commercial hunting within the North Atlantic may have reduced the humpback whale population to as little as 700 individuals (Breiwick et al. 1983). Humpback whales were commercially exploited by whalers throughout their whole range until they were protected in the North Atlantic in 1955 by the International Whaling Commission ban. Humpback whaling ended worldwide in 1966 (NatureServe 2020). Some whaling of humpback whales continued after the international ban in Greenland, Iceland, and a few Caribbean islands. However, Iceland and the Caribbean islands have suspended these activities, likely permanently. Contemporary threats to humpback whales include harmful algal (red tide) blooms, fishery entanglements, and vessel strikes. These stressors could moderately reduce the population size or growth rate of the West Indies distinct population segment (Bettridge et al. 2015). Humpback whales that were entangled exhibited the highest number of serious injury events of the six species of large whale studied by Glass et al. (2008). Historically, between 2002 and 2006, humpback whales belonging to the Gulf of Maine stock were involved in 77 confirmed entanglements with fishery equipment and nine confirmed ship strikes (Glass et al. 2008) with recent trends indicating higher numbers of both impacts. Nelson et al. (2007) reported that the minimum annual rate of anthropogenic mortality and serious injury to humpback whales occupying the Gulf of Maine was 4.2 individuals per year. Henry et al. (2020) found the average annual rate of humpback whale serious injury and mortality increased 16 percent from the 2011-2015 period (from a rate of 8.25 to 9.8). During 2012-2016, there were 119 confirmed injury events and 84 mortality events (Hayes et al. 2020, Henry et al. 2020). Thirty-three of the injury events and eight of the mortalities were caused by entanglement. Additionally, three injury events and 11 mortality events were attributed to vessel strikes (Henry et al. 2020). For the period 2013 through 2017, the minimum annual rate of human-caused mortality and serious injury to the Gulf of Maine humpback whale stock averaged 12.15 animals per year, including incidental fishery interaction records totaling 7.75 and records of vessel collisions totaling 4.4 (Hayes et al. 2020).

Between July and September 2003, a UME of 16 humpback whales was documented in the offshore waters of coastal New England and the Gulf of Maine. Biotoxin analyses of samples taken from some of these whales found saxitoxin at very low/questionable levels and domoic acid at low levels. However, neither were adequately documented, and therefore, no definitive conclusions could be drawn (Hayes et al. 2019). There was another UME in 2005, with seven humpback whales reported in New England waters and another in 2006 with 21 dead humpback whales found between 10 Jul

and 31 Dec (Hayes et al. 2019). The causes of these UMEs are unknown. Additionally, in January 2016, a humpback whale UME was declared for the U.S. Atlantic Coast that is currently ongoing due to elevated numbers of mortalities (a total of 151 strandings since 2016). The causes of these UME events have not been determined (Hayes et al. 2020; NOAA Fisheries 2021).

4.1.3 Fin Whale (*Balaenoptera physalus*) – Endangered

The fin whale is listed as endangered due to the depletion of its population from whaling (NOAA Fisheries 2010), and the western North Atlantic stock is designated as depleted under the MMPA (Hayes et al. 2021). The current recovery plan for the fin whale was published in 2010 (NOAA Fisheries 2010). A recent five-year review of the current recovery plan recommended revising the listing from endangered to threatened due to an overall increasing world population (NOAA Fisheries 2019).

The fin whale has a sleek, streamlined body with a V-shaped head. Fin whales have distinctive coloration: black or dark brownish gray on the back and sides, and white on the underside (NOAA Fisheries 2010). Head coloring is asymmetrical: dark on the left side of the lower jaw, white on the right-side of the lower jaw. Many fin whales have several light-gray, V-shaped chevrons behind their heads, and the underside of the tail flukes is often white with a gray border. These markings are unique and can be used to identify individuals (NOAA Fisheries 2010). They feed on krill and small schooling fish during the summer and fast during the winter. Fin whales are the second-largest living whale species on the planet and are found worldwide in all temperate and polar oceans (NOAA Fisheries 2019). Fin whale hearing is in the LF range (NOAA Fisheries 2018a; Southall et al. 2007).

Fin whales' range in the North Atlantic extends from the Gulf of Mexico, Caribbean Sea, and Mediterranean Sea in the south to Greenland, Iceland, and Norway in the north (Archer et al. 2019; Jonsgård 1966). They are the most commonly sighted large whales found in continental shelf waters from the Mid-Atlantic Coast of the U.S. to Nova Scotia, principally from Cape Hatteras and northward (NOAA Fisheries 2019; Hain et al. 1992; CETAP 1982). Fin whales are present in the Mid-Atlantic region during all four seasons, although sighting data indicates that they are more prevalent during winter, spring, and summer (Hayes et al. 2021). While fall is the season of lowest overall abundance of fin whales off North Carolina, they do not depart the area entirely. Fin whales, much like humpback whales, seem to exhibit habitat fidelity (Hayes et al. 2021; NOAA Fisheries 2019). While fin whales typically feed in the Gulf of Maine and the waters surrounding New England, their mating, calving, and general wintering areas are largely unknown (Hayes et al. 2021). The overall pattern of fin whale movement is complex, consisting of a less obvious north-south pattern of migration than that of right and humpback whales. Based on acoustic recordings from hydrophone arrays, Clark (1995) reported a general southward flow pattern of fin whales in the fall from the Labrador/Newfoundland region, past Bermuda, and into the West Indies.

The best abundance estimate available for the western North Atlantic fin whale stock is 6,802 (Hayes et al. 2021). There are insufficient data to determine the population trend for fin whales; however, a decline in fin whale abundance has been noted within the northern Gulf of St. Lawrence (Hayes et al. 2021). Present threats to fin whales are similar to other whale species, namely fishery entanglements and vessel strikes. Some whaling of fin whales continued after the international ban in Greenland, Iceland, and a few Caribbean islands; however, Iceland and the Caribbean islands have suspended these activities, likely permanently. There are no confirmed fishery-related mortalities or serious

injuries of fin whales reported in the NOAA Fisheries Sea Sampling bycatch database (Hayes et al. 2021). Fin whales seem less likely to become entangled than other whale species. Glass et al. (2008) reported that between 2002 and 2006, fin whales belonging to the Gulf of Maine population were involved in only eight confirmed entanglements with fishery equipment. Furthermore, Nelson et al. (2007) reported that fin whales exhibited a low proportion of entanglements (eight reported events) during their 2001 to 2005 study along the western Atlantic. Conversely, vessel strikes may be a more serious threat to fin whales. Past records on mortality reported by NOAA Fisheries data indicate that four fin whales were confirmed killed by collision from 2014 through 2018 (Hayes et al. 2021). A review of recent NOAA Fisheries records for 2014 through 2018 found four incidents that had sufficient information to confirm the cause of death as collisions with vessels and an additional nine reported observation of fin whales entangled with fishing gear in the U.S. and Canada North Atlantic waters (Hayes et al. 2021). From 2010 to 2014, the minimum annual rate of mortality for the North Atlantic stock from anthropogenic causes was approximately 3.8 per year (Hayes et al. 2017), while from 2014 through 2018, this number decreased to 2.35 per year (Hayes et al. 2021). This number includes incidental fishery interaction records averaging 1.55 individuals (U.S. and Canada), and records of vessel collisions averaging 0.8 whales (all U.S.) (Hayes et al. 2021).

4.1.4 Sei Whale (*Balaenoptera Borealis*) – Endangered

The sei whale is listed as endangered under the ESA and is designated as depleted under the MMPA (Hayes et al. 2021). The current recovery plan for the sei whale was published in 2011 (NOAA Fisheries 2011). A five-year review of the species was completed in 2012 (NOAA Fisheries 2012) with no change in status. Another five-year review was initiated in 2018 (publication pending).

Sei whales are gray. Their skin is often marked by pits or wounds likely caused by ectoparasitic copepods; after healing, the wounds become ovoid white scars. The sei whale can be distinguished from all the other species, except for smaller minke whales, by the relative shortness of its ventral grooves. These extend back only to a point about midway between the flippers and the umbilicus (Jefferson et al. 2015). This characteristic is not possible to sight from a vessel; thus, the most useful way to identify a sei whale from a fin whale is the single rostrum ridge. The dorsal fin is usually prominent, curves backward (falcate) and is set about two-thirds of the way back from the tip of the snout. Unlike fin whales, sei whales tend not to roll high out of the water as they dive. Sei whale blowholes and dorsal fins are often exposed above the water surface simultaneously. Although sei whales may prey upon small schooling fish and squid, available information suggests that calanoid copepods and euphausiids are the primary prey of this species (Flinn et al. 2002). However, there are insufficient data pertaining to the diet and foraging of sei whales in the waters off Virginia (Costidis et al. 2017). Sei whales are occasionally seen feeding in association with right whales in the southern Gulf of Maine and in the Bay of Fundy. However, there is no evidence to demonstrate interspecies competition between these species for food resources. Sei whales reach sexual maturity at 5 to 15 years of age. The calving interval is believed to be two to three years (Perry et al. 1999). Sei whale hearing is in the LF range (NOAA Fisheries 2018a; Southall et al. 2007).

The sei whale is a widespread species, inhabiting the world's temperate, subpolar, subtropical, and tropical marine waters. Based on telemetry, genetic, and historical studies, there is often conflicting information about the stock identity of sei whales in the North Atlantic (Hayes et al. 2021). NOAA Fisheries considers sei whales along the continental shelf waters of the northeastern U.S. extending north-eastward to south of Newfoundland as the "Nova Scotia stock" sei whales (Hayes et al. 2021).

Sei whales occur in the deep-water characteristic of the continental shelf edge throughout their range (Hayes et al. 2021; Hain et al. 1985). In the Northwest Atlantic, it is speculated that the whales migrate from south of Cape Cod along the eastern Canadian coast in June and July and return on a southward migration again in September and October (Waring et al. 2014, 2016). The sei whale is most commonly sighted on Georges Bank and into the Gulf of Maine/Bay of Fundy region during spring and summer, primarily in deeper waters. In the waters off North Carolina, sei whales are rarely sighted. However, a 2018 aerial survey conducted by the U.S. Navy recorded sei whales in the area surrounding Norfolk Canyon (U.S. Navy, n.d.).

The best abundance estimate for the Nova Scotia stock of sei whales is 6,292, generated from spatially and temporally explicit density models derived from recent (2010 to 2013) spring survey data (Hayes et al. 2021). There are insufficient data to determine trends of the Nova Scotian sei whale population. From 2007 to 2011, the minimum annual rate of confirmed human-caused serious injury and mortality to Nova Scotian sei whales was 1.0 (Waring et al. 2014). From 2009 to 2013, this mortality rate was estimated to be 0.4 (Waring et al. 2016). From 2010 through 2014, the minimum annual rate of human-caused mortality and serious injury was 0.8 (Hayes et al. 2017). For the period 2014 through 2018, the minimum annual rate of human-caused mortality and serious injury to sei whales was 1.20. This value includes incidental fishery interaction records occurring at 0.4 annually, and records of vessel collisions occurring at 0.8 annually (Hayes et al. 2021). No confirmed fishery-related mortalities or serious injuries of sei whales have been reported in the NOAA Fisheries Sea Sampling bycatch database (Hayes et al. 2021). There are no UMEs for this species.

4.1.5 Minke Whale (*Balaenoptera acutorostrata*) – Non-Strategic

Minke whales are not ESA listed and are considered non-strategic under the MMPA by NOAA Fisheries because the average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species (Hayes et al. 2021).

Common minke whales range between 6 and 9 m in length with maximum lengths of 9 to 10 m, and are the smallest of the North Atlantic baleen whales (Jefferson et al. 2015). Minke whales have fairly tall, sickle-shaped dorsal fins located about two-thirds down their backs. The body is black to dark grayish/brownish with a white underside and a pale chevron on the back behind the head and above the flippers. As is typical of baleen whales, minke whales are usually seen either alone or in small groups, although large aggregations sometimes occur in feeding areas (Risch et al. 2019; Reeves et al. 2002). Minke populations are often segregated by sex, age, or reproductive condition. They feed on schooling fish (e.g., herring, sand eel, capelin, cod, pollock, and mackerel), invertebrates (squid and copepods), and euphausiids (Risch et al. 2019). Minke whales feed below the surface of the water, and calves are usually not seen in adult feeding areas. Minke whale hearing is in the LF range (NOAA Fisheries 2018a; Southall et al. 2007).

Minke whales are among the most widely distributed of all the baleen whales. For the common minke whale, three subspecies have been proposed: *Balaenoptera acutorostrata* in the North Atlantic, *Balaenoptera acutorostrata scammoni* in the North Pacific, and the dwarf minke whale, an unnamed subspecies, in the Southern hemisphere (Risch et al. 2019). They occur in the North Atlantic and North Pacific, from tropical to polar waters. Generally, they inhabit warmer waters during the winter and travel north to colder regions in the summer. Some minke whales migrate as far as the ice edge.

They are frequently observed in coastal or shelf waters. Minke whales off the U.S. East Coast are considered part of the Canadian East Coast stock (Hayes et al. 2021).

The population estimate for minke whales in the Canadian East Coast stock is 21,968 individuals (Hayes et al. 2021). Minke whales have been observed south of New England during all four seasons. However, widespread abundance is highest in spring through fall (Hayes et al. 2021). Minke whales inhabit coastal waters during much of the year and are thus susceptible to collision with vessels and bycatch from gillnet and purse seine fisheries (Hayes et al. 2021). From 2008 to 2012, the minimum annual rate of mortality for the North Atlantic stock from anthropogenic causes was approximately 9.9 per year (Waring et al. 2015), while from 2010 to 2014 this decreased to 8.25 per year (Hayes et al. 2019). During 2014 through 2018, the average annual minimum detected human-caused mortality and serious injury was 10.55 minke whales per year (Hayes et al. 2021). In addition, hunting for minke whales continues today by Norway and Iceland in the northeastern North Atlantic and by Japan in the North Pacific and Antarctic (Hayes et al. 2021; Reeves et al. 2002). International trade in the species is currently banned. During 2014 through 2018, as determined from stranding and entanglement records, the minimum detected annual average was 1.2 common minke whales per year struck by vessels in U.S. waters, or first seen in U.S. waters (Hayes et al. 2021). In January 2017, a UME for minke whales was declared by NOAA Fisheries (NOAA Fisheries 2021) due to the elevated stranding along the U.S. Atlantic Coast, with a total of 112 whales stranded since 2017 (Hayes et al. 2020; NOAA Fisheries 2021).

4.2 Toothed Whales (Odontoceti)

4.2.1 Atlantic Spotted Dolphin (*Stenella frontalis*) – Non-Strategic

There are two species of spotted dolphin in the Atlantic Ocean, the Atlantic spotted dolphin (*Stenella frontalis*) and the pantropical spotted dolphin (*S. attenuata*, Perrin et al. 1987). Both are discussed here due to morphological similarities that can make them difficult to differentiate at sea (Waring et al. 2013). However, only the Atlantic spotted dolphin is anticipated in the vicinity of the Survey Area. NOAA Fisheries considers the Atlantic and pantropical spotted dolphins non-strategic (Waring et al. 2016).

In addition, two forms of the Atlantic spotted dolphin exist: one is large, heavily spotted, and usually inhabits the continental shelf; the other is smaller, with fewer spots, and occurs in the Atlantic Ocean but is not known to occur in the Gulf of Mexico (Viricel and Rosel 2014; Fulling et al. 2003; Mullin and Fulling 2003, 2004). Where these two forms co-occur, the offshore form of the Atlantic spotted dolphin and the pantropical spotted dolphin can be difficult to differentiate (Waring et al. 2016). The Atlantic spotted dolphin diet consists of a wide variety of fish and squid, as well as benthic invertebrates (Herzing 1997). The Atlantic spotted dolphin has a robust body with a tall, curved dorsal fin located midway down its back (Jefferson et al. 2015) and reaches 1.5 to 2.3 m in length (Herzing 1997). They have moderately long, slender beaks and their color patterns vary with age and location. Pantropical spotted dolphins are typically 1.8 to 2.2 m at adulthood (Jefferson et al. 2015). Pantropical dolphins have long, slender beaks similar to the Atlantic spotted dolphin. Pantropical dolphins are distinguished by a dark cape or coloration on their backs, which stretches from their head to almost midway between the dorsal fin and the tail flukes, and by a white-tipped beak (Jefferson et al. 2015; Herzing 1997). The hearing range for both species of dolphin is in the MF range (NOAA Fisheries 2018a; Southall et al. 2007).

The Atlantic spotted dolphin prefers tropical to warm temperate waters along the continental shelf 10 to 200 m deep to slope waters greater than 500 m deep. It has been suggested that the species may move inshore seasonally during the spring, but data to support this theory is limited (Fritts et al. 1983; Caldwell and Caldwell 1966). Atlantic spotted and pantropical spotted dolphins were observed during the months of July-August during the Kitty Hawk Wind 2019 HRG surveys. Spotted dolphins were also observed during all seasons except winter during the 2019 Kitty Hawk APEM survey (APEM 2020).

The best population estimate for the Atlantic spotted dolphin is approximately 39,921 individuals, and the best for pantropical spotted dolphin is approximately 6,593 individuals (Hayes et al. 2021). Prior to 1998, the species of spotted dolphins were not differentiated during surveys so prior abundance estimates are for both species combined (Waring et al. 2013). Current threats to both species in the Atlantic are poorly understood as there are insufficient data to determine the population trends for either species. No fishing-related mortality of spotted dolphin was reported for 1998 through 2003 (Garrison and Richards 2004; Garrison 2003; Yeung 1999, 2001). From 2013–2017, 21 Atlantic spotted dolphins were reported stranded between North Carolina and Florida (NOAA Fisheries unpublished data reported in Hayes et al. 2020). It could not be determined whether there was evidence of human interaction for 9 of these strandings, and for 12 dolphins, no evidence of human interaction was detected (Hayes et al. 2020). However, stranding data probably underestimates the extent of fishery-related mortality (and serious injury) because not all of the marine mammals that die or are seriously injured wash ashore. Also, stranded animals may not show clear signs of entanglement or other fishery-interaction.

4.2.2 Risso's Dolphin (*Grampus griseus*) – Non-Strategic

There is currently no information on stock structure of this species for western North Atlantic. However, the Gulf of Mexico and Atlantic populations are currently being treated as two separate stocks (Hayes et al. 2021). There are insufficient data to determine any population trend for the two stocks. The total U.S. fishery mortality and serious injury rate for Risso's Dolphin stock is greater than ten percent of the calculated potential biological removal (Hayes et al. 2021). Therefore, anthropogenic causes cannot be considered insignificant and approaching zero. The status of Risso's dolphins is unknown but is not considered strategic under the MMPA (Hayes et al. 2021). Population trends for this species have not been investigated.

The species' anterior body is extremely robust, tapering to a relatively narrow tail stock. It has one of the tallest dorsal fins in proportion to body length of any cetacean (Baird 2009). Color patterns change dramatically with age. Infants are gray to brown dorsally and creamy-white ventrally, with a white, anchor-shaped patch between the pectoral flippers and white around the mouth (Jefferson et al. 2015). Calves darken to nearly black, while retaining the ventral white patch. Older animals can appear almost completely white on the dorsal surface or when swimming just beneath the surface (Jefferson et al. 2015). The diet for this species consists mostly of squid (Jefferson et al. 2015). Risso's dolphin hearing is in the MF range (NOAA Fisheries 2018a).

Risso's dolphins are commonly found along the continental shelf edge ranging from Cape Hatteras to Georges Bank from spring through fall. They are found throughout the Mid-Atlantic Bight out to oceanic waters during winter (Baird 2009; Wells et al. 2009). The species is distributed worldwide in temperate and tropical oceans, with an apparent preference for steep, shelf-edge habitats between

400 to 1,000 m deep (Baird 2009). Risso's dolphins of the western North Atlantic stock prefer temperate to tropical waters, typically from 15 degrees Celsius (°C) to 20°C and are rarely found in waters below 10°C. Risso's dolphins are usually seen in groups of 12 to 40 individuals. Loose aggregations of hundreds or even several thousand individuals are occasionally seen (Jefferson et al. 2015). Sightings of this species during surveys are mostly in the continental shelf edge and continental slope areas (Hayes et al. 2020).

The best estimate of abundance for the stock of Risso's dolphins is 35,493 individuals, obtained from the 2016 surveys (Hayes et al. 2021). Risso's dolphins have been subject to bycatch during squid and mackerel trawl activities, pelagic drift gillnet activities, pelagic pair trawl fishery, and Mid-Atlantic gillnet fishery (Hayes et al. 2020). The average annual fishery related mortality and serious injury between 2007 and 2011 was 62 dolphins (Waring et al. 2014). From 2009 to 2013, the average annual fishery-related mortality and serious injury was 54 dolphins (Waring et al. 2016). From 2013 to 2017, the estimated annual average fishery-related mortality or serious injury was 53.9 dolphins (Hayes et al. 2020). Risso's dolphin strandings have also been recorded along the U.S. Atlantic Coast, with 38 strandings recorded between 2012 and 2016 (Hayes et al. 2020).

4.2.3 Long-Finned and Short-Finned Pilot Whale (*Globicephala melas* and *Globicephala macrorhynchus*) – Non-Endangered / Non-Strategic Western North Atlantic Stocks

The two species of pilot whales in the western Atlantic, the long-finned (*Globicephala melas melas*) and short-finned pilot whale (*G. macrorhynchus*), are difficult to differentiate from field observations. Neither species are ESA listed and both are considered non-strategic under the MMPA by NOAA Fisheries (Hayes et al. 2021).

The long-finned pilot whale is a medium-sized animal with a stocky body, large bulbous or squarish forehead, and a thick dorsal fin located about a third of the body length behind the head. The short-finned pilot whale also has a bulbous forehead, but with no obvious beak (Jefferson et al. 2015). Long-finned pilot whales are dark black, dark gray, or brownish in color. They have pale grayish or whitish marks, such as a diagonal eye-stripe, or a blaze, that extend from behind the eye and up towards the dorsal fin. The long-finned pilot whale also has a large saddle behind the dorsal fin and a whitish anchor-shaped patch that starts at the throat and extends down its underside (Jefferson et al. 2015). The short-finned pilot whale's dorsal fin is far forward on its body and has a relatively long base (Jefferson et al. 2015). The body color of the short-finned pilot whale tends to be black or dark brown with a large gray saddle behind the dorsal fin. They feed preferentially on squid, but will eat fish (e.g., herring) and invertebrates (e.g., octopus, cuttlefish) if squid are not available. They also ingest shrimp (particularly younger whales) and various other fish species occasionally. These whales probably take most of their prey at depths of 200 to 500 m, although they can forage deeper if necessary (Reeves et al. 2002). Both species' hearing is in the MF range (NOAA Fisheries 2018a).

Both species of pilot whales are generally found along the edge of the continental shelf at depths of 100 to 1,000 m and prefer areas of high relief or submerged banks. Long-finned pilot whales, in the western North Atlantic are pelagic. They occur in especially high densities during winter and early spring over the continental slope, then follow squid and mackerel populations inshore and onto the shelf in summer and fall (Reeves et al. 2002). They frequently travel into the central and northern

portion of Georges Bank, the Great South Channel, and northward into the Gulf of Maine areas during the late spring through late fall (Hayes et al. 2020).

Short-finned pilot whales prefer tropical, subtropical, and warm temperate waters (Jefferson et al. 2015). The short-finned pilot whale mostly ranges from New Jersey south through Florida, the northern Gulf of Mexico, and into the Caribbean without any seasonal movements or concentrations (Hayes et al. 2020). Populations for both of these species overlap spatially along the Mid-Atlantic shelf break between New Jersey and the southern flank of Georges Bank (Hayes et al. 2020). While the exact latitudinal ranges of the two species remain uncertain, most pilot whale sightings south of Cape Hatteras are expected to be short-finned pilot whales. While north of approximately 42° N, most pilot whale sightings are expected to be long-finned pilot whales (Hayes et al. 2020).

The best population estimate for long-finned and short-finned pilot whales in the western North Atlantic is 39,215 and 28,924, respectively (Hayes et al. 2021). Pilot whales are subject to bycatch during sink gillnet fishing, pelagic trawling, pelagic longline fishing, and purse seine fishing. The total annual human-caused mortality and serious injury for short-finned pilot whales during 2013 to 2017 is unknown (Hayes et al. 2020). The estimated mean annual fishery-related mortality and serious injury during 2013 to 2017, due to the pelagic longline fishery, was 160 for short-finned pilot whales (Hayes et al. 2020). Total annual observed average fishery-related mortality or serious injury for long-finned pilot whales during 2013 to 2017 was 21 (Hayes et al. 2020). Strandings involving hundreds of individuals are not unusual and demonstrate that these large schools have a high degree of social cohesion (Reeves et al. 2002). From 2013 through 2017, 16 long-finned pilot whales were reported as stranded between Maine and Florida (Hayes et al. 2020).

4.2.4 Common Dolphin (*Delphinus delphis*) – Non-Strategic

The common dolphin (*Delphinus delphis delphis*) is not ESA listed and the western North Atlantic stock is not considered strategic under the MMPA (Hayes et al. 2021). Population trends for this species have not been investigated.

Common dolphins feed on squids and small fish, including species that school in proximity to surface waters, as well as mesopelagic species found near the surface at night (Bearzi 2003). They have been known to feed on fish escaping from fishermen's nets or fish that have been discarded from boats (NOAA Fisheries 1993). These dolphins can gather in schools of hundreds or thousands, although the schools generally consist of smaller groups of 30 or fewer. They are eager bow riders and are active at the surface (Reeves et al. 2002). All common dolphins are slender and have a long beak, sharply demarcated from the melon. They are distinguished from other dolphins by a unique crisscross color pattern formed by the interaction of the dorsal overlay and cape (Perrin 2009), resulting in distinctive color bands on their sides. The species exhibits significant sexual dimorphism, with males being on average about nine percent larger in body length (Hayes et al. 2019). The species' hearing is in the MF range (NOAA Fisheries 2018a; Southall et al. 2007).

The common dolphin is one of the most widely distributed cetaceans and occurs in temperate, tropical, and subtropical regions (Jefferson et al. 2015). They can be found either along the 200 to 2,000 m isobaths over the continental shelf and in pelagic waters of the Atlantic and Pacific Oceans (Hayes et al. 2021; Reeves et al. 2002). They are present in the western Atlantic from Newfoundland to Florida. The common dolphin is especially common along shelf edges and in areas with sharp

bottom relief such as seamounts and escarpments (Reeves et al. 2002). They show a strong affinity for areas with warm, saline surface waters. This species is found between Cape Hatteras and Georges Bank from mid-January to May, although they migrate onto Georges Bank and the Scotian Shelf between mid-summer and fall, where large aggregations occur on Georges Bank in fall (Waring et al. 2007). The species is less common south of Cape Hatteras. Although pods have been reported as far south as the Georgia/South Carolina border and points south (Hayes et al. 2021; Jefferson et al. 2015). While this dolphin species can occupy a variety of habitats, short-beaked common dolphins occur in greatest abundance within a broad band of the northeast edge of Georges Bank in the fall (Jefferson et al. 2015). During the 2019 Kitty Hawk APEM survey, of the WDA common dolphins were observed in March and January (APEM 2020).

According to the species SAR, the best population estimate for the western North Atlantic common dolphin is approximately 172,974 individuals (Hayes et al. 2021). The common dolphin is subject to bycatch. It has been caught in gillnets, pelagic trawls, and during longline fishery activities. Average annual estimated fishery-related mortality or serious injury to this stock during 2014 to 2018 was 399 individuals (Hayes et al. 2021). From 2014 to 2018, 499 common dolphins strandings were reported between Maine and Florida (Hayes et al. 2021). Average annual fishery-related mortality and serious injury does not exceed the potential biological removal of this species (Hayes et al. 2021).

4.2.5 Bottlenose Dolphin (*Tursiops truncatus*) – Non-Strategic Western North Atlantic Offshore Stock; Non-Endangered / Strategic Western North Atlantic Southern Migratory Coastal Stock; Strategic Northern North Carolina Estuarine System Stock; Strategic Southern North Carolina Estuarine System Stock

The population of bottlenose dolphins in the North Atlantic consists of a complex mosaic of dolphin stocks (Waring et al. 2010). There are two distinct bottlenose dolphin morphotypes: migratory coastal and offshore. The migratory coastal morphotype resides in waters typically less than 20 m deep, along the inner continental shelf (within 7.5 km of shore) and around islands; it is continuously distributed south of Long Island, New York into the Gulf of Mexico (Hayes et al. 2021). This migratory coastal population is subdivided into seven stocks, based largely upon spatial distribution (Waring et al. 2016). There are four stocks that may be found in the vicinity of the Survey Area: the Western North Atlantic Offshore Stock (WNAOS), the Western North Atlantic Southern Migratory Coastal Stock (WNASMCS), the Northern North Carolina Estuarine System Stock (NNCESS), and the Southern North Carolina Estuarine System Stock (SNCESS). Species status is addressed later in this section due to stock structure complexities of bottlenose dolphins.

Bottlenose dolphins feed on a large variety of organisms, depending on their habitat. The coastal, shallow population tends to feed on benthic fish and invertebrates, while deep water populations consume pelagic or mesopelagic fish such as croakers, sea trout, mackerel, mullet, and squid (Reeves et al. 2002). Bottlenose dolphins appear to be active both during the day and night. Their activities are influenced by the seasons, time of day, tidal state, and physiological factors such as reproductive seasonality (Wells and Scott 2002). They are light- to slate-gray in color, roughly 2.4 to 3.7 m long, and have short, stubby beaks. They show sexual dimorphism between males and females, with males being larger and heavier. The species' hearing is in the MF range (NOAA Fisheries 2018a; Southall et al. 2007).

In general, the species occupies a wide variety of habitats, thus is regarded as possibly the most adaptable cetacean (Reeves et al. 2002). It occurs in oceans and peripheral seas at both tropical and temperate latitudes. In North America, bottlenose dolphins are found in surface waters with temperatures ranging from 10°C to 32°C.

The WNASMCS is the coastal stock found south of Assateague, Virginia, to northern Florida, and is the stock most likely to be encountered in the vicinity of the Survey Area. Seasonally, WNASMCS movements indicate they are mostly found in southern North Carolina (Cape Lookout) from October to December. They continue to move farther south from January to March to as far south as northern Florida and move back north to coastal North Carolina from April to June. WNASMCS bottlenose dolphins occupy waters north of Cape Lookout, North Carolina, to as far north as Chesapeake Bay from July to August (Hayes et al. 2021). These animals often move into or reside in bays, estuaries, the lower reaches of rivers, and coastal waters within the approximate 25 m depth isobath north of Cape Hatteras (Waring et al. 2016; Reeves et al. 2002). An observed shift in spatial distribution during a summer 2004 survey indicated that the northern boundary for the WNASMCS may vary from year to year (Hayes et al. 2021).

The offshore population consists of one stock (WNAOS) in the western North Atlantic, distributed primarily along the OCS and continental slope. WNAOS dolphins are distributed widely during the spring and summer from Georges Bank to the Florida Keys, with late summer and fall incursions as far north as the Gulf of Maine, depending on water temperatures (Hayes et al. 2017; Kenney 1990). This morphotype is most expected in waters north of Long Island, New York (Hayes et al. 2017). The range of the WNAOS morphotype south of Cape Hatteras has recently been found to overlap with that of the WNASMCS morphotype, found as close as 7.3 km from the shore in water depths of 13 m (Hayes et al. 2017). The WNAOS is found seaward of 34 km and in waters deeper than 34 m.).

There is slightly lower potential of the NNCESS occurring in the vicinity of the Survey Area. This morphotype is considered locally coastal and continuously distributed along the U.S. Atlantic Coast south of Long Island, New York, to the Florida peninsula, and can be found in inshore waters of the bays, sounds and estuaries (Hayes et al. 2021). The NNCESS animals primarily occur in estuarine waters of Pamlico Sound, North Carolina during warm water months (July to August), and in coastal waters (less than 1 km from shore) from Beaufort, North Carolina north to Virginia Beach, Virginia, and the lower Chesapeake Bay region (Hayes et al. 2021). The inshore estuarine and coastal waters are considered a Small and Resident Population Biologically Important Area for this species in North Carolina. However, this Biologically Important Area falls entirely outside of the Survey Area. Because the NNCESS also utilizes nearshore coastal waters of North Carolina, north to Virginia Beach and the mouth of Chesapeake Bay, it likely overlaps with the WNASMCS during warm water months (Hayes et al. 2021).

Similarly, there is a slightly lower potential of the SNCESS occurring in the vicinity of the Survey Area. This morphotype occupies estuarine and nearshore coastal waters between the Little River Inlet estuary and the New River, North Carolina, during cold water months (January to February) and expands its range only slightly northward into estuarine and nearshore waters of central Core Sound and southern Pamlico Sound during warm water months (July to August, Garrison et al. 2017; Hayes et al. 20121). SNCESS individuals have not been observed in coastal waters north of Cape Lookout or in the main portion of Pamlico Sound. During warm water months, SNCESS and NNCESS ranges

overlap in estuarine waters near Beaufort and in southern Pamlico Sound (Garrison et al. 2017). The SNCESS range also overlaps with the WNASMCS range as the latter stock makes its seasonal migratory movements during warm water months (Hayes et al. 2021). The overall likelihood of occurrence of bottlenose dolphins in the Survey Area for any of the four stocks is high. Bottlenose dolphins were observed during the months of July-November during the Kitty Hawk Wind 2019 HRG surveys. During the 2019 Kitty Hawk APEM survey, bottlenose dolphins were observed in January and March (APEM 2020).

The NOAA Fisheries species SAR estimates the population of WNAOS bottlenose dolphin stock at 62,851 individuals, the WNASMCS stock at 3,751 individuals, and the NNCESS stock at 823 animals (Hayes et al. 2018, 2021). Current population size of the SNCESS stock is unknown because the most recent estimates are more than a decade old and unbiased abundance data are unavailable; however, stock size is likely less than 200 individuals given the restricted range of the stock and the best available abundance estimate (Hayes et al. 2021). Although there was no statistically significant difference in abundance for the specific WNASMCS stock of bottlenose dolphins (a subset of the overall population) between the 2002 and 2011 surveys, a statistically significant decline in population size of all common bottlenose dolphins in coastal waters from New Jersey to Florida between 2011 and 2016 surveys was detected (Hayes et al. 2021). From 1995 to 2001, NOAA Fisheries recognized only the western North Atlantic Coastal Stock of common bottlenose dolphins in the western North Atlantic. This stock was listed as depleted due to a UME from 1988 to1989 (64 Federal Register 17789, 06 Apr 1993). The WNASMCS retains the depleted designation as due to its origin from the WNAOS (Hayes et al. 2021).

The estimated mean annual fishery-related mortality and serious injury of WNAOS from 2013 through 2017 was 28 per year. This is less than ten percent of the calculated potential biological removal, and therefore is not significant and approaches the zero mortality and serious injury rate (Hayes et al. 2020). However, the estimated mean annual fishery-related mortality and serious injury of NNCESS and the WNASMCS are greater than ten percent of the potential biological removal (Hayes et al. 2021). The estimated mean annual fishery-related mortality and serious injury of SNCESS from 2014 through 2018 was 0.4 per year (Hayes et al. 2021). This number is concerning in light of the Wells et al. (2015) estimation that only one-third of common bottlenose carcasses in estuarine environments are recovered, suggesting that annual human-caused mortality may approach ten percent of the potential biological removal for this stock based on the best available abundance estimate. Therefore, NOAA Fisheries considers the WNASMCS, NNCESS, and SNCESS as strategic and the WNAOS as non-strategic (Hayes et al. 2020, 2021).

Common bottlenose dolphins are among the most frequently stranded small cetaceans along the U.S. Atlantic Coast. Many of the animals show signs of human interaction (i.e., net marks, mutilation, etc.). However, it is unclear what proportion of these stranded animals are from which stock, because most strandings are not identified to morphotype (Hayes et al. 2021). The biggest threat to the population is bycatch, as they are frequently caught in fishing gear, gillnets, purse seines, and shrimp trawls (Waring et al. 2016). They have also been adversely impacted by pollution, habitat alteration, boat collisions, human disturbance, and are subject to bioaccumulation of toxins. Scientists have found a strong correlation between dolphins with elevated levels of polychlorinated biphenyls and illness, indicating certain pollutants may weaken their immune system (ACS 2004). Two UMEs for western Atlantic bottlenose dolphins, from 1987 to 1988 and 2013 to 2015, were attributed to morbillivirus

(Morris et al. 2015). Both UMEs also included deaths of dolphins in locations that apply to the WNASMCS, NNCESS, and SNCESS (Hayes et al. 2018; Lipscomb et al. 1994). When the impacts of the 1987-1988 UME were being assessed, only a single coastal stock of common bottlenose dolphin was thought to exist along the western Atlantic from New York to Florida, so impacts to the WNASMCS and NNCESS alone are not known (Scott et al. 1988). However, it was estimated that between 10 and 50 percent of the coast-wide stock died as a result of this UME (Eguchi 2002; Scott et al. 1988). The total number of stranded common bottlenose dolphins from New York through North Florida (Brevard County) during the 2013 to 2015 UME was 1,614 individuals (Hayes et al. 2021). A third UME occurred in South Carolina from February to May 2011, resulting in a total of six strandings from the WNASMCS (Hayes et al. 2018). The cause of this UME was undetermined. The WNASMCS mean annual human-caused mortality for 2014 to 2018 ranged between a minimum of 0 and a maximum of 18.3 (Hayes et al. 2021).

4.2.6 Rough-Toothed Dolphin (*Steno bredanensis*) – Non-Strategic

The rough-toothed dolphin (*Steno bredanensis*) is not ESA listed and the western North Atlantic stock is not considered strategic under the MMPA (Hayes et al. 2021). There have been no direct studies of the demographic independence between stocks of the western North Atlantic and the Gulf of Mexico. However, rough-toothed dolphin stocks exhibit strong global population structuring and these two stocks occupy distinct marine ecoregions (Hayes et al. 2021). Therefore, the stocks are managed separately. There are insufficient data to determine whether the western North Atlantic stock comprises multiple independent populations and population trends for this stock have not been investigated.

The rough-toothed dolphin has a relatively small, cone-shaped head with a long beak; there is no demarcation between the gently sloping melon and beak (Reeves et al. 2002; U.S. Navy 2008; Jefferson et al. 2015). Individuals have prominent, falcate dorsal fins and large pectoral fins set far back on the sides (Jefferson et al. 2015). Body coloration is dark gray with a prominent, narrow dorsal cape that dips slightly below the dorsal fin (U.S. Navy 2008). Both the lips and lower jaw are white, and many individuals have white scratches and spots on the body (U.S. Navy 2008). The species travels in tight-knit groups of 10 to 20 individuals, though pods of up to 100 individuals have been reported (Jefferson et al. 2015). Pods often include other cetacean species, including bottlenose, pantropical spotted, and spinner dolphins and short-finned pilot whales. The species forages on epipelagic squids and fishes, including dorado and flying fishes, though individuals have been known to dive up to 150 m in search of prey (U.S. Navy 2008; Jefferson et al. 2015). Rough-toothed dolphin hearing is in the MF range (NOAA Fisheries 2018a).

Rough-toothed dolphins are distributed globally in tropical, subtropical, and warm temperate waters generally between 40° North to 35° South (Jefferson et al. 2015; Hayes et al. 2019). They are found in the Atlantic, Pacific, and Indian Oceans from shallow, nearshore waters to deeper, offshore waters (Hayes et al. 2019). Most vessel sightings along the U.S. Atlantic Coast have occurred in waters with bottom depths exceeding 1,000 m and tagged individuals have ranged out to waters up to 5,000 m in depth (U.S. Navy 2008; Hayes et al. 2019). Records indicate that the species occurs from Virginia to Florida and in the Gulf of Mexico, West Indies, and the northeast coast of South America with occasional sightings on the continental shelf especially in North Carolina and Florida (U.S. Navy 2008; OBIS 2021). Off the coast of North Carolina, they are expected to reside seaward of the shelf break in the warm waters following the western edge of the Gulf Stream with occasional forays into the more

landward waters (U.S. Navy 2008; OBIS 2021). Predictive density mapping also indicates that potential occurrence of rough-toothed dolphins increased along the East Coast, beginning in the southern half of coastal Virginia and moving southwards (Roberts et al. 2018).

Based on surveys conducted in 2011 and 2016 from central Florida to the lower Bay of Fundy, estimated abundance of rough-toothed dolphins in the western North Atlantic is 136 individuals (Garrison 2020; Palka 2020; Hayes et al. 2021). Average annual estimated U.S. fishery-related mortality or serious injury to this stock from 2013 to 2017 is presumed to be zero and there are no U.S. commercial fisheries with evidence of interactions (Hayes et al. 2019). Outside of the U.S., small numbers have been directly hunted in fisheries in the Caribbean, Pacific, and off the coast of West Africa (Reeves et al. 2002; Jefferson et al. 2015). No rough-toothed dolphins were reported stranded between Maine and Florida from 2012 to 2016, though prior mass strandings have revealed persistent organic pollutant and polychlorinated biphenyl concentrations above the toxic threshold suggested by Kannan et al. (2000). Furthermore, prior strandings have involved human interaction in the form of ingested plastic (Hayes et al. 2019).

4.2.7 Harbor Porpoise (*Phocoena phocoena*) – Non-Strategic

The harbor porpoise was once considered for listing under the ESA. However, in 2001, it was removed from the candidate species list for the ESA. A review of the biological status of the stock indicated that a classification of threatened was not warranted (Waring et al. 2009). The species has been listed as non-strategic because average annual human-related mortality and injury does not exceed the potential biological removal (Hayes et al. 2021).

Harbor porpoises are the smallest North Atlantic cetacean, measuring only 1.4 to 1.9 m. They feed primarily on fish, but also prey on squid and crustaceans (Reeves and Reed 2003). Harbor porpoise hearing is in HF range (NOAA Fisheries 2018a; Southall et al. 2007).

The harbor porpoise inhabits shallow, coastal waters, and is often found in bays, estuaries, and harbors. They are likely to occur in the waters of the Mid-Atlantic during winter months, as this species prefers cold-temperate and subarctic waters (Hayes et al. 2021). During the winter months, an intermediate abundance of harbor porpoises can be expected in waters off New Jersey to North Carolina, with lower densities occurring off New York to New Brunswick, Canada. In the western Atlantic, they are found from Cape Hatteras north to Greenland. After April, they migrate north towards the Gulf of Maine and Bay of Fundy. During the 2019 Kitty Hawk APEM survey, one harbor porpoise was observed in January (APEM 2020).

The current population estimate for harbor porpoises in the Gulf of Maine/Bay of Fundy is 95,543 (Hayes et al. 2021). However, the estimate is expected to be biased low (Hayes et al. 2021). The most common threat to the harbor porpoise is from incidental mortality by fishing activities, especially from bottom-set gillnets. Roughly 150 harbor porpoises per year are killed from U.S. fisheries (Hayes et al. 2021). A UME involved the stranding of 38 animals along the North Carolina coast from 01 Jan 2005 to 28 Mar 2005 (Waring et al. 2012). From 2012 to 2018, a total of 315 harbor porpoises were stranded along the U.S. and Canadian Atlantic Coast, 30 of which were reported in North Carolina (Hayes et al. 2021). It has been demonstrated that the porpoise echolocation system is capable of detecting net fibers in certain circumstances, but not consistently enough to prevent fishery

interactions (Reeves et al. 2002). In 1999, a Take Reduction Plan to reduce harbor porpoise bycatch in U.S. Atlantic gillnets was implemented.

4.2.8 Cuvier's Beaked Whale (*Ziphius cavirostris*) – Non-Strategic

Cuvier's beaked whale (*Ziphius cavirostris*) is not ESA listed and the western North Atlantic stock is not considered strategic under the MMPA (Hayes et al. 2021). Due to insufficient sighting data, the western North Atlantic stock structure is unknown for this species. However, because the stock occupies multiple marine ecoregions and tagged individuals have exhibited restricted movements and site fidelity, it is plausible that the western North Atlantic stock contains multiple demographically independent populations (Hayes et al. 2021).

Cuvier's beaked whale has a round, robust body with a slightly falcate, triangular dorsal fin located far down the back (Perrin et al. 2009). The species possesses a sloping, concave head with no obvious melon, an indistinct beak, and a large slit-like blowhole (Perrin et al. 2009). The jawline is slightly upturned, giving the species a smiling appearance. Body coloration is variable and ranges from dark gray to reddish brown, with a paler counter-shaded belly. Reddish-brown to orange-yellow coloration is attributed to infestations of microscopic diatoms and algae. Individuals are often covered in linear scratches and oval shaped scars caused by interactions with sharks and lampreys. While there is no significant sexual dimorphism in body size, males possess a more prominent melon and two small, cone-shaped teeth that erupt from the tip of the bottom jaw. Little is known about their feeding preferences, though they may be mid-water and bottom feeders on cephalopods and fish (Perrin et al. 2009). Like all beaked whales, Cuvier's beaked whale hearing is in the MF range (NOAA Fisheries 2018a).

Cuvier's beaked whales have the most extensive range of all beaked whale species and are distributed globally in tropical, subtropical, and temperate oceans and seas (Perrin et al. 2009). They are also occasionally sighted in boreal waters. The species prefers deep pelagic waters with bottom depths exceeding 1,100 m along the continental slope edge. They are known to favor steep underwater geological features such as banks, seamounts, and submarine canyons, as well as oceanographic features such as currents, current boundaries, and core ring features. Though their distribution in the western Mid-Atlantic is poorly understood, strandings have been reported from Nova Scotia to Florida and the Caribbean (Hayes et al. 2019). The species exhibits year-round presence in the Mid-Atlantic off the coast of North Carolina (Hayes et al. 2019). Predictive density mapping also indicates potential occurrence of beaked whales, with an increased potential for beaked whales to occur in more shallow regions off the coast of North Carolina (Roberts et al. 2018).

Based on surveys conducted in 2016 from central Florida to the lower Bay of Fundy, estimated abundance of Cuvier's beaked whales in the western North Atlantic is 5,744 individuals (Garrison 2020; Palka 2020; Hayes et al. 2021). Average annual estimated U.S. fishery-related mortality or serious injury to this stock from 2013 to 2017 was 0.2 individuals per year (Hayes et al. 2019). During the same period, seven individuals stranded along the U.S. Atlantic Coast, one of which exhibited evidence of human interaction in the form of ingested plastic (Hayes et al. 2019). Outside of the U.S., small numbers have been directly hunted in fisheries in Japan, and more have been caught incidentally by fisheries in the Caribbean Sea, Chile, Indonesia, Peru, and Taiwan. Furthermore, unusual mass strandings of beaked whales, including Cuvier's beaked whale, have occurred globally

and have been associated with naval activities, including low-frequency acoustic sonar tests (Hayes et al. 2019).

4.2.9 Mesoplodont Beaked Whales (*Mesoplodon sp.*) – Non-Strategic

Four species in the genus *Mesoplodon* are known to reside in the northwest Atlantic Ocean, including Blainville's beaked whale (*M. densirostris*), Gervais' beaked whale (*M. europaeus*), Sowerby's beaked whale (*M. bidens*), and True's beaked whale (*M. mirus*). Due to the difficulty distinguishing between these species at sea, most available information is at the undifferentiated genus level. Mesoplodont whales are not ESA listed and the western North Atlantic stock is not considered strategic under the MMPA (Hayes et al. 2021). Due to insufficient sighting data, the western North Atlantic stock structure is unknown for mesoplodont whales. However, because the stock occupies multiple marine ecoregions, it is plausible that the western North Atlantic stock contains multiple demographically independent populations (Hayes et al. 2021).

Mesoplodont whales are characterized by relatively small heads, large thoraxes and abdomens, and short tails (U.S. Navy 2008). The head is concave and becomes more prominent as individuals age, and the curved jaw gives an impression of smiling (U.S. Navy 2008). Dorsal and pectoral fins tend to be small and spindle shaped. Adult mesoplodont males are distinguished by a single pair of sexually dimorphic tusks that erupt from the tip of the lower jaw. Body coloration varies slightly by species but is generally dark gray to light rusty brown, often with lighter coloration around the head; visible scratching and scarring on the body is common among these whales (U.S. Navy 2008; Jefferson et al. 2015). As with Cuvier's beaked whales, diatom infestations discolor the skin of mesoplodont whales. Mesoplodont whales feed on mesopelagic fishes, squid, and benthic invertebrates at or close to the seafloor in deep oceanic waters (U.S. Navy 2008).

Blainville's beaked whales possess round bodies with small, wide, and slightly falcate dorsal fins. Their jaws are highly arched, and the large, flattened tusks of adult males extend above the upper jaw (U.S. Navy 2008). Their coloration varies from dark gray to bluish brown on the cape and pale gray on the face and belly. Blainville's whales are found individually or in pods of 3 to 12 individuals that may often be harems of females accompanied by a single male. Gervais' beaked whales are small to medium in size and possess moderately long beaks, sloped foreheads, and small, wide, and slightly falcate dorsal fins. They are sexually dimorphic, with adult females often exceeding adult males in size. Body coloration is dark gray to blue black on the cape and paler on the ventral side. Individuals have pronounced dark patches around the eyes and faint stripes down the centerline of the back. Gervais' whales are found individually or in small pods. Sowerby's beaked whales are small to medium in size and possess long, slender beaks and distinct melons. Adult females often exceed adult males in size. Body coloration is charcoal gray on the cape and paler on the ventral side; gray spotting may be evident on adults, though body scarring is less evident than on other beaked whales (U.S. Navy 2008; Jefferson et al. 2015). Sowerby's whales are found individually or in groups of 3 to 10 individuals. True's beaked whales are cryptic and skittish. They are small to medium in size and possess a short beak, rounded melon, and small, wide, slightly falcate dorsal fin. Body coloration varies from gray to brown. They are most similar in appearance to Gervais' beaked whales but lack the defined dorsal stripe and have a straighter mouthline. True's whales are found individuals or in groups of 5 to 6 individuals.

Mesoplodont whales are distributed globally and prefer the continental slope and oceanic waters with depths exceeding 200 m (U.S. Navy 2008; Perrin et al. 2009). As with Cuvier's beaked whales, mesoplodont occurrence patterns have been linked to physical features including continental slope, canyons, escarpments, and oceanic islands, as well as oceanographic features, such as currents and core rings (U.S. Navy 2008; Perrin et al. 2009). In the western North Atlantic, the continental shelf edge and margins with bottom depths down to 5,000 m from Cape Hatteras to southern Nova Scotia have been identified as key areas for mesoplodont whales (U.S. Navy 2008; Hayes et al. 2019). Predictive density mapping also indicates potential occurrence of beaked whales, with an increased potential for beaked whales to occur in more shallow regions off the coast of North Carolina (Roberts et al. 2018).

Species distributions may vary with water temperature; Blainville's and Gervais' whales occur in warmer southern waters, while Sowerby's and True's whales are typically found farther north (U.S. Navy 2008). Blainville's whales have a continuous distribution throughout tropical, subtropical, and warm temperate areas; in the western North Atlantic, they have been reported from Nova Scotia to Florida, though they are sparsely distributed (Hayes et al. 2019). Gervais' whales are distributed throughout tropical and warm-temperate Atlantic waters. It is the most common mesoplodont species to strand along the U.S. Atlantic Coast and has been reported from Cape Cod to Florida and the Caribbean (Hayes et al. 2019). Sowerby's whales are endemic to the North Atlantic Ocean and are a temperate species. They have been reported from New England waters north to the ice pack (Hayes et al. 2019). True's whales are a temperate species and have been reported from Nova Scotia to Florida and the Bahamas (Hayes et al. 2019). Of these species, Blainville's, Gervais', and True's whales are expected to occur regularly off the coast of North Carolina, while occurrence of Sowerby's whales is expected to be rare (U.S. Navy 2008).

Based on surveys conducted in 2016 from central Florida to the lower Bay of Fundy, estimated abundance of undifferentiated mesoplodont whales in the western North Atlantic is 10,107 individuals (Garrison 2020; Palka 2020; Hayes et al. 2021). Average annual estimated U.S. fishery-related mortality or serious injury to mesoplodont whales 2013 to 2017 was zero (Hayes et al. 2019). The permanent closure of the pelagic drift gillnet fishery has eliminated the primary known source of incidental fishery mortality in the U.S. During the same period, 4 Blainville's whales, 12 Gervais' whales, 3 Sowerby's whales, and 6 True's whales stranded along the U.S. Atlantic Coast between Florida and Massachusetts (Hayes et al. 2019). Six of these strandings exhibited evidence of human interaction in the form of ingested plastic (Hayes et al. 2019). As with Cuvier's beaked whale, mass strandings of mesoplodont whales have occurred globally in connection with naval activities and low-frequency sonar tests (Hayes et al. 2019).

5.0 TYPE OF INCIDENTAL TAKING REQUESTED

The Applicant is requesting the authorization for potential non-lethal “taking” of small numbers of marine mammals to allow for incidental harassment resulting from the marine site characterization survey. The request is based upon projected HRG survey activities during the anticipated survey schedule as stated in Section 2.1.

The noise levels of HRG survey equipment were evaluated against the criteria prescribed in the *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0), Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts* (NOAA

Fisheries 2018a). To ensure that the potential for take by Level B harassment is avoided and/or minimized to the maximum extent possible, the Applicant has committed to the mitigation measures as outlined in Sections 11.0 and 13.0, which have been successfully implemented during similar activities in the North Atlantic. Due to the implementation of the mitigation and monitoring measures described, Level A harassment is not anticipated due to HRG survey activities. However, distances to regulatory Level A harassment thresholds for representative HRG activities were calculated and are included in Section 6.0.

The Applicant is requesting the authorization for the incidental take by harassment, of small numbers of marine mammals pursuant to Section 101 (a) (5) of the MMPA and in accordance with 50 Code of Federal Regulations § 216 Subpart I, in support of the Applicant's survey activities. Both NOAA Fisheries and BOEM have advised that some sound-producing survey equipment operating below 200 kHz (e.g., MCS) have the potential to cause acoustic harassment to marine species, in particular marine mammals. This request is being submitted to specifically address survey sound-producing data acquisition equipment that operate below 200 kHz, in support of the Applicant's survey activities as further detailed in Section 6.0.

6.0 TAKE ESTIMATES FOR MARINE MAMMALS

The Applicant seeks authorization for potential Level B "taking" of small numbers of marine mammals under the jurisdiction of NOAA Fisheries in the proposed region of activity. Anticipated impacts to marine mammals from the proposed survey activities will be associated with noise propagation from the use of specific survey equipment. It should be noted that the estimates of exposure for marine mammals as presented in this section are conservative. Based on the review of Protected Species Observer (PSO) sightings reports for similar surveys conducted along the Atlantic Coast, data suggests that with the application of the mitigation and monitoring actions as proposed in Section 11.0, that exposure of marine mammals to harassing level acoustic levels during survey activities can be effectively minimized (Avangrid Renewables 2019, 2021).

6.1 Propagation Models

Two separate calculation methodologies were used to calculate distances to Level A (PTS onset) and Level B acoustic harassment thresholds, both following prescriptive guidance provided by NOAA Fisheries. The Level A harassment cumulative PTS criteria were applied to the formulaic spreadsheet provided by NOAA Fisheries, which has been updated to reflect NOAA Fisheries' 2018 Revisions to Technical Guidance (NOAA Fisheries 2018a). PTS onset acoustic thresholds estimated in the NOAA Fisheries User Spreadsheets rely on overriding default values, calculating individual adjustment factors, and using the difference between levels with and without weighting functions for each of the five categories of hearing groups. The new adjustment factors in the spreadsheets allow for the calculation of cumulative sound exposure level (SEL_{cum}) distances and peak sound exposure (PK) distances and account for the accumulation (Safe Distance Methodology) using the source characteristics (duty cycle and speed) after Sivle et al. (2014). The HRG systems evaluated were input as non-impulsive and impulsive mobile sources within the NOAA Fisheries User Spreadsheet as appropriate.

The Level B harassment distances for each piece of HRG equipment operating below 200 kHz were calculated per NOAA Fisheries' *Interim Recommendation for Sound Source Level and Propagation Analysis for High Resolution Geophysical (HRG) Sources*, 02 Apr 2020 (NOAA Fisheries 2020c). The

methodology is new and is detailed within the referenced document. Methods used to estimate the horizontal distance to the 160 dB re 1 μPa isopleth include the in-beam distance at which 160 dB re 1 μPa is reached:

$$\mathrm{SPL}(r)=SL-PL(r) \tag{1}$$

Where:

SPL = sound pressure level (dB re 1 μPa),
r = in-beam distance (m),
SL = in-beam source level (dB re 1 μPa m), and
PL = propagation loss as a function of distance.

Propagation loss is calculated using:

$$PL(r)=20\log_{10}(r)+\alpha(f)\cdot r/1000 \tag{2}$$

Where:

α = absorption coefficient (dB/km), and
f = frequency (kHz).

The absorption coefficient is approximated using:

$$\alpha(f) = 0.000339f^2 + \ 48.5\frac{f^2}{f^2+5715.36}\ (dB/km) \tag{3}$$

When a range of frequencies is produced by a source, the lowest frequency is used for determining the absorption coefficient.

The in-beam distance is then adjusted to account for the influence of equipment beamwidth. For a downwards-pointing source with a beamwidth less than 180°, the vertical component *h* is calculated from the in-beam range using the following equation:

$$h = r\cos\frac{\theta}{2}\ (m) \tag{4}$$

Where:

θ = beamwidth (in *radians*).

The horizontal distance I is dependent on lesser value of the water depth *d* and vertical component of the slant distance *h*. For a beam direction pointed at a normal downward direction the following equations are used:

- Water depth *d* is greater or equal to the vertical component of the slant distance *h*, then the horizontal distance is:

$$R = h\tan\frac{\theta}{2}\ (m) \tag{5}$$

- Vertical component of the slant distance h is greater that the water depth d, then the horizontal distance is:

$$R = d \tan \frac{\theta}{2} \ (m) \tag{6}$$

Therefore, the resulting R value corresponds to the in-beam distance r to the Level B 160 dB re 1 μPa isopleth adjusted to account for both absorption, water depth, and beamwidth. The Level A harassment calculation methodology prescribed by NOAA Fisheries does not account for the influences of absorption, water depth, and/or beamwidth, whereas the April 2020 guidance issued to evaluate distances to Level B harassment thresholds does account for those factors.

Model Input Parameters

As indicated, prescriptive calculation methodologies provided by NOAA Fisheries were used to calculate maximum distances to the Level A and B harassment regulatory thresholds. The calculation methodologies do not allow for inclusion of site-specific environmental parameters, with the exception of water depth for Level B calculations, but do incorporate Project-specific sound source characteristics including the following:

- Level A harassment:
  - Manufacturer sound source level;
  - Source Velocity;
  - Pulse Duration;
  - Repetition Rate; and
  - Duty Cycle.
- Level B harassment:
  - Manufacturer sound source level;
  - Frequency;
  - Beamwidth; and
  - Water depth.

The majority of this information is identified or calculated based on HRG equipment data given in Table 1. In addition, absorption is included in the updated Level B harassment calculation methodology. The calculation of absorption coefficient varies with frequency, temperature, salinity, and pH; the largest factor driving the absorption coefficient is frequency. Therefore, to calculate the distances to the Level B threshold, the lower end of the equipment operating frequency is used and other factors (temperature, salinity, and pH) are neglected.

6.1.1 Calculation of Range to Regulatory Thresholds

The noise levels of HRG survey equipment were evaluated against the criteria prescribed in the *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0) Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts* (NOAA Fisheries 2018a). Under this revised guidance document, Level A harassment is said to occur as a result of exposure to high noise levels and the onset of permanent hearing sensitivity loss, known as a PTS, based on findings published by the Noise Criteria Group (Southall et al. 2007). The acoustic thresholds are presented using dual metrics of cumulative sound exposure level ($SELc_{um}$) and peak

sound level. The cumulative PTS criteria was applied to the formulaic spreadsheet provided by NOAA Fisheries (see Table 5). This spreadsheet incorporates the different hearing abilities of marine mammal groups (also see Appendix A). The instantaneous peak criteria was calculated by applying a practical spreading model to the peak source levels in Table 1 (see Appendix A). No marine mammal weighting correction is applied for evaluation of the peak criteria. Note that distances to the Sonardyne Ranger 2 USBL, Innomar parametric SES 2000, Klein 3900 Sidescan Sonar, and Reson T20-P were are not provided as operation of these pieces of equipment has been deemed not a possible source of disturbance to marine mammals by NOAA Fisheries.

Table 5. Distances to Regulatory Level A Harassment Thresholds for Representative HRG Equipment

Representative HRG System	Marine Mammal Group	PTS Onset a/ b/	Marine Mammal Level A Harassment Isopleth (m) b/
EdgeTech 512i	LF cetaceans	199 dB SELcum	0.0
	MF cetaceans	198 dB SELcum	0.0
	HF cetaceans	173 dB SELcum	0.8
	Phocid pinnipeds	201 dB SELcum	0.0
Applied Acoustics S-Boom (Triple Plate Boomer)	LF cetaceans	183 dB SELcum	0.2
	MF cetaceans	185 dB SELcum	0.0
	HF cetaceans	155 dB SELcum	1.6
	Phocid pinnipeds	185 dB SELcum	0.1
Applied Acoustics Dura-Spark 1000J	LF cetaceans	183 dB SELcum	17.9
	MF cetaceans	185 dB SELcum	0.5
	HF cetaceans	155 dB SELcum	120.5
	Phocid pinnipeds	185 dB SELcum	10.0
Geo Source 800J	LF cetaceans	183 dB SELcum	0.8
	MF cetaceans	185 dB SELcum	0.1
	HF cetaceans	155 dB SELcum	23.3
	Phocid pinnipeds	185 dB SELcum	0.5

Notes:
a/ The peak SPL criterion is un-weighted (i.e., flat weighted), whereas the cumulative SEL criterion is weighted for the given marine mammal functional hearing group.
b/ The calculated sound levels and results are based on NOAA Fisheries Technical Guidance's companion User Spreadsheet except as indicated in this IHA Application.

The Level A harassment distances are larger than would be expected due to some limitations inherent in the current available models used to calculate distances (i.e., as indicated above, the Level A harassment calculations do not take into account beamwidth and absorption). NOAA Fisheries has not provided guidance to date regarding how to account for beamwidth and absorption. Thus, as per conversations with NOAA Fisheries, the calculated Level A harassment distances are not utilized to calculate take.

The isopleth distances to the 160 dB_{RMS} re 1 µPa isopleth for Level B harassment are presented in Table 6. As the surveys would consist of segments with and without MCS use (as described in Section

1), the largest MCS source was chosen to represent MCS use for take estimation calculation while the largest non-MCS source was selected for take estimation calculation for segments without MCS use. The 1,259 m distance to the Geo Source 200, 400-3000J MCS represents the largest MCS distance while the 13.40 distance to the Applied Acoustics S-Boom (boomer) is the largest source when an MCS source is not in use and are likely very conservative estimates (note that the USBL is not considered a source of disturbance and therefore the boomer distance is considered the largest).

Table 6 Distances to Regulatory Level B Harassment Thresholds for Representative HRG Equipment

HRG System	Representative HRG Survey Equipment	Marine Mammal Level B Harassment 160 dB_{RMS}90% re 1 µPa Isopleth (m)
Shallow penetration sub-bottom profiler	EdgeTech 512i	4.31
Medium penetration sub-bottom profiler	Applied Acoustics S-Boom 750J (Triple Plate Boomer)	13.40
Multi-channel Sparker (MCS) in flip/flop configuration	Applied Acoustics Dura-Spark 1000J	445.00
Multi-channel Sparker (MCS) in flip/flop configuration	GeoMarine Geo-Source 800J	200.00

Notes:
a/ Based on previous conversations with NOAA regarding USBL operations, potential harassment from operation of this device is not anticipated.
b/ Operating frequencies are above all relevant marine mammal hearing thresholds.

6.2 Basis for Estimating Numbers of Marine Mammals that Might be "Taken by Harassment"

Marine animals can perceive underwater sounds over a broad range of frequencies from about 10 hertz (Hz) to more than 10,000 Hz (10 kHz). Many of the dolphins and porpoises use even higher frequency sound for echolocation and perceive these high frequency sounds with high acuity. Marine mammals respond to low-frequency sounds with broadband intensities of more than about 120 dB re 1 µPa, or about 10 to 20 dB above natural ambient noise at the same frequencies (Richardson et al. 2013). The functional hearing ranges for the marine mammals in this evaluation indicated that some species have a potential for acoustic take by Level B harassment at the time of the proposed surveys (see Table 3 for hearing ranges by functional hearing groups).

Sound is important to marine mammals for communication, individual recognition, predator avoidance, prey capture, orientation, navigation, mate selection, and mother-offspring bonding. Potential effects of anthropogenic sounds to marine mammals can include physical injury (e.g., temporary or permanent loss of hearing sensitivity), behavioral modification (e.g., changes in foraging or habitat-use patterns), and masking (the prevention of marine mammals from hearing important sounds).

An important distinction between electromechanical and other acoustic sources employed in HRG survey systems is the determinism of the transmitted signal. Whereas electromechanical sources (i.e., chirpers and pingers) employ deterministic signals generated by piezoelectric transducers, non-

electromechanical sources typically employ impulsive physical processes including the release of high-pressure air or electric field discharge at high voltage (i.e., sparkers) to generate high-intensity acoustic fields (Crocker and Fratantonio 2016).

The basis for the HRG survey take estimate is the number of marine mammals that would be exposed to sound levels in excess of Level B harassment criteria for impulsive noise (160 dB_{RMS}90% re 1 µPa). Typically, potential harassment take estimates are determined by multiplying the Zone of Influence (ZOI), i.e., radius around noise-emitting equipment out to the harassment criteria isopleth, by local marine mammal density estimates, and then correcting for seasonal use by marine mammals, seasonal duration of project-specific noise-generating activities, and estimated duration of individual activities when the maximum noise-generating activities are intermittent or occasional. In the absence of any part of this information, it becomes prudent to take a conservative approach to ensure the potential number of takes is not greatly underestimated.

Distances for noise thresholds are calculated using the conservative practical spreading model. As noted in Table 1, the Applied Acoustics Dura-Spark 1000J MCS is the loudest sound source and governs the Level B ZOI determination during its operation. When the MCS is not in operation, the Applied Acoustics S-Boom (boomer) is the loudest source and govern the Level B ZOI determination. As noted previously, the Applicant intends to conduct surveys that might result in disturbance of marine mammals over the course of 273 days. It is estimated that the MCS and boomer operation will consist of the following (see Table 7):

- Kitty Hawk South Offshore-MCS: 4 days (Base Case and Alternative A [offshore]);
- Kitty Hawk South Offshore-Boomer: 193 days (Alternative A, WDA, and Base Case);
- Kitty Hawk South WDA-MCS: 42 days;
- Kitty Hawk North–Boomer: 33 days; and
- Kitty Hawk North–MCS: 1 day.

Table 7. Survey Segment Level B Harassment ZOIs

Survey Equipment	Number of Active Survey Days a/	Estimated Total Line Distance (km)	Estimated Distance per Day (km)	Calculated ZOI per Day (km^2)
Kitty Hawk South Offshore-MCS	3	470	177.792	158.857
Kitty Hawk South Offshore-Boomer	193	36,216		4.765
Kitty Hawk South WDA-MCS	42	7,562		158.857
Kitty Hawk North - MCS	1	120		158.857
Kitty Hawk North - Boomer	33	5,843		4.765

Note:
a/ Estimated duration does not include anticipated delays associated with weather delay or other equipment downtime, including shut-down mitigation for marine mammals.

The estimated distance of the daily vessel track line was determined using the estimated average speed of the vessel (4 knots [7.4 km/hr]) and the 24-hour operational period. Within each survey segment, the ZOI was calculated using the respective maximum distance to the Level B harassment

threshold and estimated daily vessel track of 177.792 km. During the use of the Applied Acoustics Dura-Spark 1000J MCS, estimates of take have been based on a maximum Level B distance of 445 m from the sound source resulting in an ensonified area (i.e., ZOI) around the survey equipment of 158.857 km^2 per day. During the use of Applied Acoustics S-Boom (boomer), estimates of take have been based on a maximum Level B distance of 13.49 m from the sound source resulting in an ensonified area (i.e., ZOI) around the survey equipment of 4.765 km^2 per day over a projected survey period of 177 days (see Table 7).

6.2.1 Estimate of Numbers of Marine Mammals that Might be "Taken by Harassment"

Estimates of take are computed according to the following formula, commonly accepted by NOAA Fisheries for determining take:

$$\text{Estimated Take} = D \times ZOI \times (d) \tag{7}$$

Where:

D = average highest species density (number per km^2)
ZOI = maximum ensonified area to MMPA thresholds for impulsive noise (160 dB_{RMS}90% re 1 μPa); and
d = number of days.

Per NOAA Fisheries guidance for mobile sound sources, the ZOI was calculated according to the following formula (Personal Communication, 24 Nov 2015):

$$ZOI = \text{maximum ensonified area around the sound source} \times \text{the line miles traveled over a 24-hour period.} \tag{8}$$

It should be noted, however, that this calculation will result in an overly-conservative ZOI, as it assumes that once an area along a survey track line is ensonified by the sound source, the area will remain ensonified at a level that will result in Level B acoustic take (160 dB_{RMS}90% re 1 μPa) throughout the entire 24-hour period. Note, the only time survey activities could result in take by Level B acoustic harassment is if a marine mammal were to enter into the ensonified area associated with the HRG survey equipment being operated.

The data used as the basis for estimating cetacean density D for the Survey Area are sightings per unit effort derived by Duke University (Roberts et al. 2018, 2020, updated with new modeling results (Roberts et al. 2016a, 2016b, 2017, 2018, 2020).

The Duke University (Roberts et al. 2018, 2020) cetacean density data represent models derived from aggregating line-transect surveys conducted over 23 years by five institutions (NOAA Fisheries Northeast Fisheries Science Center, New Jersey Department of Environmental Protection, NOAA Fisheries Southeast Fisheries Science Center, University of North Carolina Wilmington, and Virginia Aquarium & Marine Science Center), the results of which are freely available online at the Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations (OBIS SEAMAP) repository (OBIS 2021).

Monthly density grids (e.g., rasters) for each species were overlain with the Survey Area and values from all grid cells that overlapped the Survey Area were averaged to determine monthly mean density values for each species. Monthly mean density values within the Survey Area were averaged by season (Winter [December, January, February], Spring [March, April, May], Summer [June, July, August], Fall [September, October, November]) to provide seasonal density estimates. Since the HRG surveys would occur during every season, all values were used in the take estimation analysis. Within each survey segment (WDA and ECC), the highest seasonal density estimates during the duration of the proposed survey were used to estimate take. All cetacean species analyzed had associated monthly abundance data as reported by Roberts et al. (2016b, 2017, 2018, 2020).

Due to the spatial distribution and transient nature of marine mammal species identified in the Survey Area, and the implementation of the mitigation measures as described in Section 11.0, these activities are not expected to result in Level A harassment, and Level B harassment is expected only on the species identified in Table 8. The take estimates as provided in Section 6.2.2 are based on an overly conservative ZOI and therefore are likely a significant overestimate of the actual potential for take by Level B acoustic harassment.

6.2.2 Estimate of Potential Project Survey Takes by Harassment

The parameters in Table 7 were used to estimate the potential take by incidental Level B harassment for each piece of equipment that will govern the Level B ZOI determination during HRG survey activities. Density data from Roberts et al. (2016b, 2017, 2018, 2020) were mapped within the boundary of the Survey Area for each segment (Figure 1) using geographic information systems. For both survey segments, species densities, as reported by Roberts et al. (2018, 2020) within the maximum Survey Area, were averaged by season (spring, summer, fall, winter) based on the proposed HRG survey schedule (commencing no earlier than 01 Apr 2022). Potential take calculations were then based on the average seasonal species density within the maximum Survey Area, given the survey start date and duration. Results of the take calculations by survey segment are provided in Table 8.

For bottlenose dolphin densities, Roberts et al. (2016a, 2016b, 2017, 2018, 2020) does not differentiate by individual stock. Given the southern coastal migratory stock propensity to be found shallower than the 20 m depth isobath north of Cape Hatteras (Reeves et al. 2002; Waring et al. 2016), the WDA is located within depths exceeding 20 m, where the southern coastal migratory stock would be unlikely. Bottlenose dolphin densities within the WDA have been considered part of the offshore migratory stock only. Additionally, while the potential exists for the NNCESS and SNCESS stocks to occur, they occur in estuarine waters where only equipment that is not anticipated to result in disturbance will be operated, and therefore the potential for harassment take of these stocks has been eliminated from consideration.

Table 8. Marine Mammal Density and Estimated Acoustic Harassment Take Numbers during Survey Activities

Species	Kitty Hawk South Offshore MCS		Kitty Hawk North MCS		Kitty Hawk South Offshore BOOMER		Kitty Hawk South WDA MCS		Kitty Hawk North BOOMER		Totals		Species Stock
	Maximum Average Seasonal Density a/ (No./100 km^2)	Calculated Take (No.)	Maximum Average Seasonal Density a/	Calculated Take (No.)	Maximum Average Seasonal Density a/	Calculated Take (No.)	Maximum Average Seasonal Density a/ (No./100 km^2)	Calculated Take (No.)	Maximum Average Seasonal Density a/ (No./100 km^2)	Calculated Take (No.)	Total Take Authorization (No.)	Percent of Population	
North Atlantic right whale	0.014	0.086	0.051	0.081	0.014	0.124	0.021	1.396	0.051	0.080	2.000	0.467	Western North Atlantic
Humpback whale	0.036	0.229	0.092	0.145	0.036	0.331	0.205	13.654	0.092	0.144	15.000	1.074	Gulf of Maine
Fin whale	0.080	0.508	0.161	0.256	0.080	0.735	0.242	16.144	0.161	0.253	18.000	0.243	Western North Atlantic
Sei whale	0.004	0.026	0.005	0.008	0.004	0.038	0.009	0.598	0.005	0.008	1.000	0.016	Nova Scotia
Minke whale	0.041	0.259	0.194	0.309	0.041	0.375	0.310	20.692	0.194	0.306	22.000	0.091	Canadian East Coast
Pilot whales	1.553	9.866	0.073	0.117	1.553	14.280	0.107	7.107	0.073	0.115	32.000	0.082	Western North Atlantic
Cuvier's Beaked Whale	0.266	1.689	-	-	0.266	2.445	0.004	0.252	- c/	- c/	5.000	0.087	Western North Atlantic
Mesoplodon spp.	0.190	1.204	-	-	0.190	1.743	0.000	0.000	- c/	- c/	3.000	0.030	Western North Atlantic
Bottlenose dolphin b/	44.003	187.337	6.117	6.510	44.003	271.152	5.459	364.230	6.117	9.619	823.000	1.309	Western North Atlantic, offshore
Bottlenose dolphin b/	44.003	92.270	6.117	3.206	44.003	133.552	- c/	- c/	- c/	- c/	226.000	6.025	Western North Atlantic, Southern Migratory Coastal
Atlantic spotted dolphin	3.412	21.681	4.020	6.386	3.412	31.381	5.283	352.504	4.020	6.321	8736 d/	21.883	Western North Atlantic
Short beaked common dolphin	7.057	44.839	2.878	4.572	7.057	64.901	3.685	245.879	2.878	4.526	9282 d/	5.371	Western North Atlantic
Risso's dolphin	0.185	1.178	0.039	0.063	0.185	1.705	0.070	4.684	0.039	0.062	25 d/	0.070	Western North Atlantic
Rough-toothed dolphin	0.110	0.698	-	-	0.110	1.010	0.038	2.511	- c/	- c/	20 d/	14.706	Western North Atlantic
Harbor porpoise	0.117	0.740	0.624	0.992	0.117	1.072	0.548	36.579	0.624	0.982	39.000	0.041	Gulf of Maine/Bay of Fundy

Notes:
a/ Density values from Duke University (Roberts et al. 2016b, 2017, 2018, 2020).
b/ Estimates based on bottlenose dolphin stock preferred water depths (Reeves et al. 2002; Waring et al. 2016).
c/ Given the southern coastal migratory stock propensity to be found shallower than the 20 m depth isobath north of Cape Hatteras (Reeves et al. 2002; Waring et al. 2016), the WDA is located within depths exceeding 20 m, where the southern coastal migratory stock would be unlikely. Bottlenose dolphin densities within the WDA have been considered part of the offshore migratory stock only. In addition, Cuvier's beaked whale, Mesoplodon spp., and rough-toothed dolphins are not anticipated in the more northern Kitty Hawk North survey segments.
d/ Multiplier applied to increase calculated take to account for two large group size, an average pod size of 16 individuals encountered in Survey Area (Milne 2019, 2021) has been included for spotted dolphin and 17 individuals have also been included for short beaked common dolphin (Milne 2019, 2021). Pod size adjustments of 25 and 20 individuals (average pod size from Reeves et al. [2002]) have been included for Risso's and rough-toothed dolphins, respectively.

Observational experience has indicated that the maximum distance for 100 percent coverage of an exclusion zone during nighttime activities is approximately 250 m (Milne 2019, 2021). There is the potential for species to incur into the exclusion zones without detection if the zones are greater than the 100 percent effective distance. However, detections are still likely using the proposed nighttime mitigations. For the right whale, the Applicant has proposed an exclusion zone at any distance during MCS operations. This proposed mitigation would effectively decrease the potential for Level B harassment of right whales. However, take has been included for right whales to account for the potential for incursion into the exclusion zone during nighttime survey activities. For a full description of the proposed monitoring and exclusion zones and associated mitigations, please see Section 11.

Finally, to account for the potential of large groups of spotted and short-beaked common dolphins, average pod size has been used as a multiplier to the calculated take, based on animal density. Two pods were assumed per day, therefore the total number of days, 273, was multiplied by twice the average group size for each species. For this analysis, spotted dolphin take was multiplied by 32 (average pod size 16 encountered in Survey Area [Milne 2019, 2021]) and common dolphins were multiplied by 34 (average pod size 17 encountered in Survey Area [Milne 2019, 2021]). The calculated take for Risso's and rough-toothed dolphins were adjusted to reflect one group size of 25 and 20, respectively, based on the pod sizes noted in Reeves et al. (2002). These increases were applied to the initial calculated Level B harassment take request, as indicated in Table 8.

7.0 ANTICIPATED IMPACTS OF THE ACTIVITY

Consideration of negligible impact is required for NOAA Fisheries to authorize the incidental take of marine mammals. In 50 Code of Federal Regulations § 216.103, NOAA Fisheries defines negligible impact to be "an impact resulting from a specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stocks [of marine mammals] through effects on annual rates of recruitment or survival." Based upon best available data regarding the marine mammal species (including density, status, and distribution) that are likely to occur in the Survey Area, the Applicant concludes that exposure to marine mammal species and stocks during HRG marine site characterization surveys would result in short-term, minimal effects and would not affect the overall annual recruitment or survival for the following reasons:

- The potential acoustic exposures from survey activities are within the non-injurious behavioral effects zone (Level B harassment);
- The potential for take as estimated in Section 6.2.2 represents a highly conservative estimate of harassment based upon typical HRG survey operations utilizing an overly conservative ZOI and without taking into consideration the effects of standard mitigation and monitoring measures; and
- The protective measures as described in Section 11.0 are designed to avoid and/or minimize the potential for interactions with and exposure to marine mammals.

Marine mammals are mobile, free ranging animals and have the capacity to exit an area when noise-producing survey activities are initiated. Based on the conservative take estimations, survey activities may disturb more than one individual for some species (mainly dolphins). However, in

conjunction with other aforementioned factors, we conclude the short-term survey activities are not expected to result in population level effects, and that individuals will return to normal behavioral patterns after activities have ceased or after the animal has left the area under survey.

8.0 ANTICIPATED IMPACTS ON SUBSISTENCE USES

There are no traditional subsistence hunting areas in the Survey Area.

9.0 ANTICIPATED IMPACTS ON HABITAT

Bottom disturbance associated with the survey activities is not anticipated.

HRG survey equipment (Table 1) will be towed and will not contact the seafloor. Additionally, the HRG survey equipment is not known to cause air or water pollution. Impacts to all species, including prey species, are expected to be limited to avoidance of the area around the HRG survey activities and the potential for short-term changes in behavior. These impacts are not expected to have any effects to population-levels (BOEM 2015). After survey operations in the area have been completed, or after the marine mammal has left the Survey Area, it is anticipated that the animal will return to its normal behavior

10.0 ANTICIPATED EFFECTS OF HABITAT IMPACTS ON MARINE MAMMALS

As discussed in Section 9.0 above, the impacts from proposed Project-related survey activities on marine mammals from loss of habitat will be confined to short-term, minimal, non-adverse effects.

11.0 MITIGATION MEASURES

The Applicant commits to engaging in ongoing consultations with NOAA Fisheries. The mitigation procedures outlined in this section are based on protocols and procedures that have been previously approved by NOAA Fisheries, and successfully implemented for similar offshore projects and previously approved by NOAA Fisheries (ESS 2013; Dominion 2013 and 2014; Avangrid Renewables 2019, 2021).

11.1 Vessel Strike Avoidance Procedures

The Applicant will ensure that vessel operators and crew maintain a vigilant watch for cetaceans and pinnipeds by slowing down or stopping their vessels to avoid striking these protected species when sighted within the specified mitigation distances. Survey vessel crew members responsible for navigation duties will receive site-specific training on marine mammal sighting/reporting and vessel strike avoidance measures. Vessel strike avoidance measures will include, but are not limited to, the following, except under extraordinary circumstances when complying with these requirements would put the safety of the vessel or crew at risk:

- All vessel operators and crew will maintain vigilant watch for marine mammals and sea turtles, and slow down or stop their vessel to avoid striking these protected species when animals are sighted within specific distances of the vessel as defined below;

- All vessel operators will comply with 10 knot (18.5 km/hr) or less speed restrictions. This applies to all vessels operating from 01 November through 30 April;
- All vessel operators will comply with 10 knot (18.5 km/hr) or less speed restrictions when operating in any Dynamic Management Area;
- All vessel operators will monitor the North Atlantic Right Whale Reporting Systems (e.g. the Early Warning System, Sighting Advisory System, and Mandatory Ship Reporting System) daily throughout the entire survey period for the presence of North Atlantic right whales during activities conducted in support of plan submittal;
- All survey vessels will maintain a separation distance of 500 m or greater from any sighted North Atlantic right whale or other ESA-listed whale;
- If underway, vessels must steer a course away from any sighted North Atlantic right whale at 10 knots (18.5 km/hr) or less until the 500 m minimum separation distance has been established. If a North Atlantic right whale is sighted in a vessel's path, or within 100 m to an underway vessel, the underway vessel must reduce speed and shift the engine to neutral. Engines will not be engaged until the North Atlantic right whale has moved outside of the vessel's path and beyond 100 m. If stationary, the vessel must not engage engines until the North Atlantic right whale has moved beyond 100 m;
- All vessels will maintain a separation distance of 100 m or greater from any sighted non-delphinid cetacean. If sighted, the vessel underway must reduce speed and shift the engine to neutral, and must not engage the engines until the non-delphinid cetacean has moved outside of the vessel's path and beyond 100 m. If a survey vessel is stationary, the vessel will not engage engines until the non-delphinid cetacean has moved out of the vessel's path and beyond 100 m;
- All vessel operators will comply with 10 knot (18.5 km/hr) or less speed restrictions when mother/calf pairs, pods, or large assemblages of non-delphinid cetaceans are observed near an underway vessel;
- All vessels will maintain a separation distance of 50 m or greater from any sighted delphinid cetacean and pinniped. Any vessel underway will remain parallel to a sighted delphinid cetacean or pinniped's course whenever possible and avoid excessive speed or abrupt changes in direction. Any vessel underway reduces vessel speed to 10 knots (18.5 km/hr) or less when pods (including mother/calf pairs) or large assemblages of delphinid cetaceans are observed. Vessels may not adjust course and speed until the delphinid cetaceans have moved beyond 50 m and/or the abeam of the underway vessel;
- All vessels underway will not divert or alter course in order to approach any whale, delphinid cetacean, or pinniped. Any vessel underway will avoid excessive speed or abrupt changes in direction to avoid injury to the sighted cetacean or pinniped; and
- All vessels will maintain a separation distance of 50 m or greater from any sighted sea turtle.

Confirmation of the training and understanding of the requirements will be documented on a training course log sheet. Signing the log sheet will certify that the crew members understand and will comply with the necessary requirements throughout the survey event.

11.2 Seasonal Operating Requirements

Between watch shifts, members of the monitoring team will consult NOAA Fisheries North Atlantic right whale reporting systems for the presence of North Atlantic right whales throughout survey operations. All vessel operators will comply with the 10 knot (18.5 km/hr) or less speed restrictions when operating in any Mid-Atlantic SMA from 01 November through 30 April.

11.3 Exclusion and Monitoring Zone Implementation

Monitoring and exclusion zones will be implemented. All visible waters make up the monitoring zone and will be monitored for marine mammals. Monitoring zones are meant to allow PSOs to document marine mammal occurrence and facilitate PSOs and vessel crew the opportunity to avoid take by shutting down equipment before a marine mammal enters the exclusion zone. Exclusion zones are the areas within the monitoring zone that, if marine mammals are sighted at or within the established distance, either activities may not begin if they have not started (see Section 11.5 for more details) or must be shut-down if they are underway (see Section 11.7 for more details). Voluntary approach (e.g. bow-riding) is exempted from shut-down during operations.

The Applicant proposes to employ the following exclusion zones during HRG survey activities:

- 500 m North Atlantic right whale exclusion zone;
- 450 m ESA-listed large cetacean exclusion zone (except for the North Atlantic whale) during MCS operation; and
- 100 m non-ESA cetacean exclusion zone during MCS operation (except as noted for voluntary approach).

11.4 Visual Monitoring Program

Visual monitoring of the established exclusion zones and monitoring zones will be performed by qualified and NOAA Fisheries–approved PSOs. PSO qualifications will include direct field experience on a marine mammal observation vessel and/or aerial surveys in the Atlantic Ocean/Gulf of Mexico. An observer team comprising a minimum of four NOAA Fisheries–approved PSOs, operating in shifts, will be stationed aboard either the survey vessel or a dedicated PSO vessel.

PSOs will work in shifts such that no one monitor will work more than four consecutive hours without a 2-hour break, or longer than 12 hours during any 24-hour period. During daylight hours the PSOs will rotate in shifts of one on and three off. During nighttime operations PSOs will work in pairs. Each PSO will monitor 360 degrees of the field of vision. The Applicant will provide resumes of all proposed PSOs (including alternates) to BOEM for review and approval by NOAA Fisheries prior to the start of survey operations.

The PSOs will begin observation of the exclusion zones and monitoring zone during all HRG survey operations. Observations of the zones will continue throughout the survey activity and/or while equipment operating below 200 kHz are in use. PSOs will be responsible for visually monitoring and

identifying marine mammals approaching or entering the established exclusion zones during survey activities. It will be the responsibility of the Lead PSO on duty to communicate the presence of marine mammals as well as to communicate and enforce the action(s) that are necessary to ensure mitigation and monitoring requirements are implemented as appropriate. A PSO mitigation and monitoring communications flow diagram has been included as Appendix B.

PSOs will be equipped with binoculars and have the ability to estimate distances to marine mammals located in proximity to their established zones using range finders. Reticulated binoculars will also be available to PSOs for use as appropriate based on conditions and visibility to support the siting and monitoring of marine species. Digital single-lens reflex camera equipment will be used to record sightings and verify species identification. During night operations, night-vision equipment (night-vision goggles with thermal clip-ons) and infrared (IR [thermal]) technology will be used. Position data will be recorded using hand-held or vessel global positioning system units for each sighting. Studies have concluded that the use of IR imaging technology may allow for the detection of marine mammals at night as well as improve the detection during all periods through the use of automated detection algorithms (Weissenberger et al. 2011).

Studies have also indicated that IR performance is independent of daylight and exhibits an almost uniform, omnidirectional detection probability within a radius of 5 km. Results of studies demonstrate that thermal imaging can be used for reliable and continuous marine mammal protection (Zitterbart et al. 2013). For this reason, the Applicant finds that use of IR systems for mitigation purposes warrants additional application in the field as both a standalone tool and in conjunction with other alternative monitoring methods (e.g., night vision binoculars). These equipment specifications are provided as examples of equipment most likely to be implemented. Specific night-vision and IR equipment models will be subject to availability. Each PSO will have a radio to communicate among vessel crew and PSOs.

Observations will take place from the highest available vantage point on the survey vessel. General 360-degree scanning will occur during the monitoring periods, and target scanning by the PSO will occur when alerted of a marine mammal presence.

Data on all PSO observations will be recorded based on standard PSO collection requirements. This will include dates and locations of operations; time of observation, location and weather; details of the sightings (e.g., species, age classification [if known], numbers, behavior); and details of any observed "taking" (behavioral disturbances or injury/mortality). In addition, prior to initiation of survey work, all crew members will undergo environmental training, a component of which will focus on the procedures for sighting and protection of marine mammals. A briefing will also be conducted between the survey supervisors and crews, the PSOs, and the Applicant. The purpose of the briefing will be to establish responsibilities of each party, define the chains of command, discuss communication procedures, provide an overview of monitoring purposes, and review operational procedures.

11.5 Pre-Clearance of the Exclusion Zone

For all HRG survey activities, the Applicant will implement a 30-minute clearance period of the exclusion zones prior to the initiation of ramp-up (Section 11.6). During this period the exclusion zones will be monitored by the PSOs using the appropriate visual technology. Ramp-up may not be

initiated if any marine mammal is observed within its respective exclusion zone. If a marine mammal is observed within an exclusion zone during the pre-clearance period, ramp-up may not begin until the animal has been observed exiting its respective zone or until an additional time period has elapsed with no further sightings (i.e., 15 minutes for delphinid cetaceans and pinnipeds and 30 minutes for all other marine mammal species and sea turtles). This condition is a modification to Lease stipulation 5.4.7.4 and thus the Applicant is requesting a reduction in the exclusion zone clearance protocol in accordance with the precedent established by NOAA Fisheries in recent IHAs issued on the Atlantic OCS, including the IHAs granted for the Lease Area on 03 June 2019 (modified 17 July 2019) and on 16 July 2021 (Avangrid Renewables 2019, 2021). PSOs would also continue to monitor the zone for 30 minutes after survey equipment is shut-down or survey activity has concluded.

11.6 Ramp-Up Procedures

Where technically feasible, a ramp-up procedure will be used for HRG survey equipment capable of adjusting energy levels at the start or restart of HRG survey activities. A ramp-up procedure will be used at the beginning of HRG survey activities to provide additional protection to marine mammals near the Survey Area by allowing them to vacate the area prior to the commencement of survey equipment use. Ramp-up is not required to re-initiate survey activities following a shut-down as described in Section 11.7. The ramp-up procedure will not be initiated during periods of inclement conditions if the exclusion zone cannot be adequately monitored by the PSOs using the appropriate visual technology (e.g., reticulated binoculars, night vision equipment) for a 30-minute period. A ramp-up would begin with the power of the smallest acoustic equipment at its lowest practical power output appropriate for the survey. When technically feasible the power would then be turned up and other acoustic sources added in a way such that the source level would increase gradually.

Ramp-up activities will be delayed if a marine mammal(s) enters an exclusion zone(s). Ramp-up will continue if the animal has been observed exiting the exclusion zone or until an additional time period has elapsed with no further sighting (i.e., 15 minutes for delphinid cetaceans and pinnipeds and 30 minutes for all other marine mammal species and sea turtles).

11.7 Shut-Down Procedures

The vessel operator must comply immediately with any call for shutdown by the Lead PSO, when doing so is technically feasible and does not pose a risk to the vessel or crew safety. Any disagreement should be discussed only after shutdown. The following outlines the shut-down procedures:

- If a non-delphinid cetacean or delphinid cetacean or pinniped is sighted at or within the established exclusion zone, an immediate shutdown of the survey equipment is required (except in cases of voluntary approach [e.g. bow-riding]) unless take has been authorized for that species and the allocated take has not been met. Subsequent restart of the electromechanical survey equipment must use the ramp-up procedures described above and may only occur following clearance of the exclusion zone as described in Section 11.5.

- If the HRG sound source shuts down for reasons other than encroachment into the exclusion zone by a non-delphinid cetacean or delphinid cetacean or pinniped, including but not limited to a mechanical or electronic failure, resulting in in the cessation of sound source for a period

greater than 20 minutes, a restart for the HRG survey equipment is required using the full ramp-up procedures and clearance of the exclusion zone of all cetaceans and pinnipeds for 30 minutes. If the pause is fewer than 20 minutes, the equipment may be restarted as soon as practicable at its operational level as long as visual surveys were continued diligently throughout the silent period and the exclusion zone remained clear of cetaceans and pinnipeds. If the visual surveys were not continued diligently during the pause of 20 minutes or fewer, a restart for the HRG survey equipment is required using the full ramp-up procedures and clearance of the exclusion zone for all cetaceans and pinnipeds for 30 minutes.

- If a species for which authorization has not been granted, or a species for which authorization has been granted but the authorized number of takes have been met approaches or is observed within an exclusion zone, shutdown will occur.

12.0 ARCTIC PLAN OF COOPERATION

Potential impacts to species or stocks of marine mammals will be limited to individuals of marine mammal species located in the Mid-Atlantic region of the U.S. and will not affect Arctic marine mammals. Given that the Project is not located in Arctic waters, the activities associated with the Applicant's marine characterization surveys will not have an adverse effect on the availability of marine mammals for subsistence uses allowable under the MMPA.

13.0 MONITORING AND REPORTING

13.1 Monitoring

A visual monitoring protocol is described in Section11.4.

13.2 Reporting

The Applicant will provide the following reports as necessary during construction activities:

- The Applicant will contact BOEM and NOAA Fisheries within 24 hours of the commencement of survey activities and again within 24 hours of the completion of the activity;

- Any observed significant behavioral reactions (e.g., animals departing the area) or injury or mortality to any marine mammals must be reported to BOEM and NOAA Fisheries within 24 hours of observation. Dead or injured protected species (e.g., marine mammals, sea turtles, and sturgeon) are reported to NOAA Fisheries Southeast Region's Stranding Hotline (877-942-5343) within 24 hours of sighting, regardless of whether the injury is caused by a vessel. In addition, if the injury of death was caused by a collision with a project related vessel, the Applicant must ensure that BOEM and NOAA Fisheries are notified of the strike within 24 hours. The Applicant must use the form included as Appendix A to Addendum C of the Lease to report the sighting or incident. If the Applicant is responsible for the injury or death, the vessel must assist with any salvage effort as requested by NOAA Fisheries; and

- Within 90 days after completion of the marine site characterization survey activities, a final technical report will be provided to BOEM and NOAA Fisheries that fully documents the

methods and monitoring protocols, summarizes the data recorded during monitoring, estimates the number of listed marine mammals and sea turtles that may have been taken during survey activities, and provides an interpretation of the results and effectiveness of all monitoring tasks.

14.0 SUGGESTED MEANS OF COORDINATION RESEARCH

All marine mammal data collected by the Applicant during marine characterization survey activities will be provided to NOAA Fisheries, BOEM, and other interested government agencies, and may be made available upon request to educational institutions and environmental groups. These organizations could use the data collected during this period to study ways to reduce incidental taking and evaluate its effects.

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APPENDIX A - NOAA FISHERIES ACOUSTIC MODELING SPREADSHEETS

APPENDIX B - PROTECTED SPECIES OBSERVER FLOWCHART