

Empire Offshore Wind: Empire Wind Project (EW 1 and EW 2)

Request for Rulemaking and Letter of Authorization for Taking of Marine Mammals Incidental to Construction Activities on the Outer Continental Shelf (OCS) within Lease OCS-A 0512 and Associated Submarine Export Cable Routes: Roberts and Halpin 2022 Revision Addendum

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TABLE OF CONTENTS

1.	LETTER OF AUTHORIZATION APPLICATION ADDENDUM.....	1
1.1	Foundation Installation.....	1
1.1.1	Estimate of Potential Project Impact Pile Driving Takes by Harassment	1
1.2	Cable Landfall and Marina Activities.....	10
1.2.1	Estimate of Potential Cofferdam Vibratory Pile Driving and Marina Activity Takes by Harassment.....	10
1.3	HRG Survey Activities.....	13
1.3.1	Estimate of Potential HRG Survey Takes by Level B Harassment.....	13
1.4	Total Requested Harassment Take	17
1.4.1	Summary of Annual Totals of Requested Harassment Take.....	17
2.	REFERENCES.....	21

FIGURES

Figure 1	Marine mammal (e.g., NARW) density map showing highlighted grid cells used to calculate mean monthly species estimates within a 10 km buffer around Lease Area OCS-A 0512 (Roberts and Halpin 2022).	5
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TABLES

Table 1	Mean Monthly Marine Mammal Density Estimates Within a 10 km Buffer Around OCS-A 0512 Lease Area	3
Table 2	Calculated Exposures by Level A and Level B Harassment Resulting from Wind Turbine and Offshore Substation Foundation Installation Impact Pile Driving (Year 1: 2025)	7
Table 3	Calculated Exposures by Level A and Level B Harassment Resulting from Wind Turbine and Offshore Substation Foundation Installation Impact Pile Driving Installation (Year 2: 2026)	8
Table 4	Requested Takes by Level A and Level B Harassment Resulting from Wind Turbine and Offshore Substation Foundation Installation Impact Pile Driving (Total).....	9
Table 5	Average Marine Mammal Densities Used in Exposure Estimates and Estimates of Potential Takes by Level B Harassment from Cofferdam Vibratory Pile Driving	11
Table 6	Average Marine Mammal Densities Used in Exposure Estimates and Estimates of Potential Takes by Level B Harassment from Marina Pile Driving	12
Table 7	Marine Mammal Densities Used in Exposure Estimates and Estimated Takes by Level B Harassment from HRG Surveys.....	15
Table 8	Summary of Annual Estimated and Requested Takes Across All Project Activities by Level A and Level B Harassment and Percentage of Stock Taken	18
Table 9	Summary of Total Potential Takes Across All Project Activities by Level A and Level B Harassment for the Five Year Authorization.....	20

ACRONYMS AND ABBREVIATIONS

Applicant	Empire
dB	decibel
ESA	Endangered Species Act
HRG	high-resolution geophysical
Km	kilometer
NARW	North Atlantic right whale
NOAA	National Oceanographic and Atmospheric Administration
NOAA Fisheries	NOAA's National Marine Fisheries Service
Project	The offshore wind project for OCS A-0512 proposed by Empire Offshore Wind LLC consisting of Empire Wind 1 (EW 1) and Empire Wind 2 (EW 2).
PSO	Protected Species Observer
SAR	Stock Assessment Report

1. LETTER OF AUTHORIZATION APPLICATION ADDENDUM

Empire Offshore Wind LLC (Empire, the Applicant) prepared this addendum to the Request for Rulemaking and Letter of Authorization (LOA) for Taking of Marine Mammals Incidental to Construction Activities on the Outer Continental Shelf (OCS) within Lease OCS-A 0512 and Associated Submarine Export Cable Routes, dated July 2022, which includes updates to calculated marine mammal exposure estimates and requested takes by incidental harassment. Revisions were performed in response to a request from NOAA Fisheries (15 August 2022) to update calculated marine mammal exposure estimates and requested takes by incidental harassment based on updated marine mammal density data in the Project Area produced by the Duke University Marine Geospatial Ecology Laboratory, which were released on June 24, 2022 and include recently updated model results for North Atlantic right whale (NARW) (Roberts and Halpin 2022). The recently updated density models (version 12) incorporate 2019 and 2020 aerial survey data from the New England Aquarium, NOAA (AMAPPS and NARWSS), and NYS-DEC (NYBWM), among others, and is considered the best available information regarding marine mammal density in the Project Area. The updated model predictions are summarized over three eras, 2003-2020, 2003-2009, and 2010-2020, to reflect the apparent shift in NARW distribution. The modeling conducted in this report relied on the 2010-2020 density predictions, which reflect the highest NARW densities over the three eras described above, and therefore, the most conservative possible approach to exposure calculations for NARW.

This addendum updates Sections 6.1.2.2, 6.2.2, and 6.3.2 in the Request for Rulemaking and Letter of Authorization for Taking of Marine Mammals Incidental to Construction Activities on the Outer Continental Shelf within Lease OCS-A 0512 and Associated Submarine Export Cable Routes, dated July 2022 (LOA application), as described below. Please note, the exposure modeling methodologies as described in Sections 6.1.2.2, 6.2.2, and 6.3.2 of the LOA application have not changed; revisions to modeled exposure estimates and take requests in this addendum are a result of the incorporation of updated marine mammal density data (Roberts and Halpin 2022) and incorporation of group size estimates and Protected Species Observer (PSO) data in take estimates for some species, as described below.

1.1 Foundation Installation

1.1.1 Estimate of Potential Project Impact Pile Driving Takes by Harassment

1.1.1.1 Mean Monthly Marine Mammal Density Estimates

Please refer to Sections 6.1.1 and 6.1.2 of the LOA application for a detailed description of the methodology used to calculate distances to thresholds and exposure estimates. Updated mean monthly marine mammal density estimates (animals per 100 square kilometers [animals/100 km²]) for all species, within a 10 km buffer around the Lease Area, are provided in **Table 1** (Roberts and Halpin 2022).

Densities were calculated within a 10 km buffered polygon around the lease area perimeter. The buffer size was selected as the largest 10 decibel (dB)-attenuated exposure range over all species, scenarios, and threshold criteria rounded up to the nearest 5 km¹. The mean density for each month was determined by calculating the

¹ The buffer size was selected in coordination with NOAA Fisheries and has been increased in this addendum compared to the buffer size used in exposure modeling described in the LOA application to reflect the fact that the most recent marine mammal density data is available for the first time in 5 x 5 km grid cells for all species, whereas previously 5 x 5 km grid cells were available only for NARW while 10 x 10 km grid cells were provided for all other species/taxa. The buffer size selected in exposure modeling in the LOA application was the largest 10 dB-attenuated exposure range over all species, scenarios, and threshold criteria (with the exception of the Wood et al. [2012] thresholds) rounded up to the nearest 0.5 km.

unweighted mean of all 5×5 km grid cells partially or fully within the analysis polygon (**Figure 1**) (Roberts and Halpin 2022). Densities were computed for an entire year to coincide with possible planned activities. In cases where monthly densities were unavailable, annual mean densities were used instead. For long- and short-finned pilot whales (*Globicephala melas* and *Globicephala macrorhynchus*, respectively), monthly densities are unavailable from Roberts and Halpin (2022), so annual mean densities were used. Additionally, Roberts and Halpin (2022) provide density for pilot whales as a guild that includes both species and, since it is very difficult to differentiate species at sea, take numbers for pilot whales are requested at the guild level.

Similarly, densities are provided for seals as a guild consisting primarily of harbor and gray seals (Roberts and Halpin 2022). Gray and harbor seal densities were scaled by relative NOAA Fisheries SARs (Hayes et al. 2022) abundance.

Table 1 Mean Monthly Marine Mammal Density Estimates Within a 10 km Buffer Around OCS-A 0512 Lease Area

Species of Interest	Monthly densities (animals/100 km ²) a/												Annual Mean	May to Dec Mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Fin whale b/	0.172	0.139	0.113	0.137	0.174	0.171	0.157	0.100	0.055	0.040	0.038	0.130	0.119	0.108
Minke whale	0.071	0.060	0.072	0.936	1.485	0.803	0.198	0.107	0.066	0.111	0.026	0.059	0.333	0.357
Humpback whale	0.091	0.061	0.076	0.119	0.133	0.113	0.030	0.022	0.054	0.101	0.130	0.113	0.087	0.087
North Atlantic right whale b/	0.100	0.116	0.115	0.088	0.025	0.006	0.003	0.003	0.004	0.008	0.016	0.050	0.045	0.014
Sei whale b/	0.029	0.016	0.033	0.071	0.055	0.011	0.002	0.002	0.005	0.013	0.037	0.049	0.027	0.022
Atlantic white sided dolphin	0.642	0.399	0.356	0.846	1.373	1.237	0.117	0.049	0.279	0.892	0.863	0.990	0.670	0.725
Atlantic spotted dolphin	0.001	0.000	0.001	0.003	0.010	0.019	0.033	0.072	0.177	0.260	0.133	0.013	0.060	0.090
Short-beaked common dolphin	5.664	1.852	1.246	2.457	3.474	2.835	1.566	1.917	1.623	3.495	7.244	9.177	3.546	3.917
Bottlenose dolphin	0.851	0.247	0.205	0.629	2.005	3.232	3.534	2.953	2.552	2.898	2.772	2.520	2.033	2.808
Risso's dolphin	0.042	0.005	0.003	0.021	0.034	0.014	0.014	0.007	0.008	0.010	0.056	0.186	0.033	0.041

Species of Interest	Monthly densities (animals/100 km ²) a/												Annual Mean	May to Dec Mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Long-finned pilot whale	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028
Short-finned pilot whale	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021
Sperm whale b/	0.007	0.002	0.002	0.004	0.005	0.011	0.011	0.015	0.003	0.000	0.008	0.005	0.006	0.007
Harbor porpoise	5.469	5.730	5.916	7.066	2.421	0.347	0.435	0.215	0.130	0.144	0.342	3.757	2.664	0.974
Gray seals	4.762	4.505	3.689	4.337	5.968	1.093	0.071	0.049	0.104	0.684	1.625	4.407	2.608	1.750
Harbor seals	10.698	10.121	8.289	9.745	13.409	2.456	0.160	0.110	0.233	1.537	3.651	9.902	5.859	3.932

Notes: This table corresponds to **Table 23** in the Request for Rulemaking and Letter of Authorization for Taking of Marine Mammals Incidental to Construction Activities on the Outer Continental Shelf (OCS) within Lease OCS-A 0512 and Associated Submarine Export Cable Routes, dated July 2022.

a/ Density estimates are from habitat-based density modeling of the entire Atlantic Exclusive Economic Zone (Roberts and Halpin 2022).

b/ Listed as Endangered under the Endangered Species Act (ESA).

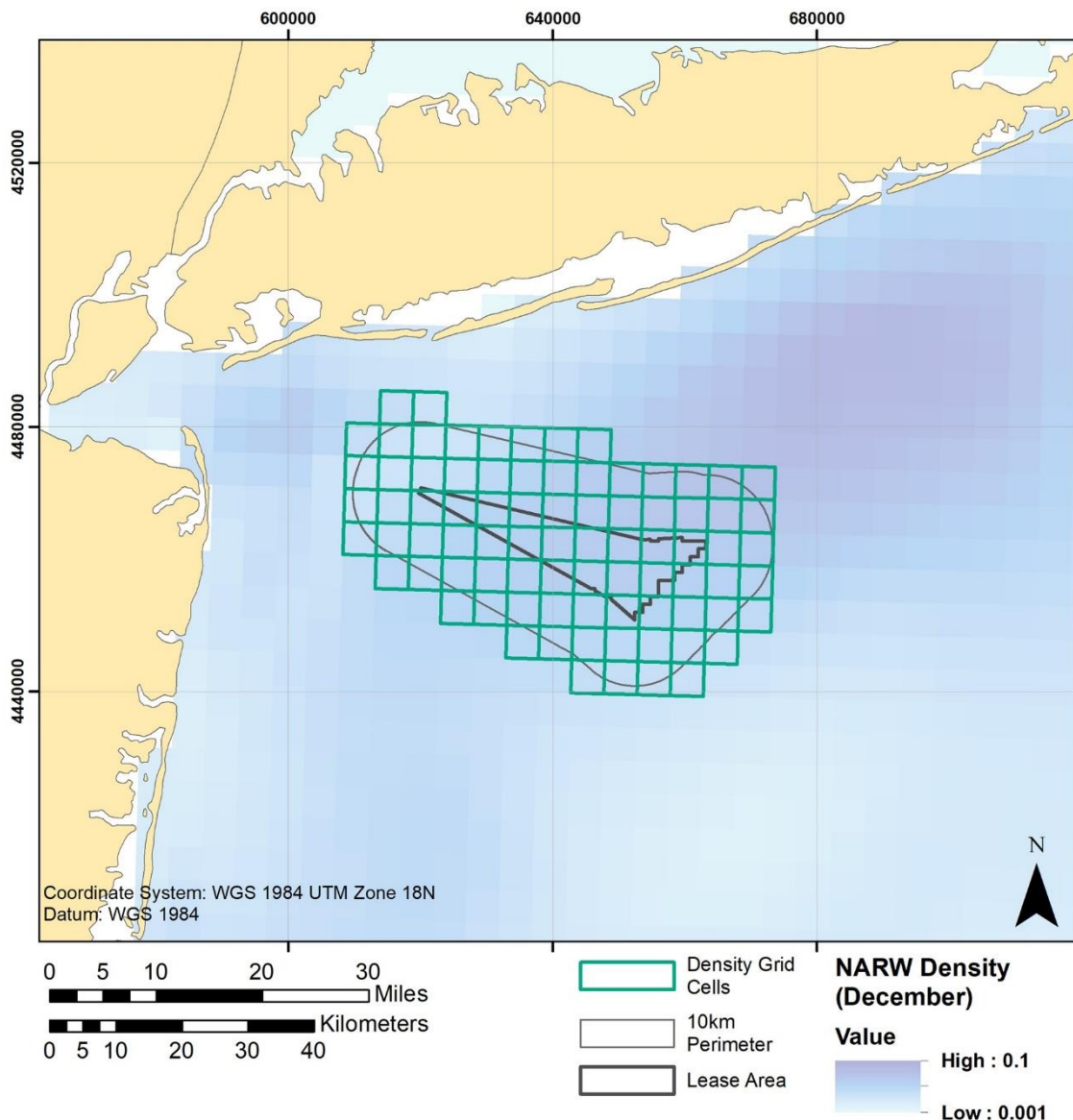


Figure 1 Marine mammal (e.g., NARW) density map showing highlighted grid cells used to calculate mean monthly species estimates within a 10 km buffer around Lease Area OCS-A 0512 (Roberts and Halpin 2022).

Estimates include the mean number of animals predicted to receive sound levels above exposure criteria for each metric (Sound Exposure Level [SEL], peak sound exposure [PK], and sound pressure level [SPL]), assuming 10 dB attenuation (Table 2, Table 3, and Table 4). For full results, including all modeled attenuation levels and both summer and winter sound speed profiles, Appendix A: Empire Wind Acoustic and Exposure Modeling [in Empire Offshore Wind: Empire Wind Project (EW 1 and EW 2) Request for Rulemaking and Letter of Authorization for Taking of Marine Mammals Incidental to Construction Activities on the Outer Continental Shelf (OCS) within Lease OCS-A 0512 and Associated Submarine Export Cable Routes].

As described in Section 6.1.2.3 of the Request for Rulemaking and Letter of Authorization dated July 2022, all possible construction scenarios were modeled (i.e., one monopile/two pin piles per day, one monopile/three pin piles per day, two monopiles/two pin piles per day, and two monopiles/three pin piles per day; Appendix A: Empire Wind Acoustic and Exposure Modeling [in Empire Offshore Wind: Empire Wind Project (EW 1

and EW 2) Request for Rulemaking and Letter of Authorization for Taking of Marine Mammals Incidental to Construction Activities on the Outer Continental Shelf (OCS) within Lease OCS-A 0512 and Associated Submarine Export Cable Routes). The incorporation of updated marine mammal density data (Roberts and Halpin 2022) in exposure modeling resulted in revised exposure estimates for all modeled construction scenarios. Empire reviewed the revised exposure modeling results to ensure the most conservative results were carried forward to the take request. All modeled construction scenarios resulted in modeled NARW exposure numbers that were nearly identical (Appendix A: Empire Wind Acoustic and Exposure Modeling [in Empire Offshore Wind: Empire Wind Project (EW 1 and EW 2) Request for Rulemaking and Letter of Authorization for Taking of Marine Mammals Incidental to Construction Activities on the Outer Continental Shelf (OCS) within Lease OCS-A 0512 and Associated Submarine Export Cable Routes]). Therefore, to be conservative with respect to exposures of all ESA-listed species, the Construction Schedule 1, which represented the construction schedule scenario that resulted in the highest modeled exposure numbers for ESA-listed species other than NARW (i.e., fin and sei whale), was carried forward to the take request. Results for all modeled construction scenarios are provided in Appendix A: Empire Wind Acoustic and Exposure Modeling [in Empire Offshore Wind: Empire Wind Project (EW 1 and EW 2) Request for Rulemaking and Letter of Authorization for Taking of Marine Mammals Incidental to Construction Activities on the Outer Continental Shelf (OCS) within Lease OCS-A 0512 and Associated Submarine Export Cable Routes).

The calculated exposure estimates based on the exposure modeling methodology described in Section 1.1.1 above were compared with the best available information on marine mammal group sizes, and with Empire Wind's PSO sightings data ranging from 2018-2021 for the Project Area, to ensure requested take numbers associated with foundation installation were conservative and based on best available information. As a result of this comparison, it was determined that the calculated number of potential takes by Level B harassment based on the exposure modeling methodology described in Section 1.1.1 above for some species may be underestimates and therefore warranted adjustment to ensure conservatism in requested take numbers.

A review of Empire Wind's PSO sightings data ranging from 2018–2021 for the Project Area indicated that exposure estimates based on the exposure modeling methodology described in Section 1.1.1 above were likely an underestimate for humpback whales, fin whales, and pilot whales (A.I.S. 2019; Alpine Ocean Seismic Survey 2018; Gardline 2021a,b; Geoquip Marine 2021; Marine Ventures International 2021; RPS 2021; Smultea Environmental Sciences 2019, 2020, 2021). PSO sightings data were analyzed to determine the average number of each species sighted per day during high-resolution geophysical (HRG) surveys in the Project Area. Results indicated that the highest average sightings-per-day rate among PSO reports from 2018-2021 was 0.5 humpback whales (Smultea Environmental Sciences 2019), 1.11 fin whales (Alpine Ocean Seismic Survey 2018), and 1.34 pilot whales (Geoquip Marine 2021) sighted per day. These highest daily averages per day were then multiplied by the maximum potential number of days of pile driving associated with wind turbine and offshore substation foundation installation for these species. In the event that one monopile or one pin pile is installed per day, up to 120 days of pile driving (i.e., 96 days of monopile installation and 24 days of pin pile installation) could occur in 2025 and up to 51 days of pile driving (i.e., 51 days of monopile installation) could occur in 2026.

At a rate of 0.5 humpback whales per day, 120 days of pile driving in 2025 resulted in an estimated 60 takes by level B harassment in that year, and 51 days of pile driving in 2026 resulted in an estimated 25.5 (rounded to 26) takes by level B harassment in that year. Since these alternate estimates of take by Level B harassment for humpback whales are higher than numbers calculated based on the exposure analysis method described in Section 1.1.1 (**Table 2** and **Table 3**), to be conservative, the Applicant has requested take by Level B harassment for humpback whales based on this alternate take calculation method (**Table 4**).

At a rate of 1.11 fin whales per day, 120 days of pile driving in 2025 resulted in an estimated 133 takes by level B harassment in that year, and 51 days of pile driving in 2026 resulted in an estimated 56.6 (rounded to 57)

takes by level B harassment in that year. Since these alternate estimates of take by Level B harassment for fin whales are higher than numbers calculated based on the exposure analysis method described in Section 1.1.1 (Table 2 and Table 3), to be conservative, the Applicant has requested take by Level B harassment for fin whales based on this alternate take calculation method (Table 4).

At a rate of 1.34 pilot whales per day, 120 days of pile driving in 2025 resulted in an estimated 160.7 (rounded to 161) takes by level B harassment in that year, and 51 days of pile driving in 2026 resulted in an estimated 68 takes by level B harassment in that year. Since these alternate estimates of take by Level B harassment for pilot whales are higher than numbers calculated based on the exposure analysis method described in Section 1.1.1 (Table 2 and Table 3), to be conservative, the Applicant has requested take by Level B harassment for pilot whales based on this alternate take calculation method (Table 4).

Table 2 Calculated Exposures by Level A and Level B Harassment Resulting from Wind Turbine and Offshore Substation Foundation Installation Impact Pile Driving (Year 1: 2025)

Species	Calculated Take		Calculated Take	Requested Take	Requested Take	
	Injury		Behavior	Injury	Behavior	
	LE	Lpk	Lp a/			
LF	Fin whale b/ c/	1.15	0	8.78	1	133
	Minke whale	3.72	0	65.05	4	65
	Humpback whale c/	0.36	<0.01	8.12	0	60
	North Atlantic right whale b/ f/	0.10	0	2.36	0	11
	Sei whale b/	0.27	<0.01	2.78	0	3
MF	Atlantic white-sided dolphin f/	0	0	116.00	0	416
	Atlantic spotted dolphin d/	0	0	0	0	45
	Short-beaked common dolphin e/	0	0	902.19	0	3,600
	Bottlenose dolphin e/	0	0	226.02	0	1,800
	Risso's dolphin d/	0	0	5.96	0	100
	Pilot whales spp. c/	0	0	0	0	161
	Sperm whale b/ d/	0	0	0.56	0	3
HF	Harbor porpoise	0	0.09	133.70	0	134
PW	Gray seal	0.17	0	162.46	0	162
	Harbor seal	0	0	356.44	0	356

Notes: This table corresponds to Table 25 in the Request for Rulemaking and Letter of Authorization for Taking of Marine Mammals Incidental to Construction Activities on the Outer Continental Shelf (OCS) within Lease OCS-A 0512 and Associated Submarine Export Cable Routes, dated July 2022.

NOAA Fisheries estimates were used as the basis of the requested take.

a/ NOAA Fisheries 2005

b/ Listed as Endangered under the ESA.

c/ Requested take adjusted based on PSO sighting data from 2018-2021 (A.I.S. 2019; Alpine Ocean Seismic Survey 2018; Gardline 2021a,b; Geoquip Marine 2021; Marine Ventures International 2021; RPS 2021; Smultea Environmental Sciences 2019, 2020, 2021).

d/ Requested take adjusted based on 1 group size per year as follows: 3 sperm whales (Barkaszi et al. 2019), 45 Atlantic spotted dolphins (Kenney and Vigness-Raposa 2010), and 100 Risso's dolphins (Jefferson et al. 2015).

e/ Requested take adjusted by 1 group size per day as follows: 30 short-beaked common dolphins (Reeves et al. 2002), 15 bottlenose dolphins (Jefferson et al. 2015).

f/ Requested take adjusted by 1 group size per month of 52 Atlantic white-sided dolphins (Jefferson et al. 2015) and 1 (monthly density < 0.01) or 2 (monthly density > 0.01) of North Atlantic right whales (Roberts and Halpin 2022).

Table 3 Calculated Exposures by Level A and Level B Harassment Resulting from Wind Turbine and Offshore Substation Foundation Impact Pile Driving Installation (Year 2: 2026)

Species	Calculated Take		Calculated Take	Requested Take	Requested Take
	Injury		Behavior	Injury	Behavior
	LE	Lpk	Lp a/		
Fin whale b/ c/	0.52	0	4.00	1	57
Minke whale	2.18	0	47.73	2	48
LF Humpback whale c/	0.14	0	3.82	0	26
North Atlantic right whale b/ f/	0.05	0	1.57	0	11
Sei whale b/	0.16	0	1.66	0	2
Atlantic white-sided dolphin f/	0	0	59.23	0	416
Atlantic spotted dolphin d/	0	0	0	0	45
Short-beaked common dolphin e/	0	0	560.75	0	1,530
MF Bottlenose dolphin e/	0	0	110.28	0	765
Risso's dolphin d/	0	0	4.09	0	100
Pilot whale spp c/	0	0	0	0	68
Sperm whale b/ d/	0	0	0.29	0	3
HF Harbor porpoise	0	0	98.43	0	98
Gray seal	0	0	111.95	0	112
PW Harbor seal	0	0	229.89	0	230

Notes: This table corresponds to **Table 26** in the Request for Rulemaking and Letter of Authorization for Taking of Marine Mammals Incidental to Construction Activities on the Outer Continental Shelf (OCS) within Lease OCS-A 0512 and Associated Submarine Export Cable Routes, dated July 2022.

NOAA Fisheries estimates were used as the basis of the requested take.

a/ NOAA Fisheries 2005

b/ Listed as Endangered under the ESA.

c/ Requested take adjusted based on PSO sighting data from 2018-2021 (A.I.S. 2019; Alpine Ocean Seismic Survey 2018; Gardline 2021a,b; Geoquip Marine 2021; Marine Ventures International 2021; RPS 2021; Smultea Environmental Sciences 2019, 2020, 2021).

d/ Requested take adjusted based on 1 group size per year as follows: 3 sperm whales (Barkaszi et al. 2019), 45 Atlantic spotted dolphins (Kenney and Vigness-Raposa 2010), and 100 Risso's dolphins (Jefferson et al. 2015).

e/ Requested take adjusted by 1 group size per day as follows: 30 short-beaked common dolphins (Reeves et al. 2002), 15 bottlenose dolphins (Jefferson et al. 2015).

f/ Requested take adjusted by 1 group size per month of 52 Atlantic white-sided dolphins (Jefferson et al. 2015) and 1 (monthly density < 0.01) or 2 (monthly density > 0.01) of North Atlantic right whales (Roberts and Halpin 2022).

Table 4 Requested Takes by Level A and Level B Harassment Resulting from Wind Turbine and Offshore Substation Foundation Installation Impact Pile Driving (Total)

Species	Requested Takes			
	Injury		Behavior	
	Year 1	Year 2	Year 1	Year 2
Fin whale b/ c/	1	1	133	57
Minke whale	4	2	65	48
LF Humpback whale c/	0	0	60	26
North Atlantic right whale b/ f/	0	0	11	11
Sei whale b/	0	0	3	2
Atlantic white-sided dolphin f/	0	0	416	416
Atlantic spotted dolphin d/	0	0	45	45
Short-beaked common dolphin e/	0	0	3,600	1,530
MF Bottlenose dolphin e/	0	0	1,800	765
Risso's dolphin d/	0	0	100	100
Pilot whale spp. c/	0	0	161	68
Sperm whale b/ d/	0	0	3	3
HF Harbor porpoise	0	0	134	98
PW Gray seal	0	0	162	112
Harbor seal	0	0	356	230

Notes: This table corresponds to **Table 27** in the Request for Rulemaking and Letter of Authorization for Taking of Marine Mammals Incidental to Construction Activities on the Outer Continental Shelf (OCS) within Lease OCS-A 0512 and Associated Submarine Export Cable Routes, dated July 2022.

NOAA Fisheries estimates were used as the basis of the requested take.

a/ NOAA Fisheries 2005

b/ Listed as Endangered under the ESA.

c/ Requested take adjusted based on PSO sighting data from 2018-2021 (A.I.S. 2019; Alpine Ocean Seismic Survey 2018; Gardline 2021a,b; Geoquip Marine 2021; Marine Ventures International 2021; RPS 2021; Smultea Environmental Sciences 2019, 2020, 2021).

d/ Requested take adjusted based on 1 group size per year as follows: 3 sperm whales (Barkaszi et al. 2019), 45 Atlantic spotted dolphins (Kenney and Vigness-Raposa 2010), and 100 Risso's dolphins (Jefferson et al. 2015).

e/ Requested take adjusted by 1 group size per day as follows: 30 short-beaked common dolphins (Reeves et al. 2002), 15 bottlenose dolphins (Jefferson et al. 2015).

f/ Requested take adjusted by 1 group size per month of 52 Atlantic white-sided dolphins (Jefferson et al. 2015) and 1 (monthly density < 0.01) or 2 (monthly density > 0.01) of North Atlantic right whales (Roberts and Halpin 2022).

For certain species for which the methodology described in Section 1.1.1 above may result in potential underestimates of take and Empire Wind's PSO sightings data were relatively low, adjustments to the take request were made based on the best available information on marine mammal group sizes to ensure conservatism. For species considered rare but still have the potential for occurrence in the Project Area, requested take by Level B harassment was adjusted to one group size per year. These include sperm whales (3 individuals; Barkaszi et al. 2019), Atlantic spotted dolphins (45 individuals; Kenney and Vigness-Raposa 2010), and Risso's dolphins (100 individuals; Jefferson et al. 2015).

For species considered relatively common in the Project Area, requested take by Level B harassment was adjusted to one group size per month. These include Atlantic white-sided dolphins (52 individuals, Jefferson et al. 2015) and North Atlantic right whales. The group size determination for North Atlantic right whales was derived based on consultation with NOAA Fisheries. A group size of 1 animal was used for months with mean

monthly densities less than 0.01, while a group size of 2 animals, reflective of the potential for a mother and calf, was used for months with mean monthly densities greater than 0.01 based on the Roberts and Halpin 2022 predictive densities. For the months when pile driving activities may occur (May through December), those criteria result in a group size of 1 animal for the months of June through October and 2 animals for the months of May, November, and December. This group size determination is intended to account for the potential presence of mother-calf pairs.

For species considered common in the Project Area, requested takes by Level B harassment was adjusted to one group size per day. These include short-beaked common dolphins (30 individuals, Reeves et al. 2002), and bottlenose dolphins (15 individuals, Jefferson et al. 2015).

1.2 Cable Landfall and Marina Activities

1.2.1 Estimate of Potential Cofferdam Vibratory Pile Driving and Marina Activity Takes by Harassment

Cofferdam Vibratory Driving

Maximum monthly densities as reported by Roberts and Halpin (2022) were averaged by season over the duration of cofferdam installation/removal (spring [March through May], summer [June through August], fall [September through November], and winter [December through February]). To be conservative, the maximum average seasonal density for each species was then carried forward into the take calculations. Bottlenose dolphin density values from Duke University (Roberts and Halpin 2022) are reported as “bottlenose” and not identified to stock. Given the noise from cofferdam installation would not extend beyond the 20-meter isobath, where the coastal stock predominates, it is expected that all estimated takes by Level B harassment of bottlenose dolphins harassment from cofferdam installation will accrue to the coastal stock. As Roberts and Halpin (2022) does not account for group size, the estimated take was adjusted to account for one group size per day of each of bottlenose and common dolphins (**Table 5**).

As described in the LOA application, due to the presence of several seal haul outs, it was determined the Roberts and Halpin (2022) density data likely underestimated potential seal occurrence; therefore, 10 Level B seal takes per day were estimated (Woo and Biolsi 2018). For pinnipeds, because the seasonality of and habitat use by gray seals roughly overlaps with harbor seals, and the density data as presented by Roberts and Halpin (2022) do not differentiate between pinniped species, the estimated takes were split evenly between harbor and gray seals (**Table 5**). This approach has not changed between the LOA application and this addendum.

Marina Activities

As described in the LOA application, since the acoustic impact of the marina work was minimal (**Table 6**) and densities are not available for the specific inshore region where the activity will occur, potential take by harassment for marine mammals could not be calculated. Instead, to be conservative, 10 takes by Level B harassment of seals per day were estimated (Woo and Biolsi 2018), which were split evenly between harbor and gray seals (**Table 6**). This approach has not changed between the LOA application and this addendum.

Table 5 Average Marine Mammal Densities Used in Exposure Estimates and Estimates of Potential Takes by Level B Harassment from Cofferdam Vibratory Pile Driving

Species	EW 1 Cofferdams (2024)		EW 2 Cofferdams (2024-2025) Totals	
	Average Seasonal Density a/ (No./100 km ²)	Calculated Take (Requested Take) by Level B Harassment	Average Seasonal Density a/ (No./100 km ²)	Calculated Take (Requested Take) by Level B Harassment
North Atlantic Right Whale	0.073	0.020 (0)	0.073	0.020 (0)
Humpback Whale	0.099	0.030 (0)	0.099	0.030 (0)
Fin Whale	0.097	0.030 (0)	0.097	0.030 (0)
Sei Whale	0.030	0.010 (0)	0.030	0.010 (0)
Sperm Whale	0.006	0.000 (0)	0.006	0.000 (0)
Minke Whale	0.526	0.170 (0)	0.526	0.160 (0)
Bottlenose Dolphin (Western North Atlantic Northern Migratory Coastal Stock) b/	6.299	2.030 (180)	6.299	1.900 (270)
Atlantic Spotted Dolphin	0.058	0.020 (0)	0.058	0.020 (0)
Short-Beaked Common Dolphin c/	2.837	0.910 (360)	2.837	0.850 (540)
Atlantic White-sided Dolphin	0.469	0.150 (0)	0.469	0.140 (0)
Risso's Dolphin	0.034	0.010 (0)	0.034	0.010 (0)
Pilot Whale <i>spp.</i> d/	0.019	0.010 (0)	0.019	0.010 (0)
Harbor Porpoise	3.177	1.020 (1)	3.177	0.960 (1)
Harbor Seal e/	13.673	2.200 (60)	13.673	2.060 (90)
Gray Seal e/	13.673	2.200 (60)	13.673	2.060 (90)

Notes: This table corresponds to **Table 34** in the Request for Rulemaking and Letter of Authorization for Taking of Marine Mammals Incidental to Construction Activities on the Outer Continental Shelf (OCS) within Lease OCS-A 0512 and Associated Submarine Export Cable Routes, dated July 2022.

a/ Cetacean density values from Duke University (Roberts and Halpin 2022).

b/ Bottlenose dolphin density values from Duke University (Roberts and Halpin 2022) reported as "bottlenose" and not identified to stock. Given the noise from cofferdam installation would not extend beyond the 20 m isobath, where the coastal stock predominates, it is expected that all estimated takes by Level B harassment of bottlenose dolphins from cofferdam installation will accrue to the coastal stock. As Roberts and Halpin does not account for group size, the requested take was adjusted to account for one group size, 15 individual (Jefferson et al. 2015) per day of bottlenose.

c/ As Roberts et al. does not account for group size, the estimated take was adjusted to account for one group size, 30 individuals (Reeves et al. 2002) per day of each common dolphins.

d/ Pilot whale density values from Duke University (Roberts and Halpin 2022) reported as "Globicephala *spp.*" and not species-specific.

e/ Pinniped density values from Duke University (Roberts and Halpin 2022) are reported as "seals" and are not species-specific, therefore, 50% of expected takes by Level B harassment are expected to accrue to harbor seals and 50% to gray seals. Due to the presence of several seal haul outs in the area, requested level B seal takes were calculated by estimating 10 individuals per day (Woo and Biolsi 2018), divided evenly between harbor seals and gray seals.

Table 6 Average Marine Mammal Densities Used in Exposure Estimates and Estimates of Potential Takes by Level B Harassment from Marina Pile Driving

Species	Marina Work (2024)	
	Average Seasonal Density a/ (No./100 km ²)	Requested Take by Level B Harassment
Bottlenose Dolphin (Western North Atlantic Northern Migratory Coastal Stock) b/	6.299	735
Harbor Seal c/	13.673	245
Gray Seal c/	13.673	245

Notes: This table corresponds to **Table 35** in the Request for Rulemaking and Letter of Authorization for Taking of Marine Mammals Incidental to Construction Activities on the Outer Continental Shelf (OCS) within Lease OCS-A 0512 and Associated Submarine Export Cable Routes, dated July 2022.

a/ Cetacean density values from Duke University (Roberts and Halpin 2022).

b/ Bottlenose dolphin density values from Duke University (Roberts and Halpin 2022) reported as “bottlenose” and not identified to stock. Given the noise from cofferdam installation would not extend beyond the 20 m isobath, where the coastal stock predominates, it is expected that all estimated takes by Level B harassment of bottlenose dolphins from cofferdam installation will accrue to the coastal stock. As Roberts and Halpin does not account for group size, the requested take was adjusted to account for one group size, 15 individual (Jefferson et al. 2015) per day of bottlenose.

c/ Pinniped density values from Duke University (Roberts and Halpin 2022) are reported as “seals” and are not species-specific, therefore, 50% of expected takes by Level B harassment are expected to accrue to harbor seals and 50% to gray seals.

1.3 HRG Survey Activities

1.3.1 Estimate of Potential HRG Survey Takes by Level B Harassment

Please refer to Section 6.3.2 of the LOA application for a description of the methodology and formulas used to calculate the Zone of Influence and the estimated take for HRG survey activities. As described in the LOA application, density data were mapped within the boundary of the Project Area (Figure 1 in the LOA application) using geographic information systems; these data were updated based on the revised data from Roberts and Halpin (2022) (**Table 7**). Maximum monthly densities as reported by Roberts and Halpin (2022) were averaged by season over the survey duration (for winter [December through February]), spring [March through May], summer [June through August], and fall [September through November]) for the entire HRG Project Area. To be conservative, the maximum average seasonal density within the HRG survey schedule, for each species, was then carried forward in the take calculations (**Table 7**).

The calculated exposure estimates based on the exposure modeling methodology described in Section 6.3.2 of the LOA application and described above were compared with the best available information on marine mammal group sizes, and with Empire Wind's PSO sightings data ranging from 2018–2021 for the Project Area, to ensure requested take numbers associated with HRG survey activities were conservative and based on best available information. As a result of this comparison, it was determined that the calculated number of potential takes by Level B harassment based on the exposure modeling methodology described in Section 6.3.2 of the LOA application and described above may be underestimates for some species and therefore warranted adjustment to ensure conservatism in requested take numbers. Despite the relatively small modeled Level B harassment zone (50 m) for HRG survey activities, it was determined that adjustments to the requested numbers of take by Level B harassment for some dolphin species was warranted in some cases to be conservative, based on the expectation that dolphins may approach or bow ride near the survey vessel. No adjustments were made to take requests for large whale species as a result of HRG survey activities due to the relatively small Level B harassment zone (50 m) and the low likelihood that large whales would be encountered within such a short distance of the vessel except in rare circumstances.

A review of Empire Wind's PSO sightings data ranging from 2018–2021 for the Project Area indicated that exposure estimates based on the exposure modeling methodology described in Section 6.3.2 of the LOA application and described above was likely an underestimate for pilot whales. The requested take for pilot whales was adjusted based on PSO data by multiplying the maximum reported daily density (1.34 individuals; Geoquip Marine 2021) by the annual days of operation.

For certain species for which the methodology described above and in Section 6.3.2 of the LOA application may result in potential underestimates of take and Empire Wind's PSO sightings data were relatively low, adjustments to the take request were made based on the best available information on marine mammal group sizes to ensure conservatism. For species considered common in the Project Area, requested takes by Level B harassment was adjusted to one group size per day of HRG surveys; these include bottlenose dolphins² (15 individuals; Jefferson et al. 2015) and common dolphins (30 individuals; Reeves et al. 2002) (note that these adjustments to take estimates were made previously and are included in the LOA application). For species considered relatively common in the Project Area, requested takes by Level B harassment were adjusted to one group size per month of HRG surveys; these include Atlantic white-sided dolphin (52 individuals; Jefferson et

² Bottlenose dolphin density values from Duke University (Roberts and Halpin 2022) are reported as “bottlenose dolphin” and are not identified to stock. HRG survey activities were not differentiated by region relative to the 20 m isobath, and therefore, bottlenose takes are not identified to stock.

al 2015). For species considered rare but that still have the potential for occurrence in the Project Area, requested takes by Level B harassment were adjusted to one group size per year of HRG surveys; these include Atlantic spotted dolphin (45 individuals; Kenney & Vigness-Raposa 2010) and Risso's dolphin (100 individuals; Jefferson et al 2015). No adjustments were deemed necessary to the calculated take estimates for seals (note that the Roberts and Halpin [2022] data do not differentiate by pinniped species; therefore, estimated takes were split evenly between harbor and gray seals).

Table 7 Marine Mammal Densities Used in Exposure Estimates and Estimated Takes by Level B Harassment from HRG Surveys

Species	Average Seasonal Density a/ (No./100 km ²)	HRG Survey 2024	HRG Survey 2025	HRG Survey 2026	HRG Survey 2027	HRG Survey 2028	Totals	
		Calculated Take (No.)	Calculated Take (No.)	Calculated Take (No.)	Calculated Take (No.)	Calculated Take (No.)	Requested Take (No.)	Stock
North Atlantic Right Whale	0.073	0.532	2.480	1.948	1.298	1.298	7	Western North Atlantic
Humpback Whale	0.099	0.722	3.363	2.641	1.761	1.761	11	Gulf of Maine
Fin Whale	0.097	0.707	3.295	2.588	1.725	1.725	11	Western North Atlantic
Sei Whale	0.030	0.219	1.019	0.800	0.534	0.534	4	Nova Scotia
Sperm Whale	0.006	0.044	0.204	0.160	0.107	0.107	0	North Atlantic
Minke Whale	0.526	3.836	17.870	14.034	9.356	9.356	54	Canadian east coast
Pilot Whale <i>spp.</i> b/	0.019	0.139	0.645	0.507	0.338	0.338	780 b/	Western North Atlantic
Bottlenose Dolphin c/	6.299	45.937	213.997	168.060	112.040	112.040	8,730 c/	Western North Atlantic, Offshore and Coastal
Atlantic White-sided Dolphin d/	0.469	3.420	15.933	12.513	8.342	8.342	1,008	Western North Atlantic
Short-Beaked Common Dolphin c/	2.837	20.689	96.382	75.693	50.462	50.462	17,460	Western North Atlantic
Atlantic Spotted Dolphin e/	0.058	0.423	1.970	1.547	1.032	1.032	225	Western North Atlantic
Risso's Dolphin e/	0.035	0.255	1.189	0.934	0.623	0.623	500	Western North Atlantic
Harbor Porpoise	3.177	23.169	107.933	84.764	56.509	56.509	330	Gulf of Maine/Bay of Fundy

Species	Average Seasonal Density a/ (No./100 km ²)	HRG Survey 2024	HRG Survey 2025	HRG Survey 2026	HRG Survey 2027	HRG Survey 2028	Totals	Stock
		Calculated Take (No.)	Calculated Take (No.)	Calculated Take (No.)	Calculated Take (No.)	Calculated Take (No.)	Requested Take (No.)	
Harbor Seal f/	13.673	49.856	232.258	182.401	121.601	121.601	708	Western North Atlantic
Gray Seal f/	13.673	49.856	232.258	182.401	121.601	121.601	708	Western North Atlantic

Notes: This table corresponds to **Table 39** in the Request for Rulemaking and Letter of Authorization for Taking of Marine Mammals Incidental to Construction Activities on the Outer Continental Shelf (OCS) within Lease OCS-A 0512 and Associated Submarine Export Cable Routes, dated July 2022.

a/ Cetacean density values from Duke University (Roberts and Halpin 2022).

b/ Requested take adjusted based on PSO sighting data from 2018-2021 (A.I.S. 2019; Alpine Ocean Seismic Survey 2018; Gardline 2021a,b; Geoquip Marine 2021; Marine Ventures International 2021; RPS 2021; Smultea Environmental Sciences 2019, 2020, 2021).

c/ Bottlenose dolphin density values from Duke University (Roberts and Halpin 2022) reported as “bottlenose dolphin” and not identified to stock. HRG survey activities were not differentiated by region relative to the 20 m isopleth and therefore bottlenose takes are not identified to stock. As Roberts and Halpin does not account for group size, the estimated take was adjusted to account for one group size, 15 individual (Jefferson et al. 2015) per day of bottlenose dolphins and 30 individuals (Reeves et al. 2002), per day of common dolphins.

d/ As Roberts and Halpin does not account for group size, the estimated take was adjusted to account for one group size, 52 individuals (Jefferson et al. 2015) per month of Atlantic white-sided dolphins.

e/ As Roberts and Halpin does not account for group size, the estimated take was adjusted to account for one group size, 100 individuals (Jefferson et al. 2015), per year of Risso's dolphins and 45 individuals (Kenney and Vigness-Raposa 2010) per year of Atlantic spotted dolphins.

f/ Pinniped density values from Duke University (Roberts and Halpin 2022) reported as “seals,” so take allocated by 50% accrued to harbor seals and 50% accrued to gray seals.

1.4 Total Requested Harassment Take

1.4.1 Summary of Annual Totals of Requested Harassment Take

Table 8 summarizes the total Level B harassment take requested across all construction activities as described in Sections 1.1, 1.2, and 1.3, assuming the 10 dB reduction in source level will be achieved by the selected mitigation for pile driving. Please note that as impact pile driving is the only activity anticipated to result in potential Level A harassment takes, those estimates are only reported in Section 1.1.1. Requested take across the entire Letter of Authorization period is summarized in **Table 9**.

Table 8 Summary of Annual Estimated and Requested Takes Across All Project Activities by Level A and Level B Harassment and Percentage of Stock Taken

Species	2024 a/			2025 a/				2026 a/				2027 a/			2028 a/			Stock
	Estimated Take Behavior	Requested Take (No.) Behavior	%	Estimated Take (No.) Behavior	Requested Take (No.) Behavior	Requested Take (No.) Injury	%	Estimated Take (No.) Behavior	Requested Take (No.) Behavior	Requested Take (No.) Injury	%	Estimated Take (No.) Behavior	Requested Take (No.) Behavior	%	Estimated Take (No.) Behavior	Requested Take (No.) Behavior	%	
North Atlantic Right Whale	0.53	1	0.27	4.84	13	0	3.53	3.52	13	0	3.53	1.30	1	0.27	1.30	1	0.27	Western North Atlantic
Humpback Whale	0.72	1	0.07	11.48	63	0	4.51	6.46	29	0	2.08	1.76	2	0.14	1.76	2	0.14	Gulf of Maine
Fin Whale	0.71	1	0.01	12.08	136	1	2.01	6.59	60	1	0.9	1.73	2	0.03	1.73	2	0.03	Western North Atlantic
Sei Whale	0.22	0	0	3.8	4	0	0.06	2.46	3	0	0.05	0.53	1	0.02	0.53	1	0.02	Nova Scotia
Sperm Whale	0.04	0	0	0.76	3	0	0.07	0.45	3	0	0.07	0.45	0	0	0.45	0	0	North Atlantic
Minke Whale	3.84	4	0.02	66.92	83	4	0.4	61.76	62	2	0.29	9.36	9	0.04	9.36	9	0.04	Canadian east coast
Pilot Whale spp. c/	0.14	55	0.14	0.65	417	0	1.06	0.51	269	0	0.69	0.338	25	0.06	0.338	25	0.06	Western North Atlantic
Bottlenose Dolphin d/	0	0	0	226.02	1,800	0	2.86	110.28	765	0	1.22	0	0	0	0	0	0	Western North Atlantic, Offshore
	8.33	1,185	17.85	1.9	270	0	4.07	0	0	0	0	0	0	0	0	0	0	Western North Atlantic, Coastal
	45.94	615	0.89	214	2,865	0	4.12	168	2,250	0	3.24	112	1,500	2.16	112	1,500	2.16	Western North Atlantic, Offshore and Coastal
Atlantic White-sided Dolphin	3.42	71	0.08	131.93	747	0	0.8	71.74	676	0	0.73	8.34	8	0.01	8.34	8	0.01	Western North Atlantic
Short-Beaked Common Dolphin	20.69	2,130	1.23	1,001	9,870	0	5.71	636	6,030	0	3.49	50.5	3,000	1.73	50.5	3,000	1.73	Western North Atlantic
Atlantic Spotted Dolphin	3.42	45	0.11	1.97	90	0.23	0.01	1.54	90	0	0.23	1.03	1	0	1.03	1	0	Western North Atlantic

Species	2024 a/			2025 a/				2026 a/				2027 a/			2028 a/			Stock
	Estimated Take Behavior	Requested Take (No.) Behavior	%	Estimated Take (No.) Behavior	Requested Take (No.) Behavior	Requested Take (No.) Injury	%	Estimated Take (No.) Behavior	Requested Take (No.) Behavior	Requested Take (No.) Injury	%	Estimated Take (No.) Behavior	Requested Take (No.) Behavior	%	Estimated Take (No.) Behavior	Requested Take (No.) Behavior	%	
Risso's Dolphin	0.26	100	0.28	7.15	200	0.57	0.09	5.02	200	0	0.57	0.623	25	0.07	0.623	25	0.07	Western North Atlantic
Harbor Porpoise	23.17	25	0.03	243	243	0	0.25	183.19	183	0	0.19	56.5	57	0.06	56.5	57	0.06	Gulf of Maine/Bay of Fundy
Harbor Seal e/	54.12	445	0.73	465	678	0	1.11	412.29	412	0	0.67	121.60	122	0.2	121.60	122	0.2	Western North Atlantic
Gray Seal e/	54.12	445	1.63	346.59	484	0	1.77	294.35	294	0	1.08	121.60	122	0.45	121.60	122	0.45	Western North Atlantic
Harp Seal f/	0	4	UNK	0	4	0	UNK	0	4	0	UNK	0	4	UNK	0	4	UNK	Western North Atlantic

Notes:
 This table corresponds to **Table 40** in the Request for Rulemaking and Letter of Authorization for Taking of Marine Mammals Incidental to Construction Activities on the Outer Continental Shelf (OCS) within Lease OCS-A 0512 and Associated Submarine Export Cable Routes, dated July 2022.a/ Since EW 2 cofferdam activities are planned for either 2024 or 2025, the requested take was included in both years in the yearly total.
 b/ Cetacean density values from Duke University (Roberts and Halpin 2022).
 c/ Pilot whale density values from Duke University (Roberts and Halpin 2022) reported as "Globicephala spp." and not species-specific. As the short-finned pilot whale is the smaller stock, take estimates have been assumed to be of this stock to be conservative. As described in Section 4.1.4of the Letter of Authorization application, both the short-finned and long-finned pilot whale occur in the Mid-Atlantic, though the short-finned pilot whale tends to occur in more southern waters.
 d/ Bottlenose dolphin density values from Duke University (Roberts and Halpin 2022) reported as "bottlenose dolphin" and not identified to stock. Given the noise from cofferdam installation would not extend beyond the 20-meter isobath, where the coastal stock predominates, all estimated takes by Level B harassment of bottlenose dolphins from cofferdam installation were attributed to the coastal stock. Takes from impact pile driving were attributed to each stock (coastal and offshore) according to delineation along the 20-meter isobath during the animat modeling process. Takes from HRG survey activities were not differentiated, per NOAA Fisheries recommendation.
 e/ Pinniped density values from Duke University (Roberts and Halpin 2022) reported as "seals" and not species-specific, so take allocated by 50% accrued to harbor seals and 50% accrued to gray seals.
 f/ Harp seal occurrence is anticipated to be rare. Anecdotal stranding data indicate only a few harp seals are sighted within the vicinity of the Project each year. Therefore, 4 harp seal Level B takes have been requested per year of the Project.

Table 9 Summary of Total Potential Takes Across All Project Activities by Level A and Level B Harassment for the Five Year Authorization

Species	Requested Take		Stock
	Level B Harassment	Level A Harassment	
North Atlantic Right Whale	29	0	Western North Atlantic
Humpback Whale	97	0	Gulf of Maine
Fin Whale	201	2	Western North Atlantic
Sei Whale	9	0	Nova Scotia
Sperm Whale	6	0	North Atlantic
Minke Whale	167	6	Canadian east coast
Pilot Whale <i>spp.</i>	1,009	0	Western North Atlantic
	2,565	0	Western North Atlantic, Offshore
Bottlenose Dolphin	1,455	0	Western North Atlantic, Coastal
	8,730	0	Western North Atlantic, Offshore and Coastal
Atlantic White-sided Dolphin	1,840	0	Western North Atlantic
Short-Beaked Common Dolphin	24,030	0	Western North Atlantic
Atlantic Spotted Dolphin	315	0	Western North Atlantic
Risso's Dolphin	700	0	Western North Atlantic
Harbor Porpoise	565	0	Gulf of Maine/Bay of Fundy
Harbor Seal	1,779	0	Western North Atlantic
Gray Seal	1,467	0	Western North Atlantic
Harp Seal <i>a/</i>	20	0	Western North Atlantic

Note: This table corresponds to **Table 41** in the Request for Rulemaking and Letter of Authorization for Taking of Marine Mammals Incidental to Construction Activities on the Outer Continental Shelf (OCS) within Lease OCS-A 0512 and Associated Submarine Export Cable Routes, dated July 2022.

a/ Harp seal occurrence is anticipated to be rare. Anecdotal stranding data indicate only a few harp seals are sighted within the vicinity of the Project each year. Therefore, 4 harp seal Level B takes have been requested per year of the Project

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