Appendix C. High-Resolution Geophysical Surveys Take Estimate Memorandum

Memorandum

To:	Maria Hartnett, Principal
From:	Jeff Nield, Senior Project Manager & New England Practice Leader Caitlin Pfeil, Environmental Scientist
Date:	September 21, 2022
Reference:	Take Estimates from High-Resolution Geophysical Surveys for the Letter of Authorization
EDR Project No:	20043

This memorandum serves to provide Jasco with estimated takes of marine mammals from high-resolution geophysical surveys that will be conducted for the development of Atlantic Shores Offshore Wind, LLC's (Atlantic Shores) offshore wind energy generation project (the Project). Atlantic Shores proposes to conduct high-resolution geophysical (HRG) and geotechnical surveys within the approximately 589,511- acre survey area. The Survey Area extends from the coastline out to a maximum distance of approximately 24 nautical miles (nm). As depicted in Figure 1, the Survey Area generally spans from Wall Township, New Jersey to Atlantic City, New Jersey.

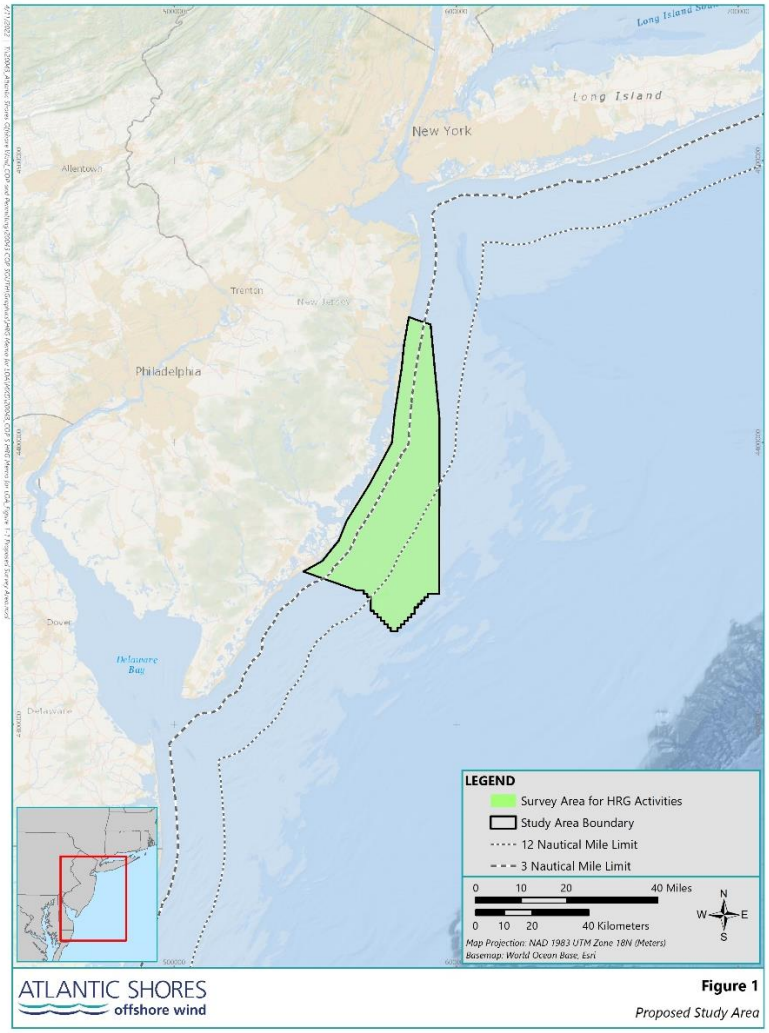

Figure 1
Proposed Study Area

The purpose of the HRG and geotechnical surveys is to:

- Support the site characterization, siting, and engineering design of offshore Project facilities including wind turbine generators, offshore substation(s), and submarine cables within the Survey Area; and
- Collect the data necessary to support Project review requirements associated with 30 C.F.R. § 585 and the National Environmental Policy Act.

National Oceanic and Atmospheric Administration (NOAA) Fisheries Greater Atlantic Regional Office (GARFO) programmatic consultation regarding geophysical and geotechnical surveys along the U.S. Atlantic coast in the three Atlantic Renewable Energy Regions (i.e., 2021 NOAA GARFO Biological Assessment) states that noise form geotechnical surveys are not expect to result in physiological or behavioral responses from Endangered Species Act-listed whales. Based on this opinion and other agency-published incidental harassment authorizations (IHAs), it is unlikely that

the geotechnical surveys to be conducted by Atlantic Shores (e.g., sample boreholes, deep cone penetration tests [CPTs], and shallow CPTs) will result in Level A or B harassment of marine mammals. Therefore, geotechnical survey activities are not discussed in further detail.

The following sections of this memorandum focus on the type of proposed HRG survey activities, representative examples of equipment, and calculated Level B take of marine mammals.

HRG Survey Activities

The HRG survey activities that have been proposed in the Survey Area will include the following:

- Depth sounding (multibeam depth sounder and single beam echosounder) to determine water depths and general bottom topography (currently estimated to range from approximately 16 feet (ft) (5 meters [m] to 131 ft [40 m] in depth);
- Magnetic intensity measurements (gradiometer) for detecting local variations in regional magnetic field from geological strata and potential ferrous objects on and below the bottom;
- Seafloor imaging (side scan sonar survey) for seabed sediment classification purposes, to identify natural and man-made acoustic targets resting on the bottom as well as any anomalous features;
- Shallow penetration sub-bottom profiler (pinger/chirp) to map the near surface stratigraphy (top 0 ft to 16 ft [0 m to 5 m] soils below seabed); and,
- Medium penetration sub-bottom profiler (chirps/parametric profilers/sparkers) to map deeper subsurface stratigraphy as needed (soils down to 246 ft [75 m] to 328 ft [100 m] below seabed).
- Grab sampling to validate seabed classification using typical sample sizes between 0.1 square meters (m^2) and 0.2 m^2.

The HRG survey equipment to be used in each of the identified Survey Areas will be similar to the HRG survey equipment used to support Atlantic Shores in 2020, 2021 and 2022 surveys and other offshore wind development projects along the Atlantic Coast that have been previously approved by both NOAA Fisheries and Bureau of Ocean Energy Management (BOEM). Geophysical surveys are expected to last for 60 days.

Atlantic Shores has evaluated a range of possible HRG survey equipment that would be necessary to support seabed assessments across the Survey Area during the specified timeframe associated with the proposed activities. This evaluation has been based on both the technical and regulatory requirements for project development as well as the type of survey equipment that has been recently deployed in support of offshore wind projects along the Atlantic Coast. The categories of representative HRG survey equipment with operating frequencies <180 kilohertz (kHz) that are

anticipated for use are presented in Table 1. This equipment will either be mounted to or towed behind the survey vessel at a typical survey speed of approximately 3.5 knots (6.5 km) per hour.

Operational parameters presented in Table 1 were obtained from the following sources: Crocker and Fratantonio (2016); manufacturer specifications; personal communication with manufacturers; agency correspondence; and Atlantic Shores. The operational source level, frequency, and beamwidth were used in the NOAA Fisheries Level B spreadsheet tool for calculating the distance to the Level B threshold. Manufacturer specifications are included in Attachment A.

Table 1. Representative Equipment Specification with operating Frequencies Below 180 kHz

HRG Survey Equipment (Sub-Bottom Profiler)	Representative Equipment Type	Operating Frequencies Ranges (kHz)	Operational Source Level Ranges (dB_{RMS})	Beamwidth Ranges (degree)	Typical Pulse Durations RMS_{90} (millisec)	Pulse Repetition Rate (Hz)
Sparker	Applied Acoustics Dura-Spark 240	0.01 to 1.9[a]	203[a]	180	3.4[a]	2
	Geo Marine Geo-Source	0.2 to 5[b]	195[b]	180	7.2[b]	0.41
Chirp	Edgetech 2000-DSS	2 to 16[b]	195[c]	24[d]	6.3	10
	Edgetech 216	2 to 16	179[e]	17, 20, or 24	10	10
	Edgetech 424	4 to 24[f]	180[f]	71[f]	4	2
	Edgetech 512i	0.7 to 12[f]	179[f]	80[f]	9	8
	Pangeosubsea Sub-Bottom Imager™	4 to 12.5[d]	190[d,g]	120[d]	4.5	44
	INNOMAR SES-2000 Medium-100 Parametric [h]	85 to 115[d]	241[i]	2[d]	2	40
	INNOMAR deep -36 Parametric [h]	30 to 42	245	1.5	0.15 to 5	40

Notes:

a) The operational source level for the Dura-Spark 240 is assigned based on the value closest to the field operational history of the Dura-Spark 240 [operating between 500 – 600 J] found in Table 10 in Crocker and Fratantonio (2016), which reports a 203 dB_{RMS} for 500 J source setting and 400 tips. Because Crocker and Fratantonio (2016) did not provide other source levels for the Dura-Spark 240 near the known operational range, the SIG ELC 820 @750 J at 5m depth assuming an omnidirectional beam width was considered as a proxy or comparison to the Dura-Spark 240. The corresponding 203 dB_{RMS} level is considered a realistic and conservative value that aligns with the history of operations of the Dura-Spark 240 over three years of survey by Atlantic Shores. Operational information provided by Atlantic Shores. Geo Marine Survey System operating at 400J.

b) Gene Andella (Edgetech), personal conversation with JASCO Applied Sciences, 2019-07-29.

c) Manufacturer specifications and/or correspondence with manufacturer.

d) Considered EdgeTech Chirp as a proxy source for levels as the Chirp512i has similar operation settings as the Chirp 2000-DSS tow vehicle. See Table 18 in Crocker and Fratantonio (2016) for source levels for 100% power and 2-12 kHz.
e) Values from Crocker and Fratantonio (2016) for 100% power and comparable bandwidth.
f) For frequency of 4 kHz
g) Based on personal communication with Benjamin Laws, NOAA Fisheries (2022a and 2022b), NOAA Fisheries does not expect take from these parametric sub-bottom profilers due to their lower frequencies and extremely narrow beamwidth. Therefore, these sources were not considered in calculating the maximum r value for the ZOI calculation.
h) The specification sheet indicates a peak source level of 247 dB re 1 µPa m (Jens Wunderlich, Innomar, personal communication, 7-18-2019). The average difference between the peak SPL source levels for sub-bottom profilers measured by Crocker and Fratantonio (2016) was 6 dB. We therefore estimate the SPL source level is 241 dB re 1 µPa m.

Previous Atlantic Shores survey experience with the Applied Acoustics Dura-Spark indicates that the necessary electrical input of this sparker is approximately 500 - 600 joules (J). Only in seafloor areas where very dense substrates are encountered would a higher level of electrical input be used, which has not been the case thus far. For the purposes of estimating Level B Harassment takes from sparker operation, Atlantic Shores consulted NOAA Fisheries staff, published IHAs, NOAA GARFO (2021) and Crocker and Fratantonio (2016) to identify a source level value that considers the use of the Applied Acoustics Dura-Spark that is not overly conservative. Crocker and Fratantonio (2016) reports for the Applied Acoustics Dura-Spark a source level of 203 dB_{RMS} for 500 J electrical input using 400 tips. The SIG ELC 820 was selected as a comparison to the Applied Acoustics Dura-Spark. As indicated in Table 1, the maximum reported [RMS] source level of 203 dB re 1µPa@1m for the SIG ELC 820 operating at 750 J at a depth of 5 meters provides another point of reference from the Crocker and Fratantonio (2016) report.

Some of the equipment expected to be operated during certain survey activities are not considered impactful to marine mammals and were not included in Table 1. These include single beam depth echosounders which are not believed to result in take of marine mammals; gradiometers which generate no acoustic output and do not pose risk of take to marine mammals; and side scan sonar and multibeam echosounders operated at frequencies above 180 kHz which are outside the general hearing range of most marine mammals (pers comm. Benjamin Laws, NOAA Fisheries, 2021a; CSA Ocean Sciences Inc 2021; NOAA 2018). Of the HRG survey equipment expected to be operated during the survey campaign, only the sparkers and non-impulsive, nonparametric sub-bottom profilers generate the sound with characteristics that have the potential to result in the non-lethal take of exposed marine mammals.

Due to the implementation of mitigation and monitoring measures, in combination with the behavior of marine mammal species (i.e., their transient nature and their ability to move away from the source of potential harassment), it is unlikely that these pieces of equipment will result

in the Level A harassment of marine mammals. This conclusion has been supported by both BOEM and NOAA Fisheries through published literature and agency communications from past Atlantic Shores IHA applications. Given the discrete frequency bands and small area of sound propagation emitted from HRG equipment, BOEM has concluded that injury to marine mammals (i.e., Level A harassment) is not expected as sound diminishes rapidly from the equipment (BOEM, 2018). Therefore, Level A take calculations have not been performed and Level A take has not been requested for any marine mammal species. Atlantic Shores is only requesting authorization for the incidental take of small numbers of marine mammals within each of the Survey Areas by Level B harassment. Estimates of Level B take are provided in the following section.

Take Estimates for Marine Mammals

To determine the type of take that could result from the operation of the HRG survey equipment operating below 180 kHz throughout the survey period, Atlantic Shores followed the interim recommendations provided by NOAA Fisheries (2020) and the NOAA Fisheries HRG Level B Impact Distance Calculation spreadsheet (pers comm. Benjamin Laws, NOAA Fisheries, 2022c) to estimate the maximum horizontal distance to the Level B marine mammal acoustic harassment threshold for impulsive noise (160 $dB_{RMS90\%}$ re 1 µPa) based on equipment source specifications. Results of this assessment are provided in Table 2 and Attachment B.

Table 2. Maximum Distances to Level B 160 $dB_{RMS90\%}$ Threshold by Equipment Type Operating Below 180 kHz

HRG Survey Equipment (Sub-Bottom Profiler)	Representative Equipment Type	Operating Frequencies Ranges (kHz)	Operational Source Level Ranges (dB_{RMS})	Beamwidth Ranges (degree)	Distance to Level B Threshold (m)
Sparker	Applied Acoustics Dura-Spark 240	0.01 to 1.9	203	180	141
	Geo Marine Geo-Source	0.2 to 5	195	180	56
Chirp	Edgetech 2000-DSS	2 to 16	195	24	56
	Edgetech 216	2 to 16	179	17, 20, or 24	9
	Edgetech 424	4 to 24	180	71	10
	Edgetech 512i	0.7 to 12	179	80	9
	Pangeosubsea Sub-Bottom Imager™	4 to 12.5	190	120	32

As evidenced in Table 2, the maximum distance to the Level B harassment threshold is 463 ft (141 m) and results from use of the Applied Acoustics Dura-Spark sparker equipment. This distance

was used as the "*r*" input in calculating the zone of influence (ZOI), which in turn is used to calculate estimated takes of marine mammals. It is unlikely that the sound source (sparker) resulting in the maximum possible impact as presented in Table 2 will be used over the entire duration of the 60-day survey period in the Survey Area. As such, the assessment included herein is based on conservative assumptions and provides a cautious approach to predicting active survey operations and their potential impact on marine mammal species.

Atlantic Shores proposes the potential take of small numbers of marine mammals by Level B harassment in the specified areas where the proposed activities will occur (Figure 1). Anticipated impacts to marine mammals from the proposed survey activities will be associated with noise propagation from the use of specific HRG survey equipment deployed to meet the goals of the survey campaigns conducted over the 60-day period. The following sections present the basis for estimating take and associated request for take related to planned HRG surveys.

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

To provide flexibility in the design, selection, and execution of the survey campaign (including choice of equipment) and to maximize protection of marine mammals from survey activities, the following conservative (i.e., maximum or upper-end) parameters to estimate the potential for take:

- Maximum number of days of survey that could occur over a 60-day period in each of the identified Survey Areas;
- Maximum distance each vessel could travel per 24-hour period in each of the identified Survey Areas;
- Maximum ensonified area (ZOI) from the equipment listed in Table 2; and
- Maximum average marine mammal densities for any given season that a survey could occur.

The following sections provide additional details on how each of these parameters have been applied to calculate the maximum ZOI associated with the planned survey activities in each survey area, along with estimates and associated requests for take.

Calculation of Maximum ZOI

The ZOI is the maximum ensonified area around the sound source over a 24-hour period. The following formula for a mobile source was used to calculate the ZOI:

$$Mobile\ Source\ ZOI = (Distance/day \times 2r) + \pi r^2$$

Where:

Distance/day = the maximum distance a survey vessel could travel in a 24-hour period;

r = the maximum radial distance from a given sound source to the NOAA Level A or Level B harassment thresholds.

For the purpose of the Atlantic Shores HRG surveys, the total distance/day has been estimated to be approximately 34.2 mi (55.0 km) in the Survey Area (see Table 3). This estimated distance per day has taken into consideration not only the line-kilometers per day achieved during Atlantic Shores' surveys to date, but also data inputs from previous offshore wind and oil and gas surveys performed by members of the Atlantic Shores Geoscience Team.

To calculate a conservative ZOI, Atlantic Shores applied the maximum radial distance ("*r*") for any category and type of HRG survey equipment considered in its assessment to the mobile source ZOI calculation. Following the methods in the interim recommendations provided by NOAA Fisheries (2020) and the results from the NOAA Fisheries HRG Level B Impact Distance Calculation spreadsheet, the maximum calculated distance to the Level B harassment threshold for any category and type of HRG survey equipment that could be operated is the sparker at 462.6 ft (141 m; Table 3 and Attachment B). As such, the ZOI for the sparker was applied as the maximum assumption.

Results of the maximum mobile source ZOI calculations are provided in Table 6-2.

Table 3. HRG Survey Area Distances and ZOI

Survey Area	Number of Active Survey Days	Survey distances per day (km)	Maximum Radial Distance (r) (m)	Calculated ZOI per day (km^2)
Survey Area	60	55	141	15.57

It should be noted that the maximum ZOI calculation for mobile sources results in a conservative ZOI because:

- it uses the sparker, which produces the largest Level B ZOI, as the basis for the take estimates and assumes it is operational for 100% of the survey effort[1]; and
- this ZOI is a representation of the maximum extent of the ensonified area around a sound source over a 24-hour period.

Estimate of Numbers of Potential Marine Mammal Takes by Harassment

[1] Though take estimates account for operation of the sparker during all survey campaigns, Atlantic Shores and their contractor report that it is more likely that the sparker will only be used during 80% of survey campaigns. Thus, using the sparker to calculate take estimates for the entirety of surveying provides conservative take values.

Estimates of take are computed according to the following formula:

$$Estimated\ Take = D \times ZOI \times (d).$$

Where:

D = average highest marine mammal species density (number per km^2)
ZOI = maximum ensonified area (as summarized in Table 3)
d = number of survey days (as summarized in 3)

The data used as the basis for estimating species density "*D*" for the Survey Areas were derived from data provided by Duke University's Marine Geospatial Ecology Lab and the Marine-life Data and Analysis Team. This dataset is a compilation of the best available marine mammal data (1992-2019) and was prepared in a collaboration between Duke University, Northeast Regional Planning Body, University of North Carolina Wilmington, the Virginia Aquarium and Marine Science Center, and NOAA (Roberts et al. 2016a; Curtice et al. 2018). To determine seasonal densities of marine mammal species in each of the survey areas, density data from Roberts et al. (2016b, 2017, 2018, 2021) were mapped within the boundary of each survey area using geographic information systems (GIS). For each survey area, the densities as reported by Roberts et al. (2016b, 2017, 2018, 2021), were averaged by season (spring [March-May], summer [June – August], fall [September – November], and winter [December – February]). To support the most conservative estimates of take over a 12-month period, Atlantic Shores applied the maximum average seasonal density values for each marine mammal to the calculation. The seasonal densities for the Survey Area are provided in Attachment C. Maximum average densities used to support the calculations of take are presented in bold. Table 4 provides a summary of total take for the Survey Area. It should be noted that calculations do not consider whether a single animal is exposed multiple times or whether each exposure is a different animal. Therefore, the numbers summarized in Table 4 are the maximum estimates for animals that may be harassed during the HRG surveys (i.e., Atlantic Shores assumes that each exposure event is a different animal).

Recently, these data have been updated with new modeling results and include density estimates for pinnipeds (Roberts et al. 2016b, 2017, 2018, 2021). Pinniped density data (as presented in Roberts et al. 2016b, 2017, 2018) were used to estimate pinniped densities within the identified Survey Areas. For pinnipeds, because the seasonality of, and habitat use by, gray seals roughly overlap with harbor seals, the same estimated abundance has been applied to both gray and harbor seals. Pinniped density data (as presented in Roberts et al. 2016b; 2017; 2018) were used to estimate pinniped numbers presented in Table 4. These data, as presented by Roberts et al. (2016b; 2017; 2018) do not differentiate between pinniped species.

For bottlenose dolphin densities, Roberts et al. (2016b, 2017, 2018) does not differentiate by individual stock. Given the northern migratory coastal stock propensity to be found shallower than the 65.6 ft (20 m) depth isobath between Assateague, Virginia and Long Island, New York (Reeves et al. 2002; Hayes et al. 2018), the Survey Area was roughly divided along the 65.6 ft (20 m) depth isobath, which roughly corresponds to the 10-fathom contour on NOAA navigation charts. Roughly 33% of Survey Area is 65.6 ft (20 m) or less in depth. Therefore, to account for the potential for mixed stocks within Survey Area, 33% of the estimated take calculation for bottlenose dolphins was applied to the northern migratory coastal stock and the remaining was applied to the western North Atlantic offshore stock.

Some take estimates have been adjusted based on species behavior and typical pod size. For the short-beaked common dolphin, estimated takes were adjusted to reflect field observations collected by PSOs during the 2020 survey season. According to an RPS report (2021) which examined Level B exposure from 2020 survey activities of short-beaked common dolphin, PSOs observed voluntary approach behavior and strong seasonal abundance trends, which resulted in larger exposure accumulation than calculated take results which depended on density data. If Atlantic Shores calculated the estimated take using the density-based take equation, the result would be 21 individuals. However, PSO reporting from previous Atlantic Shores survey activities (2020 – 2022) include common dolphin detection events where several dolphins were observed during each detection event. Based on previous common dolphin detection events during the 2020 survey campaign, and the observed average pod size of 7 animals, a request of 147 common dolphins is being made (i.e., 21 takes based on predicted density multiplied by an average pod size of 7).

Requested take estimates were also adjusted to account for typical group size of long-finned pilot whale, Atlantic spotted dolphin, and Risso's dolphin. While Level B harassment take is unlikely due to the required mitigation measures (e.g., shutdown/power-down if an animal enters the Level B harassment isopleths), a total of 20 takes of pilot whales, 50 takes of Atlantic spotted dolphin, and 30 takes of Risso's dolphin are requested based on past NMFS IHAs issued for Atlantic Shores Offshore Wind and typical group sizes (Atlantic Shores Offshore Wind 2021). Group sizes for pilot whales, Atlantic spotted dolphins, and Risso's dolphins were determined using species profiles published on the NOAA Fisheries website and publish literature. Adding these additional takes ensures the number of takes authorized is at least equal to the average group size.

While Table 4 provides estimates of take over the entire survey schedule, not all HRG equipment will be in operation for the entire duration. Yet, to provide maximum operational flexibility, this analysis assumes that the sound source that could result in the largest Level B ZOI (sparker) would be used for the entire duration and in all locations. However, it should be noted that, based on

past experience by Atlantic Shores, the sparker is estimated to be used only 80% of the time during the surveys. The remaining 20% of survey time will use other equipment that result in a smaller Level B ZOI. Because the equipment resulting in the maximum-case ZOI would not be used during all survey campaigns in each survey area, the calculated take represents a conservative number. In addition, for delphinoid cetaceans, HRG survey equipment can continue operating if the individuals voluntarily approach the vessel (e.g., to bow ride) when the sound sources are at full operating power. Therefore, the determination of "voluntary" approach will effectively reduce the numbers and percent population affected for delphinoid cetaceans, below estimated values.

Table 4. Total Maximum Average Seasonal Density of Marine Mammals and Total Estimated Level B Harassment Table Numbers

Species		Survey Area		Total Takes	
		Max. Seasonal Density (No./100 km^2)	Calculated Take (No.)	Adjusted Take Authorization (No.)	Percent of Population
North Atlantic right whale		0.321	3	3	0.79%
Humpback whale		0.082	1	1	0.06%
Fin whale		0.079	1	1	0.01%
Sei whale		0.003	1	2	<0.01%
Minke whale		0.037	1	1	<0.01%
Sperm whale		0.009	1	1	<0.01%
Long-finned pilot whale		0.025	1	20[d]	0.05%
Bottlenose dolphin	N. Coastal Migratory	29.295	90	90	1.36%
	Offshore	29.295	182	182	0.29%
Short beaked common dolphin		2.247	21	147	0.21%
Atlantic white-sided dolphin		0.332	3	3	<0.01%
Atlantic spotted dolphin		0.062	1	50[d]	0.13%
Risso's dolphin		0.006	1	30[d]	0.09%
Harbor porpoise		3.035	29	29	0.03%
Harbor seal [b]		4.409	41	41	0.05%
Gray seal [b]		4.409	41	41	0.15%

Notes:

a) Cetacean density values from Duke University (Roberts et al. 2016b, 2017, 2018, 2021). It is worth noting that NARW density data was updated in 2021, yielding higher density values than the previous 2017 dataset. This change is attributed to inclusion of three new datasets: 2011-2015 Northeast Large Pelagic Survey Cooperative, 2017-2018 Marine Mammal Surveys of the Wind Energy Areas conducted by the New England Aquarium, and 2017-2018 New York Bight Whale Monitoring Program surveys conducted by the

NYSDEC, all of which show distribution changes that are likely influenced by oceanographic and prey covariates in the whale density model (Roberts et.al. 2021).

b) Pinniped density values from Duke University (Roberts et al. 2016, 2017, 2018) reported as "seals" and not species-specific.

c) Atlantic Shores is requesting one additional sei whale take for a total of two animals based on an encounter during 2020 survey operations where a single sei whale surfaced inside the Level B exposure zone resulting in a take.

d) The number of authorized takes (Level B harassment only) for these species has been increased from the calculated take to consider that more than one individual is normally detected during each detection event and mean species group size. Source for long-finned and short-fined pilot whale estimate is NOAA's Species Directory (NOAA 2022a). Source for Atlantic spotted dolphin group size estimate is Jefferson et al. (2008). Source for Risso's dolphin group size estimate is NOAA Species Directory (NOAA 2022a).

References

Atlantic Shores Offshore Wind. 2021. Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf, OCS-A 0499 – Incidental Harassment Authorization Renewal. Submitted March 2, 2021

BOEM. 2018. Geological and Geophysical Surveys. Available at: https://www.boem.gov/sites/default/files/about-boem/BOEM-Regions/Atlantic-Region/GandG-Overview.pdf.

Crocker, S.E., and F.D. Fratantonio. 2016. Characteristics of Sounds Emitted During High-Resolution Marine Geophysical Surveys. Naval Undersea Warfare Center Division (Sponsored by BOEM & USGS).

CSA Ocean Sciences Inc. 2021. Application for incidental harassment authorization for the non-lethal taking of marine mammals: site characterization surveys Lease OCS-A 0498. Submitted November 2020. Updated March 2021.

Curtice C., J. Cleary, E. Shumchenia, and P.N. Halpin. 2018. Marine-life Data and Analysis Team (MDAT) technical report on the methods and development of marine-life data to support regional ocean planning and management. Prepared on behalf of the Marine-life Data and Analysis Team (MDAT). Accessed at: http://seamap.env.duke.edu/models/MDAT/MDAT-Technical-Report.pdf.

NOAA Fisheries. 2018. 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. Office of Protected Resources. NOAA Technical Memorandum NMFS – OPR – 59.

NOAA Fisheries. 2020. Interim Recommendation for Sound Source Level and Propagation Analysis for High Resolution Geophysical (HRG) Sources. Version 4.0. Available at: https://www.researchgate.net/publication/341822965_INTERIM_RECOMMENDATION_FOR_SOUND_SOURCE_LEVEL_AND_PROPAGATION_ANALYSIS_FOR_HIGH_RESOLUTION_GEOPHYSICAL_HRG_SOURCES. Access April 2022.

NOAA Fisheries. 2021. Data Collection and Site Survey Activities Programmatic Informal consultation-NMFS-2021. Available at: https://www.boem.gov/sites/default/files/documents/renewable-energy/OSW-surveys-NLAA-programmatic.pdf.

NOAA Fisheries. 2022a. Species Directory. Available at: https://www.fisheries.noaa.gov/species-directory. Accessed July 2021.

NOAA Fisheries. 2022b. Marine Mammal Stock Assessment Reports by Species/Stock. Available at: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-species-stock. Accessed April 2022.

NOAA Fisheries. 2022c. Marine Mammal Acoustic Technical Guidance. Available at: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance. Accessed April 2022.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, and G.G. Lockhart. 2016a. Habitat-based cetacean density models for the U.S. Atlantic and Gulf of Mexico. Scientific Reports 6: 22615. doi: 10.1038/srep22615.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2016b. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2015-2016 (Base Year). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC.

Roberts, J.J., L. Mannocci, and P.N. Halpin. 2017. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1). Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC.

Roberts, J.J.,, L. Mannocci, R.S. Schick, and P.N. Halpin. 2018. Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017-2018 (Opt. Year 2). Document version 1.2. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC.

Roberts, J.J., R.S. Schick, and P.N. Halpin. 2021. Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2020 (Opt. Year 4). Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC.

RPS. 2021. Atlantic Shores OCS-A 0499: Common Dolphin Level B Exposure Report. Published by RPS for Atlantic Shores. February 2021.

RPS. 2022. Atlantic Shores Lease Areas. FUGRO Enterprise PAM / PSO Daily Summary Report 13 April 2022. PSO: Jo-Ann Sookar, Celine Ramsarran, Chelsea Twohy, Neftali Bonfil, Fritz Smith