# VINEYARD NORTHEAST

# CONSTRUCTION AND OPERATIONS PLAN
## VOLUME II APPENDIX

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VINEYARD OFFSHORE

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# Vineyard Northeast COP

# Appendix II-E Vineyard Northeast Acoustic and Exposure Modeling

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# Vineyard Northeast Preliminary Acoustic and Exposure Modeling

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# Executive Summary

Vineyard Northeast LLC (the "Proponent") proposes to develop, construct, and operate offshore renewable wind energy facilities in Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0522 (the "Lease Area") along with associated offshore and onshore transmission systems. This proposed development is referred to as "Vineyard Northeast."

Vineyard Northeast includes 160 total wind turbine generator (WTG) and electrical service platform (ESP) positions within the Lease Area. Up to three of those positions will be occupied by ESPs[1], and the remaining positions will be occupied by WTGs. Between the Lease Area and shore, offshore export cables will be installed within two offshore export cable corridors (OECCs)—the Massachusetts OECC and the Connecticut OECC—that connect to onshore transmission systems in Massachusetts and Connecticut. If high voltage alternating current (HVAC) offshore export cables are used in the Massachusetts OECC, the cables would connect to a booster station in the northwestern aliquot[2] of Lease Area OCS-A 0534. As proposed, the WTGs and ESP(s) will be oriented in fixed east-to-west rows and north-to-south columns with 1 nautical mile (NM) (1.9 kilometer [km]) spacing between positions. The WTGs, ESP(s), and booster station will be supported by monopiles or piled jacket foundations. The base of the foundations may be surrounded by scour protection. Submarine inter-array cables will transmit power from groups of WTGs to the ESP(s). If two or three ESPs are used, they may be connected with inter-link cables.

The WTGs, ESP(s), and their foundations as well as the inter-array cables, inter-link cables (if used), and a portion of the offshore export cables will be located in Lease Area OCS-A 0522. The Lease Area is within the Massachusetts Wind Energy Area (MA WEA) identified by BOEM, following a public process and environmental review, as suitable for wind energy development. At its closest point, the 536 square kilometer ($km^2$) (132,370 acre) Lease Area is approximately 46 km (29 miles [mi]) from Nantucket. The potential booster station is located approximately 23 km (15 mi) from Martha's Vineyard and 26 km (16 mi) from Nantucket.

The primary sound sources associated with Vineyard Northeast are impact pile driving and vibratory pile setting during construction. Other sound sources include 1) drilling during pile installation to remove boulders and in cases of pile refusal and 2) potential detonation of unexploded ordnance (UXO). To assess potential impacts to marine mammals from sound exposure associated with anthropogenic activities, JASCO Applied Sciences (USA) Inc. (JASCO) performed acoustic modeling of impact and vibratory pile driving during pile installation (Sections 1–5, Appendix F–H), drilling activities (Appendix I), and UXO detonation (Appendix J) on behalf of the Proponent.

1 If two or three ESPs are used, they may be located at separate positions or two of the ESPs may be co-located at the same grid position. Co-located ESPs would be smaller structures installed on monopile foundations. The modeling conservatively assumes each ESP is installed at its own grid position on a jacket foundation (with up to 18 legs per jacket) as that is more impactful than assuming two ESPs are installed at the same grid position (each with its own monopile foundation) and one ESP is installed on a jacket foundation (with up to 18 legs).
2 An aliquot is 1/64th of a BOEM Outer Continental Shelf (OCS) Lease Block.

## Vibratory Pile Setting Followed by Impact Pile Driving

As the final construction schedule for Vineyard Northeast is unknown at this early stage in the construction planning process, a conservative approach was taken in the assessment. To provide the Proponent flexibility, the modeling assumed different possible schedules with 161 foundations (160 WTGs/ESPs and one booster station). The piling construction schedules were established based on various pile characteristics, including typical and difficult to drive piling scenarios for 14 m monopile foundations and 4.25 m jacket foundations. For some scenarios, the construction schedules used to calculate exposures are conservative and overestimate potential environmental impacts. The conservative modeling scenarios and hammering schedules are based on preliminary information and will continue to be refined.

The goal of this underwater acoustic modeling study was to predict monitoring distances (acoustic and exposure ranges) to regulatory-defined acoustic thresholds associated with injury and behavioral disturbance for various marine fauna, including marine mammals, sea turtles, and fish. Sound generated during impact and vibratory pile driving, the primary sound sources associated with Vineyard Northeast, was modeled by characterizing the sound produced at the pile and then calculating how the sound propagates within the surrounding water column. For impulsive sounds from impact pile driving and non-impulsive sounds from vibratory pile driving, time-domain representations of the pressure waves generated in the water are required for calculating sound pressure level (SPL) and zero-to-peak pressure level (PK), which are then used to evaluate potential impacts. JASCO's animal movement modeling software, JASMINE, was used to integrate the computed sound fields with species-typical movement (e.g., dive patterns) to estimate received sound levels for the modeled marine mammals and sea turtles that may occur near the construction area.

The potential acoustic exposure for marine species was estimated by finding the accumulated sound energy (SEL) and maximum SPL and PK pressure level each animat received over the course of the simulation. Exposure criteria are based on relevant regulatory-defined thresholds (Stadler and Woodbury 2009, GARFO 2020a), best available science for fish and sea turtles (Popper et al. 2014), and available relevant scientific understanding for marine mammal behavioral thresholds (Wood et al. 2012). The projected number of animals exposed to sound levels above threshold values was determined by scaling the number of animats exposed to a criterion in the model to reflect local populations. The Duke University Habitat-based Cetacean Density Models were used to estimate densities for marine mammal species (Roberts et al. 2016, 2022) and the U.S. Naval Undersea Warfare Center (NUWC; DiMatteo et al. 2023) were used to estimate sea turtle densities (NUWC; DiMatteo et al. 2023) surrounding the Lease Area.

Using the time history of the received levels, exposure ranges accounting for 95% of exposures ($ER_{95\%}$) above regulatory-defined injury and behavioral disruption thresholds (NMFS 2018, McCauley et al. 2000b, Finneran et al. 2017) were calculated. The number of animals predicted to experience levels exceeding injury or behavioral thresholds are provided in Section 4.2.1. The species-specific $ER_{95\%}$ (see tables in Section 4.4) were determined with different broadband attenuation levels (0, 10, 12, and 15 dB) to account for the use of noise reduction systems, such as bubble curtains. $ER_{95\%}$ can be used for mitigation purposes, like establishing monitoring or exclusion areas. Fish were considered static receivers, so the acoustic distance to their regulatory thresholds (FHWG Andersson et al. 2007, Wysocki et al. 2007, 2008, Stadler and Woodbury 2009, Mueller-Blenkle et al. 2010, Purser and Radford 2011) were calculated (see tables in Section 4.5).

## Drilling

Drilling operations may be required during pile driving when large sub-surface boulders or hard sediment layers are encountered. Vineyard Northeast estimates that the installation of each wind turbine foundation could require up to 6 hours of drilling per day in addition to vibratory pile setting and pile driving operations for two foundation types: 1) 14 m monopile foundations, and 2) 4.25 m jacket foundations. Methodology and results for drilling sound sources are presented in Appendix I.

Drilling activities produce non-impulsive sounds that may cause hearing damage or behavioral responses in marine mammals, sea turtles and fish. Distances to potential injury and behavioral disruption of marine fauna (NMFS 2018) are computed here by propagating measured mudline cellar excavation (Austin et al. 2018) in the Lease Area, as detailed in Appendix I. We assume that pile installation drilling produces similar sound levels as mudline cellar drilling as a conservative measure. The modeled ensonified areas are combined with the planned drilling schedules and predicted species densities to estimate the number of marine mammals and sea turtles that will be exposed above thresholds for injury and behavioral response. Density-based exposure estimates of this sound source were calculated for marine mammals and are provided in Appendix I.

## Unexploded ordnance (UXO)

UXOs may be encountered on the seabed during installation within the Lease Area and along the OECCs. While non-explosive methods may be employed to lift and move these objects, it is conservatively assessed that some may need to be removed by explosive detonation. The assessment considers acoustic effects to marine mammals, sea turtles, and fish from two possible charge sizes across six locations within the Lease Area and along the OECCs. Methodology and results for UXO sound sources are presented in Appendix J.

Underwater explosive detonations generate sound waves with high pressure levels that could cause disturbance and/or injury to marine fauna. Most UXO assessment work in the US has been performed by or for the US Navy, who have worked closely with National Marine Fisheries Service (NMFS) to choose and define appropriate criteria for effects based on best available science. Sound propagation modeling and empirical acoustic analyses are conducted to estimate acoustic threshold ranges to injury and behavioral disturbance for three key sound pressure metrics (Popper et al. 2014, Finneran et al. 2017, NMFS 2018): unweighted peak compressional pressure level ($L_{\text{pk,c}}$ and abbreviated here $L_{\text{pk}}$), frequency weighted sound exposure level (SEL or $L_{E,w}$), and acoustic impulse ($J_p$). Appendix J describes the modeled acoustic source and sound propagation used to estimate range to marine mammal, sea turtle, and fish injury and behavioral thresholds. These acoustic threshold ranges may be used to estimate the rate of marine fauna injury and behavioral response within a given radius. The model predictions presented in Appendix J assume the full mass of UXO explosive charges is detonated together with an additional donor charge with mass equal to 2% of the UXO weight but limited at 10 kg TNT-equivalent. A recent review of UXO explosive removals in the North Sea indicates that in most cases the UXO charge mass either did not detonate or only partly detonated, with the result being that the pressure waves generated were produced by the donor charge and only a small fraction of the UXO charge (Bellmann 2021). As such, it is likely that the full UXO charge will not detonate in all cases and the results presented herein should be considered the worst case.

# Acronyms and Abbreviations

| | |
|---|---|
| ANSI | American National Standards Institute |
| APE | American Piledriving Equipment |
| BMP | best management practice |
| BOEM | Bureau of Ocean Energy Management |
| BRAHSS | Behavioral Response of Australian Humpback whales (Megaptera novaeangliae) to Seismic Surveys |
| CPA | closest point of approach |
| COP | Construction and Operations Plan |
| dB | decibels |
| DC | direct current |
| DP | dynamic positioning |
| EEZ | Exclusive Economic Zone |
| $ER_{95\%}$ | 95% exposure range |
| ESA | Endangered Species Act |
| FM | frequency-modulated |
| FWRAM | Full Wave Range Dependent Acoustic Model |
| GDEM | Generalized Digital Environmental Model |
| h | hour |
| HDD | horizontal directional drilling |
| HF | high frequency (cetacean hearing group) |
| HRG | high resolution geophysical (survey) |
| Hz | hertz |
| IAC | Inter-Array Cables |
| JASCO | JASCO Applied Sciences |
| JASMINE | JASCO Animal Simulation Model Including Noise Exposure |
| kg | kilogram |
| kHz | kilohertz |
| kJ | kilojoule |
| km | kilometer |
| LF | low frequency (cetacean hearing group) |
| m | meter |
| mm | millimeter |
| m/s | meters per second |
| MA | Massachusetts State |
| MF | mid-frequency (cetacean hearing group) |
| MMPA | Marine Mammal Protection Act |
| MONM | Marine Operations Noise Model |
| NARW | North Atlantic right whale |
| NAS | noise abatement system |
| nm | nautical mile |
| NMFS | National Marine Fisheries Service (also known as NOAA Fisheries) |
| NMS | noise mitigation system |
| NOAA | National Oceanic and Atmospheric Administration |
| NODE | Navy Operating Area Density Estimate |
| NY | New York |
| OCS | Outer Continental Shelf |
| OCS–DC | Offshore Converter Station |
| OSP | Optimum Sustainable Population |
| PDSM | Pile Driving Source Model |
| PE | parabolic equation |
| PK | zero-to-peak sound pressure level |
| PPW | phocid (pinniped) in water (hearing group) |
| PTS | permanent (hearing) threshold shift |
| PW | phocid (seal) in water (hearing group) |
| RAM | Range-dependent Acoustic Model |
| RI | Rhode Island State |
| rms | root mean square |
| SC | species of concern |
| SEL | sound exposure level |
| SELcum | cumulative sound exposure level |
| SERDP-SDSS | Strategic Environmental Research and Development Program Spatial Decision Support System |
| SGCN | Species of greatest conservation need |
| SL | source level |
| SPL | root-mean-square sound pressure level |
| SRTM | Shuttle Radar Topography Mission |

| | |
|---|---|
| TL | transmission loss |
| TTS | temporary (hearing) threshold shift |
| TU | sea turtles in water (hearing group) |
| WEA | Wind Energy Area |
| WTG | wind turbine generator |
| μPa | micropascal |

# 1. Introduction

## 1.1. Project Background and Overview of Assessed Activity

Vineyard Northeast LLC (the "Proponent") proposes to develop, construct, and operate offshore renewable wind energy facilities in Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0522 (the "Lease Area") along with associated offshore and onshore transmission systems. This proposed development is referred to as "Vineyard Northeast." Vineyard Northeast includes 160 total wind turbine generator (WTG) and electrical service platform (ESP) positions within the Lease Area. Up to three of those positions will be occupied by ESPs and the remaining positions will be occupied by WTGs. Two offshore export cable corridors (OECCs)—the Massachusetts OECC and the Connecticut OECC—will connect the renewable wind energy facilities to onshore transmission systems in Massachusetts and Connecticut. If high voltage alternating current (HVAC) offshore export cables are used in the Massachusetts OECC, the cables would connect to a booster station in the northwestern aliquot[3] of Lease Area OCS-A 0534. Figure 1 provides an overview of Vineyard Northeast.

Underwater sound may be generated by several activities associated with Vineyard Northeast. Impacts of sound on marine fauna for most of these anthropogenic sound sources are expected to be low or very low. The primary sound sources that could be expected to have greater effects are impact (impulsive) and vibratory (non-impulsive, continuous sound) pile driving during foundation installation for the WTGs, ESP(s), and the booster station (if used). A quantitative assessment of pile driving activities is undertaken here as the primary source of sound associated with the installation of foundations in Lease Area OCS-A 0522.

For the quantitative acoustic analysis, the potential underwater acoustic impacts resulting from the installation of tapered monopile foundations and jacket foundations were modeled. The tapered monopiles have a maximum diameter of 14 meters (m) (46 foot [ft]).The jacket foundation uses 4 or 4.25 m (13 or 14 (ft)) diameter pin piles[4]. This underwater sound assessment considers the currently available information; the precise locations, sound sources, and schedule of the construction and operation scenarios are subject to change as the engineering design progresses. This initial assessment uses conservative modeling scenarios based on preliminary information and will continue to be refined.
The two primary sources of underwater sound are expected to occur during installation of monopile and jacket pile foundations in the Lease Area from impact pile driving, and vibratory pile setting followed by impact pile driving. The methodology for modeling the acoustic field and estimating marine fauna exposures from these primary sources of sound is presented in Section 2, with the results presented in Section 4 and Appendices F to H. Secondary sources of underwater sound may occur during installation and are modeled using source-specific methodology. Drilling may be required during pile installation if large sub-surface boulders or hard sediment layers are encountered. Appendix I presents the methodology and criterion for estimating acoustic ranges to injury and behavioral thresholds and marine fauna exposures during drilling. Unexploded ordnance (UXO) on the ocean bottom may be detonated during installation, producing sound waves with high pressure levels. The methodology and criterion for estimating acoustic ranges to injury and behavioral thresholds for UXOs are presented Appendix J.

3 An aliquot is 1/64th of a BOEM Outer Continental Shelf (OCS) Lease Block.

4 Acoustic modeling was conducted for both the 4 and 4.25 m diameter pin piles; however, exposure modeling was only conducted for the 4.25 m diameter pin pile since it represents the maximum PDE.

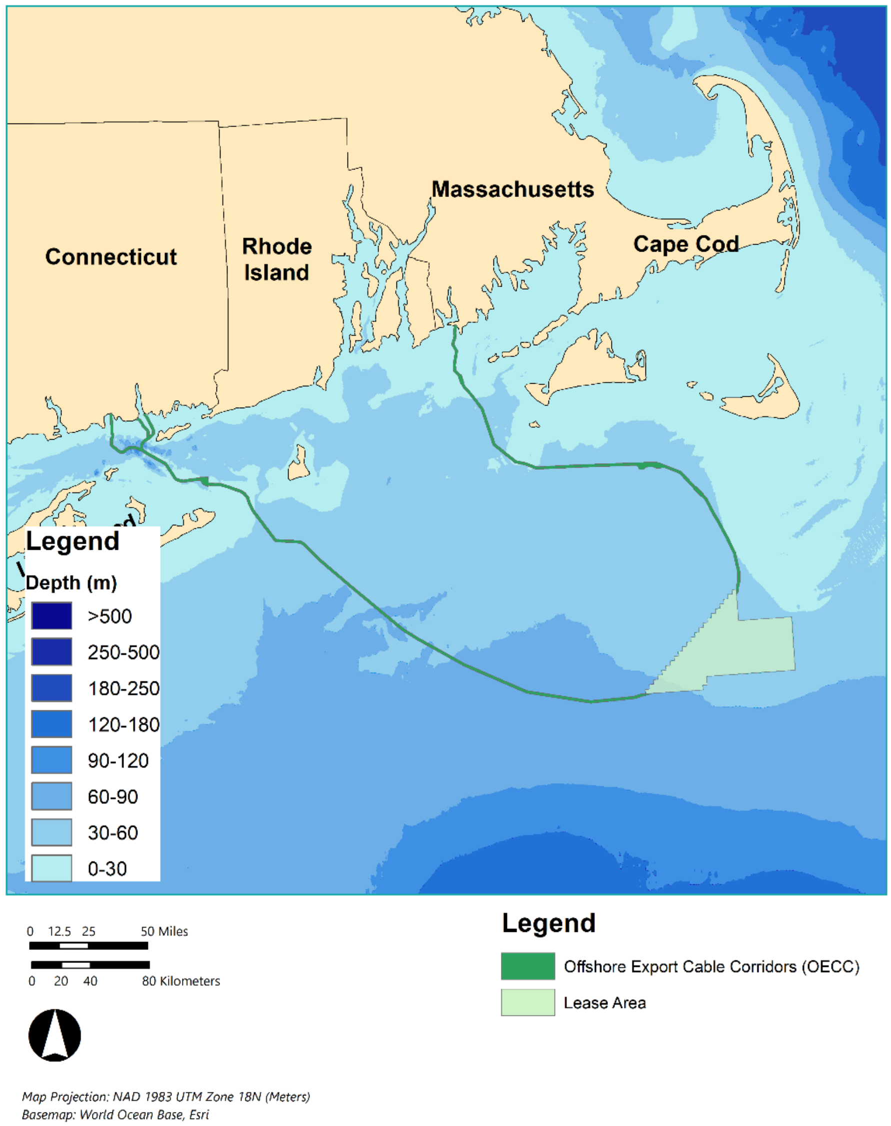



Figure 1. Location of the Vineyard Northeast Lease Area OCS-A 0522 in relation to Martha's Vineyard and Nantucket, Massachusetts.

## 1.2. Modeling Scope and Assumptions

The objectives of this modeling study were to predict the acoustic ranges to regulatory-defined acoustic thresholds associated with injury and behavioral disturbance for various marine fauna, including marine mammals, fish, and sea turtles that may occur near the Lease Area during pile driving in the construction stage of Vineyard Northeast. JASCO also used the results of animal movement and exposure modeling to estimate potential exposure ranges ($ER_{95\%}$) and exposure numbers for marine mammals and sea turtles.

There are several potential anthropogenic sound sources associated with Vineyard Northeast; however, the primary sound sources are impact (impulsive) and vibratory (non-impulsive, continuous) pile driving during foundation installation in the construction stage.

Foundations may be entirely installed using only impact pile driving. Alternatively, a vibratory hammer could be used to install the pile through surficial sediments in a controlled fashion to avoid the potential for a "pile run," where the pile could drop quickly through the looser surficial sediments and destabilize the installation vessel. Once the pile has penetrated the surficial sediments with the vibratory hammer, an impact hammer would be used for the remainder of the installation. The extent to which a vibratory hammer may be used has been assumed for this modeling exercise and will continue to be evaluated based on site-specific data and the selected contractor's installation methodologies.

Other sound sources include potential drilling, which may be required during pile installation in cases of pile refusal; high-resolution geophysical (HRG) surveys; and potential detonation of unexploded ordnance (UXO) if encountered and avoidance, physical removal, or alternative combustive removal techniques (e.g., deflagration) are not feasible. Modeled acoustic ranges and calculated exposure estimates to marine fauna injury and behavioral thresholds can be found in Appendix I for drilling and Appendix J for UXO detonation.

### 1.2.1. Foundations – Monopile and Jacket

A monopile foundation is a single hollow cylinder fabricated from steel that is installed by driving (hammering) it into the seabed. The 14 m diameter monopiles proposed for Vineyard Northeast represent the largest monopile foundation that will be installed within the Project Design Envelope (PDE) as WTG foundations. The 14 m monopiles correspond to the size of foundation expected to be used more near-term. Up to two monopiles are expected to be installed per day. Jacket foundations used for ESPs or WTGs (or the booster station, if used) consist of a large lattice structure supported/secured by pin piles. Up to eight pin piles are expected to be installed per day. The pin piles to secure the jacket structure for Vineyard Northeast are 4 and 4.25 m diameter straight piles. Acoustic modeling was conducted for all foundations however, exposure modeling was not conducted for the 4 m diameter pin pile since the 4.25 m diameter pin pile represents the maximum PDE.

The amount of sound generated during pile driving varies with the energy required to drive piles to a desired depth and depends on the sediment resistance encountered. Sediment types with greater resistance require hammers that deliver higher energy strikes and/or an increased number of strikes relative to installations in softer sediment. Maximum sound levels usually occur during the last stage of impact pile driving where the greatest resistance is encountered (Betke 2008). The Proponent included typical and difficult to drive piling scenarios. The difficult to drive piles were based on drivability analyses which suggest that some piles would be installed at locations requiring higher energies or a greater number of strikes. The make and model of impact hammer (MHU 5500 and MHU 5500 scaled to 6600), vibratory hammer (TR-CV640 and TR-CV320), and conservative hammering schedules used in the acoustic modeling effort were provided by Vineyard Northeast in coordination with potential hammer suppliers. As no hammer parameters were available for a 6600 kJ hammer, the modeled energies of the 5500 kJ hammer were scaled to 6600 kJ by artificially increasing the stroke length to represent the effect of the hammer energy to the monopile foundation. Although the MHU5500 and MHU6600 were scaled to energies above 5500 kJ using the same technique per strike, the number of strikes to reach penetration depth differed between the two hammers. The hammering schedules, or the number of strikes at each hammer energy level, needed to drive the monopiles and jacket foundations at typical locations and at difficult to drive locations are listed in Tables 3-8 for impact pile driving, and Tables 9-14 for vibratory pile setting followed by impact pile driving scenarios. In some cases, piles were driven into the sediment at a desired penetration depth for a fixed hammer energy, and then required additional hammer strikes to deeper depth at the same energy. The energies for these scenarios are noted as (a) for the shallower depth and (b) for the deeper depth.

Sound fields from 14 m monopiles and the 4 m and 4.25 m pin piles were modeled at two representative locations in the Lease Area (L01 and L02) as depicted in Figure 1 and Table 1. The modeling locations were selected as they represent the range of water depths in the Lease Area. The 14 m monopiles were assumed to be vertical and driven to a maximum expected penetration depth of 45 m (147.6 ft) and the pin piles were assumed to be vertical and driven to a maximum expected depth of 80 m (262.5 ft).

The acoustic assessment assumed no concurrent piling. Key modeling assumptions for the monopiles and pin piles are listed in Table 2 with additional modeling details and input parameters shown in Appendix A.

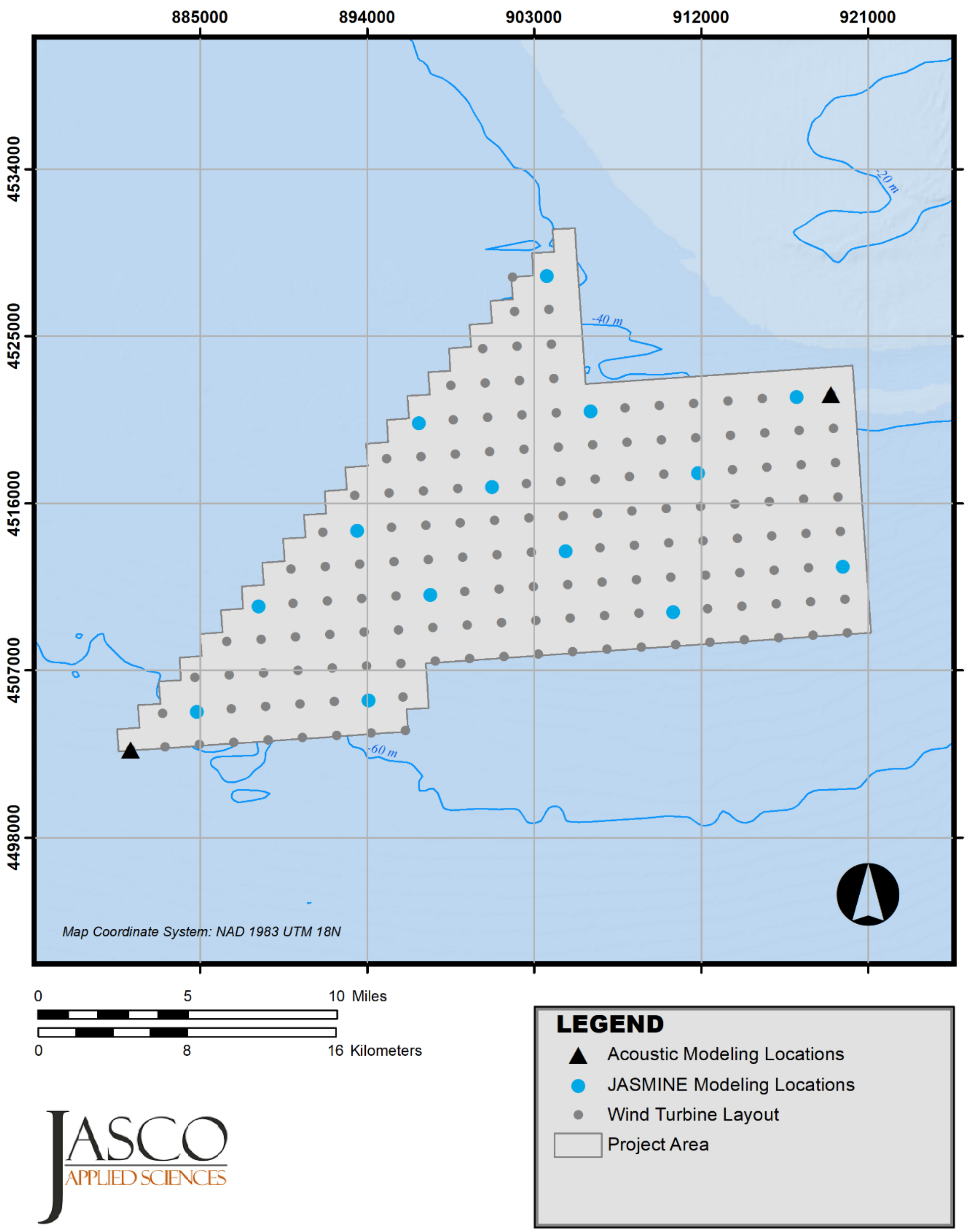



Figure 2. Vineyard Northeast Lease Area OCS-A 0522 turbine locations with acoustic propagation and animal movement modeling locations.

Table 1. Acoustic modeling locations and water depth for the monopile and jacket foundations.

| Modeling location | Latitude | Longitude | Depth (m) |
|---|---|---|---|
| L01 | 40.74124 | −70.06064 | 35.1 |
| L02 | 40.58755 | −70.81783 | 63.2 |

Table 2. Key piling assumptions used in underwater acoustic modeling during vibratory pile setting and impact pile driving.

| Foundation type | Modeled vibratory hammer duration (min) | Modeled maximum impact hammer energy (kJ) | Pile length (m) | Pile diameter (m) | Pile wall thickness (mm) | Seabed penetration (m) | Number of piles per day |
|---|---|---|---|---|---|---|---|
| Monopile | 30 | 4400 | 144 | 14 | 200 | 45 | 1–2 |
| Monopile | 30 | 6600 | 144 | 14 | 200 | 45 | 1–2 |
| Jacket | 30 | 3500 | 87 | 4 | 100 | 80 | 4, 8 |
| Jacket | 30 | 3500 | 99 | 4.25 | 100 | 80 | 4, 8 |

#### 1.2.1.1. Impact Pile Driving

Table 3. Hammer energy schedule and number of strikes for 14 m typical monopile with an MHU 5500 hammer.

| Energy level (kJ) | Strike rate (strikes/min) | Strike count | Pile penetration depth (m) |
|---|---|---|---|
| 800 | 0 | 1000 | 10 |
| 2500 | 30 | 2000 | 10 |
| 3500 | 30 | 2000 | 10 |
| 4400 | 30 | 3900 | 15 |
| **Total** | **NA** | **8900** | **45** |

Table 4. Hammer energy schedule and number of strikes for 14 m difficult to drive monopile with an MHU 5500 hammer, scaled to 6600 kJ.

| Energy level (kJ) | Strike rate (strikes/min) | Strike count | Pile penetration depth (m) |
|---|---|---|---|
| 2500 | 30 | 1500 | 10 |
| 4500 | 30 | 2000 | 10 |
| 6600a | 30 | 2000 | 10 |
| 6600b | 30 | 3900 | 15 |
| **Total** | **NA** | **9400** | **45** |

Table 5. Hammer energy schedule and number of strikes for 4 m [a] typical jacket foundation with an MHU 3500S hammer.

| Energy level (kJ) | Strike rate (strikes/min) | Strike count | Pile penetration depth (m) |
|---|---|---|---|
| 200 | 30 | 1000 | 10 |
| 600 | 30 | 2000 | 10 |
| 1000 | 30 | 2000 | 10 |
| 1500 | 30 | 2000 | 10 |
| 2000 | 30 | 2000 | 10 |
| 3000 | 30 | 2000 | 10 |
| 3500 | 30 | 5200 | 20 |
| **Total** | **NA** | **16200** | **80** |

[a] 4 m jacket foundation pin piles were not included in the animal movement modeling.

Table 6. Hammer energy schedule and number of strikes for 4 m [a] difficult to drive jacket foundation with an MHU 3500S hammer.

| Energy level (kJ) | Strike rate (strikes/min) | Strike count | Pile penetration depth (m) |
|---|---|---|---|
| 500 | 30 | 1600 | 10 |
| 1000 | 30 | 2000 | 10 |
| 1500 | 30 | 2000 | 10 |
| 2000 | 30 | 2000 | 10 |
| 3000 | 30 | 2000 | 10 |
| 3500a | 30 | 2000 | 10 |
| 3500b | 30 | 4800 | 20 |
| **Total** | **NA** | **16400** | **80** |

[a] 4 m jacket foundation pin piles were not included in the animal movement modeling.

Table 7. Hammer energy schedule and number of strikes for 4.25 m typical jacket foundation with an MHU 3500S hammer.

| Energy level (kJ) | Strike rate (strikes/min) 4 per day | Strike rate (strikes/min) 8 per day | Strike count | Pile penetration depth (m) |
|---|---|---|---|---|
| 200 | 48 | 96 | 1400 | 10 |
| 500 | 48 | 96 | 2000 | 10 |
| 1000 | 48 | 96 | 2000 | 10 |
| 1500 | 48 | 96 | 2000 | 10 |
| 2000 | 48 | 96 | 2000 | 10 |
| 2500 | 48 | 96 | 4000 | 10 |
| 3500a | 48 | 96 | 3200 | 10 |
| 3500b | 48 | 96 | 3200 | 10 |
| **Total** | **NA** | **NA** | **16600** | **80** |

Table 8. Hammer energy schedule and number of strikes for 4.25 m difficult to drive jacket foundation with an MHU 3500S hammer.

| Energy level (kJ) | Strike rate (strikes/min) 4 per day | Strike rate (strikes/min) 8 per day | Strike count | Pile penetration depth (m) |
|---|---|---|---|---|
| 500 | 48 | 96 | 1400 | 10 |
| 1000 | 48 | 96 | 2000 | 10 |
| 1500 | 48 | 96 | 2000 | 10 |
| 2000 | 48 | 96 | 2000 | 10 |
| 3000 | 48 | 96 | 2000 | 10 |
| 3500a | 48 | 96 | 4000 | 20 |
| 3500b | 48 | 96 | 3200 | 10 |
| **Total** | **NA** | **NA** | **16600** | **80** |

## 1.2.1.2. Vibratory Pile Driving

Table 9. Installation schedule for a 14 m typical monopile using vibratory pile setting (TR-CV640) followed by impact hammering (5500 kJ hammer).

| Hammer type | Pile penetration depth (m) | Time vibratory piling (min) | Hammer energy (kJ) | Strike count |
|---|---|---|---|---|
| Vibratory | 10 | 30 | - | - |
| Impact | 10 | - | 2500 | 2000 |
| Impact | 10 | - | 3500 | 2000 |
| Impact | 15 | - | 4400 | 3900 |
| **Total** | **45** | **30** | **-** | **7900** |

Table 10. Installation schedule for a 14 m difficult to drive monopile using vibratory pile setting (TR-CV640) followed by impact hammering (5500 kJ hammer, scaled to 6600 kJ). Letters in parentheses after each energy level are used to differentiate penetration depths at the same energy level.

| Hammer type | Pile penetration depth (m) | Time vibratory piling (min) | Hammer energy (kJ) | Strike count |
|---|---|---|---|---|
| Vibratory | 10 | 30 | - | - |
| Impact | 10 | - | 4500 | 2000 |
| Impact | 10 | - | 6600 (a) [a] | 2000 |
| Impact | 15 | - | 6600 (b) [a] | 3900 |
| **Total** | **45** | **30** | **-** | **7900** |

[a] Acoustic source characteristics were modeled at two pile penetrations (a, b) using the full hammer energy.

Table 11 Installation schedule for a 4 m [a] typical jacket using vibratory pile setting (TR-CV320) followed by impact hammering (3500 kJ hammer).

| Hammer type | Pile penetration depth (m) | Time vibratory piling (min) | Hammer energy (kJ) | Strike count |
|---|---|---|---|---|
| Vibratory | 10 | 30 | - | - |
| Impact | 10 | - | 600 | 2000 |
| Impact | 10 | - | 1000 | 2000 |
| Impact | 10 | - | 1500 | 2000 |
| Impact | 10 | - | 2000 | 2000 |
| Impact | 10 | - | 3000 | 2000 |
| Impact | 20 | - | 3500 | 5200 |
| **Total** | **80** | **30** | **-** | **15200** |

[a] 4 m jacket foundation pin piles were not included in the animal movement modeling.

Table 12. Installation schedule for a 4 m difficult to drive jacket [a] using vibratory pile setting (TR-CV320) followed by impact hammering (3500 kJ hammer). Letters in parentheses after each energy level are used to differentiate penetration depths at the same energy level.

| Hammer type | Pile penetration depth (m) | Time vibratory piling (min) | Hammer energy (kJ) | Strike count |
|---|---|---|---|---|
| Vibratory | 10 | 30 | - | - |
| Impact | 10 | - | 1000 | 2000 |
| Impact | 10 | - | 1500 | 2000 |
| Impact | 10 | - | 2000 | 2000 |
| Impact | 10 | - | 3000 | 2000 |
| Impact | 10 | - | 3500 (a) [b] | 2000 |
| Impact | 20 | - | 3500 (b) [b] | 4800 |
| **Total** | **80** | **30** | **-** | **14800** |

[a] 4 m jacket foundation pin piles were not included in the animal movement modeling.
[b] Acoustic source characteristics were modeled at two pile penetrations (a, b) using the full hammer energy.

Table 13. Installation schedule for a 4.25 m typical jacket using vibratory pile setting (TR-CV320) followed by impact hammering (3500 kJ hammer). Letters in parentheses after each energy level are used to differentiate penetration depths at the same energy level.

| Hammer type | Pile penetration depth (m) | Time vibratory piling (min) | Hammer energy (kJ) | Strike count |
|---|---|---|---|---|
| Vibratory | 10 | 30 | - | - |
| Impact | 10 | - | 500 | 2000 |
| Impact | 10 | - | 1000 | 2000 |
| Impact | 10 | - | 1500 | 2000 |
| Impact | 10 | - | 2000 | 2000 |
| Impact | 10 | - | 2500 | 2000 |
| Impact | 10 | - | 3500 (a) [a] | 2000 |
| Impact | 10 | | 3500 (b) [a] | 3200 |
| **Total** | **80** | **30** | **-** | **15200** |

[a] Acoustic source characteristics were modeled at two pile penetrations (a, b) using the full hammer energy.

Table 14. Installation schedule for a 4.25 m difficult to drive jacket using vibratory pile setting (TR-CV320) followed by impact hammering (3500 kJ hammer). Letters in parentheses after each energy level are used to differentiate penetration depths at the same energy level.

| Hammer type | Pile penetration depth (m) | Time vibratory piling (min) | Hammer energy (kJ) | Strike count |
|---|---|---|---|---|
| Vibratory | 10 | 30 | - | - |
| Impact | 10 | - | 1000 | 2000 |
| Impact | 10 | - | 1500 | 2000 |
| Impact | 10 | - | 2000 | 2000 |
| Impact | 10 | - | 3000 | 2000 |
| Impact | 20 | - | 3500 (a) [a] | 4000 |
| Impact | 10 | - | 3500 (b) [a] | 3200 |
| **Total** | **80** | **30** | **-** | **15200** |

[a] Acoustic source characteristics were modeled at two pile penetrations (a, b) using the full hammer energy.

## 1.2.2. Modeling Pile Construction Schedules

Construction schedules are difficult to predict because of factors like weather and installation variation related to drivability. To allow some flexibility in the final design and during foundation installation, multiple construction schedules (Tables 15–Table 30) were used to calculate potential impacts to marine mammals and sea turtles during pile installation. Each construction schedule includes both typical and difficult to drive (DTD) piling scenarios as well as a combination of foundations installed with impact pile driving alone and foundations installed with vibratory setting of the pile followed by impact pile driving. As noted in Table 2, the modeled duration of vibratory hammering was 30 minutes for all foundation types that included vibratory setting of the pile. Schedule A shows a two-year buildout of pile installation and schedule B shows a four-year pile installation buildout. Schedules A includes all WTGs installed on monopile foundations and all ESPs and the booster station installed on jacket foundations. Schedule B includes all WTGs and ESPs installed on jacket foundations. It is assumed that there are 4 pin piles per WTG jacket foundation and 18 pin piles per ESP/booster station jacket foundation. WTG jacket foundations are expected to be pre-piled and ESP jacket foundations are expected to be post-piled. Each schedule includes 157 WTG foundations and four ESP/booster station foundations. See Section 2.2 for a description of pre- and post-piled foundations and how this affects the acoustic modeling assumptions.

To estimate exposures, it is necessary to predict not only the number of piles per day but also the number of days of piling. To do this, the modeling included installation at a rate of one or two monopiles per day and four or eight jacket pin piles per day. Possible combinations of these piling rates were modeled (Construction Schedules A and B) so that the combination that produced the greatest number of predicted exposures could be carried forward as a conservative approach to estimating impacts. Tables 15–Table 30 show the number of days of piling under the different modeled schedules.

Table 15. Construction Schedule A (14 m monopile), year 1: The number of potential days of pile installation per month for each case [a], used to estimate the total number of marine mammal and sea turtle acoustic exposures above threshold criteria.

| Month | WTG Vibratory + impact: 14 m MP 1 pile per day | WTG Vibratory + impact: 14 m MP 2 piles per day | WTG Vibratory + impact: DTD 14 m MP 1 pile per day | ESP Impact only: Post-piled Jacket pile 4 piles per day | ESP Impact only: DTD Post-piled Jacket pile 4 piles per day |
|---|---|---|---|---|---|
| May | 1 | 0 | 0 | 0 | 0 |
| June | 1 | 0 | 0 | 0 | 0 |
| July | 17 | 2 | 3 | 4 | 0 |
| August | 17 | 2 | 3 | 4 | 1 |
| September | 17 | 2 | 2 | 0 | 0 |
| October | 1 | 1 | 1 | 0 | 0 |
| November | 1 | 0 | 0 | 0 | 0 |
| December | 1 | 0 | 0 | 0 | 0 |

[a] WTGs are installed on 14 m monopile foundations. ESPs (which include both ESPs and a booster station) are installed on jacket foundations with eighteen 4.25 m post-piled pin piles. DTD = difficult to drive, indicating that the Proponent's drivability analysis suggests some piles would be installed at location requiring higher energies or a greater number of strikes.

Table 16. Construction Schedule A (14 m monopile), year 1: The number of potential days of pile installation for each foundation type [a], used to estimate the total number of piles and foundations at the end of the construction schedule.

| Foundation type | Total # days | Total # piles | Total # foundations |
|---|---|---|---|
| WTG | 72 | 79 | 79 |
| ESP | 9 | 36 | 2 |

[a] WTGs are installed on 14 m monopile foundations. ESPs (which include both ESPs and a booster station) are installed on jacket foundations with eighteen 4.25 m post-piled pin piles. DTD = difficult to drive, indicating that the Proponent's drivability analysis suggests some piles would be installed at location requiring higher energies or a greater number of strikes. The schedule includes a combination of foundations installed with impact only piling and foundations installed with vibratory setting of the pile followed by impact pile driving. The modeled parameters for all foundations are shown in Table A-1.

Table 17. Construction Schedule A (14 m monopile), year 2: The number of potential days of pile installation per month for each case [a], used to estimate the total number of marine mammal and sea turtle acoustic exposures above threshold criteria.

| Month | WTG Vibratory + impact: 14 m MP 1 pile per day | WTG Vibratory + impact: 14 m MP 2 piles per day | WTG Vibratory + impact: DTD 14 m MP 1 pile per day | ESP Impact only: post-piled jacket pile 4 piles per day | ESP Impact only: DTD post-piled jacket pile 4 piles per day |
|---|---|---|---|---|---|
| May | 1 | 0 | 0 | 0 | 0 |
| June | 1 | 0 | 0 | 0 | 0 |
| July | 17 | 2 | 3 | 4 | 0 |
| August | 17 | 2 | 3 | 4 | 1 |
| September | 16 | 2 | 2 | 0 | 0 |
| October | 1 | 1 | 1 | 0 | 0 |
| November | 1 | 0 | 0 | 0 | 0 |
| December | 1 | 0 | 0 | 0 | 0 |

[a] WTGs are installed on 14 m monopile foundations. ESPs (which include both ESPs and a booster station) are installed on jacket foundations with eighteen 4.25 m post-piled pin piles. DTD = difficult to drive, indicating that the Proponent's drivability analysis suggests some piles would be installed at location requiring higher energies or a greater number of strikes.

Table 18. Construction Schedule A (14 m monopile), year 2: The number of potential days of pile installation for each foundation type [a], used to estimate the total number of piles and foundations at the end of the construction schedule.

| Foundation type | Total # days | Total # piles | Total # foundations |
|---|---|---|---|
| WTG | 71 | 78 | 78 |
| ESP | 9 | 36 | 2 |

[a] WTGs are installed on 14 m monopile foundations. ESPs (which include both ESPs and a booster station) are installed on jacket foundations with eighteen 4.25 m post-piled pin piles. DTD = difficult to drive, indicating that the Proponent's drivability analysis suggests some piles would be installed at location requiring higher energies or a greater number of strikes. The schedule includes a combination of foundations installed with impact only piling and foundations installed with vibratory setting of the pile followed by impact pile driving. The modeled parameters for all foundations are shown in Table A-1.

Table 19. Construction Schedule A (14 m monopile), years 1 and 2 combined: The number of potential days of pile installation per month for each case [a], used to estimate the total number of marine mammal and sea turtle acoustic exposures above threshold criteria.

| Month | WTG Vibratory + impact: 14 m MP 1 pile per day | WTG Vibratory + impact: 14 m MP 2 piles per day | WTG Vibratory + impact: DTD 14 m MP 1 pile per day | ESP Impact only: post-piled jacket pile 4 piles per day | ESP Impact only: DTD post-piled jacket pile 4 piles per day |
|---|---|---|---|---|---|
| May | 2 | 0 | 0 | 0 | 0 |
| June | 2 | 0 | 0 | 0 | 0 |
| July | 34 | 4 | 6 | 8 | 0 |
| August | 34 | 4 | 6 | 8 | 2 |
| September | 33 | 4 | 4 | 0 | 0 |
| October | 2 | 2 | 2 | 0 | 0 |
| November | 2 | 0 | 0 | 0 | 0 |
| December | 2 | 0 | 0 | 0 | 0 |

[a] WTGs are installed on 14 m monopile foundations. ESPs (which include both ESPs and a booster station) are installed on jacket foundations with eighteen 4.25 m post-piled pin piles. DTD = difficult to drive, indicating that the Proponent's drivability analysis suggests some piles would be installed at location requiring higher energies or a greater number of strikes.

Table 20. Construction Schedule A (14 m monopile), years 1 and 2 combined: The number of potential days of pile installation for each foundation type [a], used to estimate the total number of piles and foundations at the end of the construction schedule.

| Foundation type | Total # days | Total # piles | Total # foundations |
|---|---|---|---|
| WTG | 143 | 157 | 157 |
| ESP | 18 | 72 | 4 |

[a] WTGs are installed on 14 m monopile foundations. ESPs (which include both ESPs and a booster station) are installed on jacket foundations with eighteen 4.25 m post-piled pin piles. DTD = difficult to drive, indicating that the Proponent's drivability analysis suggests some piles would be installed at location requiring higher energies or a greater number of strikes. The schedule includes a combination of foundations installed with impact only piling and foundations installed with vibratory setting of the pile followed by impact pile driving. The modeled parameters for all foundations are shown in Table A-1.

Table 21. Construction Schedule B (jacket), year 1: The number of potential days of pile installation per month for each case [a], used to estimate the total number of marine mammal and sea turtle acoustic exposures above threshold criteria.

| Month | WTG Vibratory + impact: pre-piled jacket pile 4 piles per day | WTG Vibratory + impact: pre-piled jacket pile 8 piles per day | WTG Vibratory + impact: DTD pre-piled jacket pile 4 piles per day | WTG Impact only: pre-piled jacket pile 4 piles per day | ESP Impact only: post-piled jacket pile 4 piles per day | ESP Impact only: DTD post-piled jacket pile 4 piles per day |
|---|---|---|---|---|---|---|
| May | 1 | 0 | 0 | 0 | 0 | 0 |
| June | 1 | 0 | 0 | 0 | 0 | 0 |
| July | 1 | 0 | 0 | 1 | 0 | 0 |
| August | 11 | 1 | 2 | 5 | 8 | 1 |
| September | 2 | 1 | 2 | 1 | 0 | 0 |
| October | 1 | 0 | 0 | 0 | 0 | 0 |
| November | 1 | 0 | 0 | 0 | 0 | 0 |
| December | 1 | 0 | 0 | 0 | 0 | 0 |

[a] WTGs are installed on jacket foundations with four 4.25 m pre-piled pin piles. ESPs (which include both ESPs and a booster station) are installed on jacket foundations with eighteen 4.25 m post-piled pin piles. DTD = difficult to drive, indicating that the Proponent's drivability analysis suggests some piles would be installed at location requiring higher energies or a greater number of strikes.

Table 22. Construction Schedule B (jacket), year 1: The number of potential days of pile installation for each foundation type [a], used to estimate the total number of piles and foundations at the end of the construction schedule.

| Foundation type | Total # days | Total # piles | Total # foundations |
|---|---|---|---|
| WTG | 32 | 136 | 34 |
| ESP | 9 | 36 | 2 |

[a] WTGs are installed on 14 m monopile foundations. ESPs (which include both ESPs and a booster station) are installed on jacket foundations with eighteen 4.25 m post-piled pin piles. DTD = difficult to drive, indicating that the Proponent's drivability analysis suggests some piles would be installed at location requiring higher energies or a greater number of strikes. The schedule includes a combination of foundations installed with impact only piling and foundations installed with vibratory setting of the pile followed by impact pile driving. The modeled parameters for all foundations are shown in Table A-1.

Table 23. Construction Schedule B (jacket), year 2: The number of potential days of pile installation per month for each case [a], used to estimate the total number of marine mammal and sea turtle acoustic exposures above threshold criteria.

| Month | WTG Vibratory + impact: pre-piled jacket pile 4 piles per day | WTG Vibratory + impact: pre-piled jacket pile 8 piles per day | WTG Vibratory + impact: DTD pre-piled jacket pile 4 piles per day | WTG Impact only: pre-piled jacket pile 4 piles per day | ESP Impact only: post-piled jacket pile 4 piles per day | ESP Impact only: DTD post-piled jacket pile 4 piles per day |
|---|---|---|---|---|---|---|
| May | 1 | 0 | 0 | 0 | 0 | 0 |
| June | 1 | 0 | 0 | 0 | 0 | 0 |
| July | 1 | 0 | 0 | 1 | 0 | 0 |
| August | 16 | 1 | 2 | 10 | 0 | 0 |
| September | 2 | 1 | 2 | 1 | 0 | 0 |
| October | 1 | 0 | 0 | 0 | 0 | 0 |
| November | 1 | 0 | 0 | 0 | 0 | 0 |
| December | 1 | 0 | 0 | 0 | 0 | 0 |

[a] WTGs are installed on jacket foundations with four 4.25 m pre-piled pin piles. ESPs (which include both ESPs and a booster station) are installed on jacket foundations with eighteen 4.25 m post-piled pin piles. DTD = difficult to drive, indicating that the Proponent's drivability analysis suggests some piles would be installed at location requiring higher energies or a greater number of strikes.

Table 24. Construction Schedule B (jacket), year 2: The number of potential days of pile installation for each foundation type [a], used to estimate the total number of piles and foundations at the end of the construction schedule.

| Foundation type | Total # days | Total # piles | Total # foundations |
|---|---|---|---|
| WTG | 42 | 176 | 44 |
| ESP | 0 | 0 | 0 |

[a] WTGs are installed on 14 m monopile foundations. ESPs (which include both ESPs and a booster station) are installed on jacket foundations with eighteen 4.25 m post-piled pin piles. DTD = difficult to drive, indicating that the Proponent's drivability analysis suggests some piles would be installed at location requiring higher energies or a greater number of strikes. The schedule includes a combination of foundations installed with impact only piling and foundations installed with vibratory setting of the pile followed by impact pile driving. The modeled parameters for all foundations are shown in Table A-1.

Table 25. Construction Schedule B (jacket), year 3: The number of potential days of pile installation per month for each case [a], used to estimate the total number of marine mammal and sea turtle acoustic exposures above threshold criteria.

| Month | WTG Vibratory + impact: pre-piled jacket pile 4 piles per day | WTG Vibratory + impact: pre-piled jacket pile 8 piles per day | WTG Vibratory + impact: DTD pre-piled jacket pile 4 piles per day | WTG Impact only: pre-piled jacket pile 4 piles per day | ESP Impact only: post-piled jacket pile 4 piles per day | ESP Impact only: DTD post-piled jacket pile 4 piles per day |
|---|---|---|---|---|---|---|
| May | 1 | 0 | 0 | 0 | 0 | 0 |
| June | 1 | 0 | 0 | 0 | 0 | 0 |
| July | 1 | 0 | 0 | 1 | 0 | 0 |
| August | 9 | 2 | 2 | 5 | 8 | 1 |
| September | 2 | 1 | 2 | 1 | 0 | 0 |
| October | 1 | 0 | 0 | 0 | 0 | 0 |
| November | 1 | 0 | 0 | 0 | 0 | 0 |
| December | 1 | 0 | 0 | 0 | 0 | 0 |

[a] WTGs are installed on jacket foundations with four 4.25 m pre-piled pin piles. ESPs (which include both ESPs and a booster station) are installed on jacket foundations with eighteen 4.25 m post-piled pin piles. DTD = difficult to drive, indicating that the Proponent's drivability analysis suggests some piles would be installed at location requiring higher energies or a greater number of strikes.

Table 26. Construction Schedule B (jacket), year 3: The number of potential days of pile installation for each foundation type [a], used to estimate the total number of piles and foundations at the end of the construction schedule.

| Foundation type | Total # days | Total # piles | Total # foundations |
|---|---|---|---|
| WTG | 31 | 136 | 34 |
| ESP | 9 | 36 | 2 |

[a] WTGs are installed on 14 m monopile foundations. ESPs (which include both ESPs and a booster station) are installed on jacket foundations with eighteen 4.25 m post-piled pin piles. DTD = difficult to drive, indicating that the Proponent's drivability analysis suggests some piles would be installed at location requiring higher energies or a greater number of strikes. The schedule includes a combination of foundations installed with impact only piling and foundations installed with vibratory setting of the pile followed by impact pile driving. The modeled parameters for all foundations are shown in Table A-1.

Table 27. Construction Schedule B (jacket), year 4: The number of potential days of pile installation per month for each case [a], used to estimate the total number of marine mammal and sea turtle acoustic exposures above threshold criteria.

| Month | WTG Vibratory + impact: pre-piled jacket pile 4 piles per day | WTG Vibratory + impact: pre-piled jacket pile 8 piles per day | WTG Vibratory + impact: DTD pre-piled jacket pile 4 piles per day | WTG Impact only pre-piled jacket pile 4 piles per day | ESP Impact only: post-piled jacket pile 4 piles per day | ESP Impact only: DTD post-piled jacket pile 4 piles per day |
|---|---|---|---|---|---|---|
| May | 1 | 0 | 0 | 0 | 0 | 0 |
| June | 1 | 0 | 0 | 0 | 0 | 0 |
| July | 1 | 0 | 0 | 1 | 0 | 0 |
| August | 15 | 1 | 2 | 11 | 0 | 0 |
| September | 3 | 1 | 2 | 1 | 0 | 0 |
| October | 1 | 0 | 0 | 0 | 0 | 0 |
| November | 1 | 0 | 0 | 0 | 0 | 0 |
| December | 1 | 0 | 0 | 0 | 0 | 0 |

[a] WTGs are installed on jacket foundations with four 4.25 m pre-piled pin piles. ESPs (which include both ESPs and a booster station) are installed on jacket foundations with eighteen 4.25 m post-piled pin piles. DTD = difficult to drive, indicating that the Proponent's drivability analysis suggests some piles would be installed at location requiring higher energies or a greater number of strikes.

Table 28. Construction Schedule B (jacket), year 4: The number of potential days of pile installation for each foundation type [a], used to estimate the total number of piles and foundations at the end of the construction schedule.

| Foundation type | Total # days | Total # piles | Total # foundations |
|---|---|---|---|
| WTG | 43 | 180 | 45 |
| ESP | 0 | 0 | 0 |

[a] WTGs are installed on 14 m monopile foundations. ESPs (which include both ESPs and a booster station) are installed on jacket foundations with eighteen 4.25 m post-piled pin piles. DTD = difficult to drive, indicating that the Proponent's drivability analysis suggests some piles would be installed at location requiring higher energies or a greater number of strikes. The schedule includes a combination of foundations installed with impact only piling and foundations installed with vibratory setting of the pile followed by impact pile driving. The modeled parameters for all foundations are shown in Table A-1.

Table 29. Construction Schedule B (jacket), years 1-4 combined: The number of potential days of pile installation per month for each case [a], used to estimate the total number of marine mammal and sea turtle acoustic exposures above threshold criteria.

| Month | WTG Vibratory + impact: pre-piled jacket pile 4 piles per day | WTG Vibratory + impact: pre-piled jacket pile 8 piles per day | WTG Vibratory + impact: DTD pre-piled jacket pile 4 piles per day | WTG Impact only: pre-piled jacket pile 4 piles per day | ESP Impact only: post-piled jacket pile 4 piles per day | ESP Impact only: DTD post-piled jacket pile 4 piles per day |
|---|---|---|---|---|---|---|
| May | 4 | 0 | 0 | 0 | 0 | 0 |
| June | 4 | 0 | 0 | 0 | 0 | 0 |
| July | 4 | 0 | 0 | 4 | 0 | 0 |
| August | 51 | 5 | 8 | 31 | 16 | 2 |
| September | 9 | 4 | 8 | 4 | 0 | 0 |
| October | 4 | 0 | 0 | 0 | 0 | 0 |
| November | 4 | 0 | 0 | 0 | 0 | 0 |
| December | 4 | 0 | 0 | 0 | 0 | 0 |

[a] WTGs are installed on jacket foundations with four 4.25 m pre-piled pin piles. ESPs (which include both ESPs and a booster station) are installed on jacket foundations with eighteen 4.25 m post-piled pin piles. DTD = difficult to drive, indicating that the Proponent's drivability analysis suggests some piles would be installed at location requiring higher energies or a greater number of strikes.

Table 30. Construction Schedule B (jacket), years 1-4 combined: The number of potential days of pile installation for each foundation type [a], used to estimate the total number of piles and foundations at the end of the construction schedule.

| Foundation type | Total # days | Total # piles | Total # foundations |
|---|---|---|---|
| WTG | 148 | 628 | 157 |
| ESP | 18 | 72 | 4 |

[a] WTGs are installed on 14 m monopile foundations. ESPs (which include both ESPs and a booster station) are installed on jacket foundations with eighteen 4.25 m post-piled pin piles. DTD = difficult to drive, indicating that the Proponent's drivability analysis suggests some piles would be installed at location requiring higher energies or a greater number of strikes. The schedule includes a combination of foundations installed with impact only piling and foundations installed with vibratory setting of the pile followed by impact pile driving. The modeled parameters for all foundations are shown in Table A-1.

# 2. Methods

The basic modeling approach is to characterize the sounds produced by the source, determine how the sounds propagate within the surrounding water column, and then estimate species-specific exposure probability by considering the range- and depth-dependent sound fields in relation to animal movement in simulated representative scenarios.

For impact and vibratory pile driving sounds, time-domain representations of the pressure waves generated in the water are required for calculating sound pressure level (SPL) and peak pressure level (PK), which are then used to evaluate potential impacts. The source signatures associated with installing each of the modeled typical and difficult to drive monopiles and jacket piles were predicted using a finite-difference model of the physical vibration of the pile caused by pile driving equipment. The pile as a sound source radiating into the environment was simulated as an array of point sources.

For this study, synthetic pressure waveforms were computed using a Full Waveform Range-dependent Acoustic Model (FWRAM), which is JASCO's acoustic propagation model capable of producing time-domain waveforms. The sound propagation modeling incorporates site-specific environmental data including bathymetry, sound speed in the water column, and seabed geoacoustics in the proposed construction area. To estimate received levels for animals in the construction area exposed to sounds associated with installing the monopiles and jacket piles, JASCO's Animal Simulation Model Including Noise Exposure (JASMINE) was used to integrate the sound fields with species-typical behavioral parameters (e.g., dive patterns). Animats that exceed pre-defined acoustic thresholds/criteria (e.g., NMFS 2018) are identified and the range for the exceedances determined. The potential acoustic exposure for marine species was estimated by finding the accumulated sound energy (SEL) and maximum SPL and PK pressure level each animat received over the course of the simulation. The number of animals expected to exceed the regulatory thresholds is determined by scaling the probability of exposure by the species-specific density of animals in the area.

This section provides an overview of the modeling and analysis undertaken for this study, and additional details can be found in the appendices. Appendix A summarizes the assumptions made for each acoustic source. Appendix B defines the acoustic metrics and decidecade frequency band analysis used in this study. Appendix C describes the frequency weighting functions that are used in calculating some acoustic metrics associated with acoustic criteria. Appendices D and E provide details of the acoustic modeling.

## 2.1. Acoustic Environment

Vineyard Northeast is located in a continental shelf environment characterized by predominantly fine-to-coarse grained sandy-seabed sediments, with some clay content. Water depths in the Vineyard Northeast Lease Area vary between approximately 32–64 m, while the surrounding area of impact varies between 10–100 m. From June to November, the average temperature of the upper (0–50 m) water column is higher, which can lead to a surface layer of increased sound speeds (Appendix E-2). This may create a downward refracting environment in which propagating sound interacts with the seafloor more than in a well-mixed environment. Increased wind mixing combined with a decrease in solar energy during winter, from December through May, results in a cooler surface layer. The cooler surface layer combined with a layer of warmer subsurface water may create sound ducts that enable sound to travel further during these months. An average summer (June-August) and winter (January-March) sound speed profiles were used in the acoustic propagation modeling. See Appendix E-1 for more details on the environmental parameters used in acoustic propagation and exposure modeling.

## 2.2. Modeling Acoustic Sources

### 2.2.1. Impact Pile Driving

When driven with impact hammers, piles deform, creating a bulge that travels down the pile and radiates sound into the surrounding air, water, and seabed. This sound may be received as a direct transmission from the sound source to biological receivers (such as marine mammals, sea turtles, and fish) through the water or as the result of reflected paths from the surface or re-radiated into the water from the seabed (Figure 3). Sound transmission depends on many environmental parameters, such as the sound speeds in water and substrates; sound production parameters of the pile and how it is driven, including the pile material, size (length, diameter, and thickness) and the type and energy of the hammer.

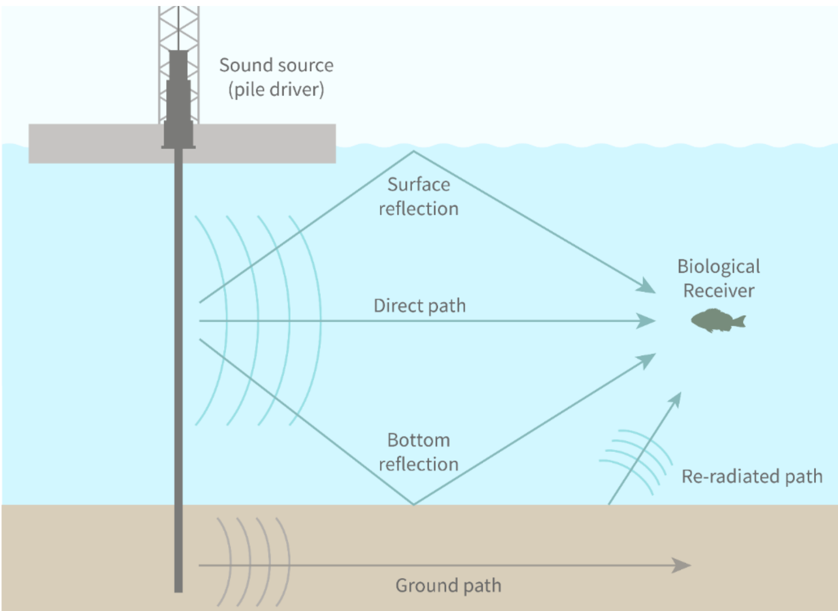



Figure 3. Sound propagation paths associated with pile driving (adapted from Buehler et al. 2015).

JASCO's physical model of pile vibration and near-field sound radiation (MacGillivray 2014) was used in conjunction with the GRLWEAP 2010 wave equation model (GRLWEAP, Pile Dynamics 2010) to predict source levels associated with impact pile driving activities. Piles are modeled as a vertical installation using a finite-difference structural model of pile vibration based on thin-shell theory. The sound radiating from the pile itself was simulated using a vertical array of discrete point sources. These models account for several parameters that describe the operation—pile type, material, size, and length—the pile driving equipment, and approximate pile penetration depth. See Appendix D for a more detailed description.

Forcing functions were computed for the typical and difficult to drive monopiles and jacket foundation piles using GRLWEAP 2010 (GRLWEAP, Pile Dynamics 2010). The model assumed direct contact between the representative hammers, helmets, and piles (i.e., no cushioning material). The forcing functions serve as inputs to JASCO's pile driving source model (PDSM), which was used to estimate equivalent acoustic source characteristics detailed in Appendix D.1.

JASCO's FWRAM (Appendix E.3) propagation model was used to combine the outputs of the source model with spatial and temporal environmental factors (e.g., location, oceanographic conditions, and seabed type) to get time-domain representations of the sound signals in the environment and estimate sound field levels. This model is used to estimate the energy distribution per frequency (source spectrum) at a close distance from the source (10 m). Examples of decidecade band levels for each pile type, hammer energy, and modeled location, using the average summer and winter sound speed profiles are provided in Section 4.1 for monopiles and jacket foundation piles.

Jacket foundation piles are assumed to be pre- and post-piled. Pre-piling means that the jacket structure will be set on pre-installed piles. Post-piling means that the jacket structure is placed on the seafloor and piles are subsequently driven through guides at the base of each leg. These jacket foundations will also radiate sound as the piles are driven. During the project NavES: Experience Report Pile-Driving Noise, a quantitative comparison between installations of monopiles and main-piles by the post-piling procedure showed an up to 2 dB increased in noise levels due to post-piling (Bellmann et al. 2020).To account for the larger radiating area in post-piled jackets for this study, the broadband sound level was increased by 2 dB for post-piling scenarios. WTG jacket foundations are expected to be pre-piled, and the ESP/booster station jacket foundations are expected to be post-piled.

## 2.2.2. Vibratory Pile Driving

During vibratory pile driving, piles are driven into the substrate due to longitudinal vibration motion at the hammer’s operational frequency and corresponding amplitude. This causes the soil to liquefy, allowing the pile to penetrate into the seabed.

One second long vibratory forcing functions were computed for the 14 m monopile and the 4 and 4.25 m jacket foundations, using GRLWEAP 2010 (GRLWEAP, Pile Dynamics 2010). Clamps are used to connect the vibratory hammer to the pile. The model assumed the use of 20 clamps with a total weight of 1314 kN for the 14 m monopile, 6 clamps with total weight of 394.2 kN for the 4 m jacket piles, and 8 clamps with total weight of 525.6 kN for the 4.25 m jacket piles. No cushion between the hammer and pile was used. Non-linearities were introduced to the vibratory forcing functions based on the decay rate observed in data measured during vibratory pile driving of smaller diameter piles (Quijano et al. 2017). The resulting forcing functions serve as inputs to JASCO’s pile driving source model (PDSM) used to estimate an equivalent acoustic source represented by a linear array of monopoles evenly distributed along the pile, as detailed in Appendix D. Sound propagation of the vibratory pile driving source signature is performed using FWRAM and modeling details are described in Appendix E. Decidecade band levels at 10 m from the source for each pile type, hammer energy and modeled location, using an average summer and winter sound speed profiles, are provided in Section 4.1.

## 2.3. Noise Mitigation

Noise abatement systems (NASs) are often used to decrease the sound levels in the water near a source by inserting a local impedance change that acts as a barrier to sound transmission. Various technologies can achieve attenuation by changing impedance. These technologies include bubble curtains, evacuated sleeve systems (e.g., IHC-Noise Mitigation System [NMS]), encapsulated bubble systems (e.g., HydroSound Dampers), or Helmholtz resonators (AdBm NMS). The effectiveness of each system is frequency dependent and may be influenced by local environmental conditions such as water current and depth. For example, the size of the bubbles determines the effective frequency band of an air bubble curtain, with larger bubbles needed for lower frequencies.

Small bubble curtains (bubble curtains positioned within in a short radius around the pile) have been measured to reduce sound levels from impact pile driving by ~10 dB to more than 20 dB but are highly dependent on water depth, current, and how the curtain is configured and operated (Koschinski and Lüdemann 2013, Bellmann 2014, Austin and Li 2016). Larger bubble curtains tend to perform better and more reliably, particularly when deployed with two rings, known as double bubble curtains (Koschinski and Lüdemann 2013, Bellmann 2014, Nehls et al. 2016). A California Department of Transportation study tested several small, single, bubble-curtain systems and found that the best attenuation systems resulted in 10–15 dB of attenuation. Buehler et al. (2015) concluded that attenuation greater than 10 dB could not be reliably predicted from small, single, bubble curtains because sound transmitted through the seabed and re-radiated into the water column is the dominant source of sound in the water for bubble curtains deployed immediately around (10 m [32 ft]) the pile (Buehler et al. 2015).

A recent analysis by Bellmann et al. (2020) of NAS performance measured during impact driving for wind farm foundation installation provides expected performance for common NAS configurations. Measurements with a single bubble curtain and an air supply of 0.3 $m^3$/min resulted in 7–11 dB of broadband attenuation for optimized systems in up to 40 m water depth. Increased air flow (0.5 $m^3$/min) may improve the attenuation levels up to 11–13 dB (M. Bellmann, personal communication, 2019). Double bubble curtains add another local impedance change and, for optimized systems, can achieve 15 to 16 dB of broadband attenuation (measured in up to 40 m water depth). The IHC-NMS can provide 15 to 17 dB of attenuation but is currently limited to piles <8 m diameter. Other NASs, such as the AdBm NMS, achieved 6 to 8 dB (M. Bellmann, personal communication, 2019), but HydroSound Dampers were measured at 10 to 12 dB attenuation and are independent of depth (Bellmann et al. 2020). Systems may be deployed in series to achieve higher levels of attenuation.

The NAS must be chosen, tailored, and optimized for site-specific conditions. NAS performance of 10 dB broadband (across all frequencies) attenuation was chosen for this study as an achievable reduction of sound levels produced during pile driving when one NAS is in use, noting that a 10 dB decrease means the sound energy level is reduced by 90%. For exposure-based radial distance estimation, several levels of broadband attenuation were included for comparison purposes.

The studies and measurements referenced above are from impact pile driving. JASCO is not aware of similar publicly available studies on the performance of NASs for vibratory pile driving. However, primary sound production of both vibratory and impact pile driving is in similar frequency bands, between ~20 to ~300 Hz. Therefore, NASs performance for vibratory pile driving is expected to be comparable to impact pile driving, and the same levels of attenuation were used for vibratory driving as impact driving.

## 2.4. Acoustic Criteria for Marine Fauna

The acoustic criteria used for this study are from the current US regulatory acoustic criteria and are summarized below (further details on these criteria are in Sections 2.4.1 and 2.4.3):

1. Peak sound pressure levels (PK; $L_{pk}$) and frequency-weighted accumulated sound exposure levels (SEL; $L_{E,24h}$) are from the US National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) Technical Guidance (NMFS 2018) for marine mammal injury thresholds.
2. Sound pressure levels (SPL; $L_p$) for marine mammal behavioral thresholds are based on the unweighted NOAA (2005) and the frequency-weighted Wood et al. (2012) criteria.
3. Injury thresholds (PK and SEL) for fish are from the Fisheries Hydroacoustic Working Group (FHWG 2008) and Stadler and Woodbury (2009) for fish that are equal, greater than, or less than 2 g.
4. Injury thresholds (PK and SEL) for fish are from Popper et al. (2014) for fish without swim bladders, fish with swim bladders not involved in hearing, and fish with swim bladders involved in hearing.
5. Behavioral thresholds for fish are from the NOAA Fisheries Greater Atlantic Regional Fisheries Office (GARFO) (Andersson et al. 2007, Wysocki et al. 2007, Mueller-Blenkle et al. 2010, Purser and Radford 2011)
6. Peak pressure levels (PK; $L_{pk}$) and frequency-weighted accumulated sound exposure levels (SEL; $L_{E,24h}$) from Finneran et al. (2017) were used for the onset of permanent threshold shift (PTS) in sea turtles.
7. Behavioral response thresholds for sea turtles were obtained from McCauley et al. (2000a), which was confirmed in Finneran et al. (2017).

### 2.4.1. Acoustic Criteria–Marine Mammals

The Marine Mammal Protection Act (MMPA) prohibits the take of marine mammals. The term "take" is defined as: to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal. MMPA regulations define harassment in two categories relevant to the Vineyard Northeast construction and operations. These are:

- **Level A**: Any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild, and
- **Level B**: Any act of pursuit, torment or annoyance that has the potential to disturb a marine mammal or marine mammal stock in the wild by disrupting behavioral patterns, including, but not limited to, migrating, breathing, nursing, breeding, feeding, or sheltering but that does not have the potential to injure a marine mammal or marine mammal stock in the wild (16 U.S.C. 1362).

To assess the potential impacts of the underwater sound in the Lease Area, it is necessary to first establish the acoustic exposure criteria used by United States regulators to estimate marine mammal takes. In 2016, National Oceanographic and Atmospheric Administration (NOAA) Fisheries issued a Technical Guidance document that provides acoustic thresholds for onset of PTS and TTS in marine mammal hearing for most sound sources, which was updated in 2018 (NMFS 2016, 2018). This Technical Guidance document also recognizes two main types of sound sources: impulsive and non-impulsive. Non-impulsive sources are further separated into continuous or intermittent categories.

NMFS also provided guidance on using weighting functions when applying Level A harassment criteria. The Guidance recommends using a dual criterion for assessing Level A exposures, including a PK (unweighted/flat) sound level metric and a cumulative SEL metric with frequency weighting. Both acoustic criteria and weighting function application are divided into functional hearing groups (low-, mid-, and high-frequency cetaceans and phocid pinnipeds) that species are assigned to, based on their respective hearing frequency ranges. This report applies the most recent sound exposure criteria used by NMFS to estimate acoustic harassment (NMFS 2018).

Based on observations of mysticetes (Malme et al. 1983, 1984, Richardson et al. 1986, 1990), sound levels thought to elicit disruptive behavioral responses are described using the SPL metric (NOAA 2005). NMFS currently uses behavioral response thresholds of SPL 160 dB re 1 µPa for marine mammals exposed to non-explosive impulsive sounds, like impact pile driving, and SPL 120 dB re 1 µPa for marine mammals exposed to continuous sounds, like vibratory pile driving or drilling (NMFS 2022). Alternative thresholds used in acoustic assessments include a graded probability of response approach and account for the frequency-dependence of animal hearing sensitivity (Wood et al. 2012).

The publication of ISO 18405 Underwater Acoustics–Terminology (ISO 2017) provided a dictionary of underwater bioacoustics (the previous standard was ANSI and ASA S1.1-2013). In the remainder of this report, we follow the definitions and conventions of ISO (2017), except where stated otherwise (Table 31).

Table 31. Summary of relevant acoustic terminology used by US regulators and in the modeling report.

| Metric | NMFS (2018) | Main text [a] | Equations/tables [a] |
|---|---|---|---|
| Sound pressure level | n/a | SPL | $L_{p,w}$ [c] |
| Peak pressure level | PK | PK | $L_{pk}$ |
| Sound exposure level | $SEL_{cum}$ [a] | SEL | $L_{E,w,T,}$ [d] |

[a] Following ISO (2017), with modifications described in the footnotes.

[b] $SEL_{cum}$ metric used by NOAA Fisheries (NMFS) describes sound energy received by a receptor over a 24 h period. Accordingly, following the ISO standard, this will be denoted as SEL in this report, except for in tables and equations where $L_{E,w,T}$ is used.

[c] w in $L_{p,w}$ and $L_{E,w,T}$ describes frequency-weighting function, if used.

[d] T in $L_{E,w,T}$ describes the time window used to calculate SEL.

## 2.4.2. Marine Mammal Hearing groups

Current data and predictions show that marine mammal species differ in their hearing capabilities, in absolute hearing sensitivity as well as frequency band of hearing (Richardson et al. 1995, Wartzok and Ketten 1999, Southall et al. 2007, Au and Hastings 2008). While hearing measurements are available for a small number of species based on captive animal studies, there are no direct measurements of many odontocetes or any mysticetes. As a result, hearing distances for many odontocetes are grouped with similar species, and predictions for mysticetes are based on other methods including: anatomical studies and modeling (Houser et al. 2001, Parks et al. 2007, Tubelli et al. 2012, Cranford and Krysl 2015); vocalizations (see reviews in Richardson et al. 1995, Wartzok and Ketten 1999, Au and Hastings 2008); taxonomy; and behavioral responses to sound (Dahlheim and Ljungblad 1990, see review in Reichmuth et al. 2007). In 2007, Southall et al. proposed that marine mammals be divided into hearing groups. This division was updated in 2016 and 2018 by NOAA Fisheries using more recent best available science (Table 32).

Southall et al. (2019) published an updated set of Level A sound exposure criteria (including the onset of temporary threshold shift [TTS] and permanent threshold shift [PTS] in marine mammals). While the authors propose a new nomenclature and classification for the marine mammal functional hearing groups, the proposed thresholds and weighting functions do not differ in effect from those proposed by NOAA Fisheries (2018). The new hearing groups proposed by Southall et al. (2019) have not yet been adopted by NOAA. The NOAA Fisheries (NMFS 2018) hearing groups presented in Table 32 are used in this analysis.

Table 32. Marine mammal hearing groups (Sills et al. 2014, NMFS 2018).

| Faunal group | Generalized hearing range [a] |
|---|---|
| Low-frequency (LF) cetaceans (mysticetes or baleen whales) | 7 Hz to 35 kHz |
| Mid-frequency (MF) cetaceans (odontocetes: delphinids, beaked whales) | 150 Hz to 160 kHz |
| High-frequency (HF) cetaceans (other odontocetes) | 275 Hz to 160 kHz |
| Phocid pinnipeds in water (PPW) | 50 Hz to 86 kHz |
| Phocid pinnipeds in air (PPA) [b] | 50 Hz to 36 kHz |

[a] The generalized hearing distance is for all species within a group. Individual hearing will vary.
[b] Sound from piling will not reach NOAA Fisheries thresholds for behavioral disturbance of seals in air (90 dB [rms] re 20 μPa for harbor seals and 100 dB [rms] re 20 μPa for all other seal species) at the closest land-based sites where seals may spend time out of the water. Thus in-air hearing is not considered further.

### 2.4.2.1. Marine Mammal Auditory Weighting Functions

The potential for anthropogenic sound to impact marine mammals is largely dependent on whether the sound occurs at frequencies that an animal can hear well unless the sound pressure level is so high that it can cause physical tissue damage regardless of frequency. Auditory (frequency) weighting functions reflect an animal's ability to hear a sound (Nedwell and Turnpenny 1998, Nedwell et al. 2007). Auditory weighting functions have been proposed for marine mammals, specifically associated with PTS thresholds expressed in metrics that consider what is known about marine mammal hearing (e.g., SEL) (Southall et al. 2007, Erbe et al. 2016, Finneran 2016). Marine mammal auditory weighting functions for all hearing groups (see Table 32) published by Finneran (2016) are included in the NMFS (2018) Technical Guidance for use in conjunction with corresponding permanent threshold shift (PTS [Level A] onset acoustic criteria; Table 33). See Appendix C for a detailed description of the weighting functions.

The application of marine mammal auditory weighting functions emphasizes the importance of taking measurements and characterizing sound sources in terms of their overlap with biologically important frequencies (e.g., frequencies used for environmental awareness, communication, and the detection of predators or prey), and not only the frequencies that are relevant to achieving the objectives of the sound producing activity (i.e., context of sound source; NMFS 2018).

#### 2.4.2.2. Marine Mammal Auditory Injury Exposure Criteria

Injury to the hearing apparatus of a marine mammal may result from brief exposure to an intense sound or from longer fatiguing sound exposures. Damage to hearing from brief exposure to intense sounds is independent of the duration of the signal, and the PK metric is used to assess the potential risk for injury. For longer-duration exposures, a measure of the total received sound energy is needed. The SEL metric is proportional to sound energy and is calculated by summing over the duration of the received signal. A PTS in hearing may be considered injurious, but there are no published data on the sound levels that cause PTS in marine mammals. There are data that indicate the received sound levels at which temporary threshold shift, TTS, occurs, and PTS onset may be extrapolated from TTS onset level and an assumed growth function (Southall et al. 2007). The NMFS (2018) criteria incorporate the best available science to estimate PTS onset in marine mammals from instantaneous peak (PK) sound pressure levels and sound energy accumulated over 24 h (SEL; $L_E$) (Table 33).

Different types of sounds affect the ear differently. Impulsive sounds are known to be more damaging than non-impulsive sounds. For this reason, there are lower thresholds for exposure to impulsive sounds than non-impulsive sounds (Table 33). In some cases, an animal may be exposed to a combination of impulsive and non-impulsive sounds, or an impulsive sound may follow exposure to a non-impulsive sound. When concurrent sounds of different types are received, the sound energy from all sources should be summed and the threshold for impulsive sounds should be used because the resultant sound can be thought of as impulses within a background of non-impulsive sound. When impulsive sound (such as impact pile driving) follows exposure to non-impulsive sound (such as vibratory pile driving), potential effects of the non-impulsive sound (vibratory pile driving) should be evaluated first followed by the potential effects of the impulsive sound (impact pile driving). The sound energy from the exposure to non-impulsive sound (vibratory pile driving), however, should be included in the total received energy during the impulsive sound (impact pile driving) if the non-impulsive sound occurs within the time window of evaluation (24 h).

Table 33. Summary of relevant permanent threshold shift (PTS) onset acoustic thresholds for marine mammal hearing groups (NMFS 2018).

| Hearing group | Impulsive signals [a] Unweighted $L_{pk}$ (dB re 1 µPa) | Impulsive signals [a] Frequency-weighted $L_{E,w,24h}$ (dB re 1 µPa²·s) | Non-impulsive signals Frequency-weighted $L_{E,w,24h}$ (dB re 1 µPa²·s) |
|---|---|---|---|
| Low-frequency (LF) cetaceans | 219 | 183 | 199 |
| Mid-frequency (MF) cetaceans | 230 | 185 | 198 |
| High-frequency (HF) cetaceans | 202 | 155 | 173 |
| Phocid seals in water (PW) | 218 | 185 | 201 |

[a] Dual metric acoustic thresholds for impulsive sounds: Of these two metrics, the one with the larger acoustic isopleth or the larger exposure effect is used to assess PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds have also been considered.

#### 2.4.2.3. Marine Mammal Behavioral Response Exposure Criteria

Numerous studies on marine mammal behavioral responses to sound exposure have not resulted in consensus in the scientific community regarding the appropriate metric for assessing behavioral reactions. It is recognized that the context in which the sound is received affects the nature and extent of responses to a stimulus (Southall et al. 2007, Ellison et al. 2012). Due to the complexity and variability of marine mammal behavioral responses to acoustic exposure, NMFS has not yet released updated technical guidance for determining potential behavioral responses of marine mammals exposed to sounds (NMFS 2018)(NMFS 2018)(NMFS 2018) and currently uses a step function to assess behavioral impact (NOAA 2005). The step function sets an SPL of 160 dB re 1 µPa as the behavioral disruption threshold based on the 50% response rate of collated responses from the HESS (1999) report. An SPL of 120 dB re 1 µPa was set as the behavioral disruption threshold for migrating mysticetes (NOAA 2005), which was based on the responses of migrating mysticete whales to airgun sounds (Malme et al. 1983, 1984). The HESS team recognized that behavioral responses to sound may occur at lower levels, but substantial responses were only likely to occur above an SPL of 140 dB re 1 µPa. NMFS currently uses behavioral response thresholds of SPL 160 dB re 1 µPa for non-explosive, impulsive sounds, such as impact pile driving, and SPL120 dB re 1 µPa for continuous sounds, live vibratory pile driving and drilling, for all marine mammal species (NMFS 2022).

An extensive review of behavioral responses to sound was undertaken by Southall et al. (2007, their Appendix B). Southall et al. (2007) found varying responses for most marine mammals between an SPL of 140 and 180 dB re 1 µPa, consistent with the HESS (1999) report, but lack of convergence in the data prevented them from suggesting explicit step functions. In 2012, Wood et al. proposed a graded probability of response for impulsive sounds using a frequency weighted SPL metric. Wood et al. (2012) also designated behavioral response categories for sensitive species (including harbor porpoises and beaked whales) and for migrating mysticetes. For this analysis, both the unweighted SPLs from NOAA (2005) and the frequency-weighted Wood et al. (2012) criteria are used to estimate behavioral exposures (Table 34).

Table 34. Wood et al. (2012) frequency-weighted and NOAA (2005) unweighted acoustic sound pressure level (SPL) thresholds used to evaluate potential behavioral impacts to marine mammals. Probabilities are not additive.

| Marine mammal group | Species | Frequency-weighted probabilistic response ($L_{p,w}$ >120 dB re 1 µPa$^2$) | Frequency-weighted probabilistic response ($L_{p,w}$ >140 dB re 1 µPa$^2$) | Frequency-weighted probabilistic response ($L_{p,w}$ >160 dB re 1 µPa$^2$) | Frequency-weighted probabilistic response ($L_{p,w}$ >180 dB re 1 µPa$^2$) | Unweighted probabilistic response, impulsive ($L_p$= 160 dB re 1 µPa$^2$) | Unweighted probabilistic response, impulsive ($L_p$= 120 dB re 1 µPa$^2$) |
|---|---|---|---|---|---|---|---|
| Sensitive odontocetes | Harbor porpoise | 50% | 90% | – | – | 100% | 100% |
| Migrating mysticete whales | Minke whale<br>Sei whale | 10% | 50% | 90% | – | 100% | 100% |
| - | All other species | – | 10% | 50% | 90% | 100% | 100% |

### 2.4.3. Acoustic Criteria – Sea Turtles and Fish

In a cooperative effort between Federal and State transportation and resource agencies, interim criteria were developed to assess the potential for injury to fish exposed to pile driving sounds (Stadler and Woodbury 2009) and described by the Fisheries Hydroacoustic Working Group (FHWG 2008). Injury and behavioral thresholds for sea turtles were developed for use by the US Navy (Blackstock et al. 2018) based on exposure studies (e.g., McCauley et al. 2003). These injury and behavioral response levels for fish and sea turtles were compiled and listed in the NOAA Fisheries Greater Atlantic Regional Fisheries Office (GARFO) tool for assessing the potential effects to ESA-listed fish and sea turtles exposed to elevated levels of underwater sound from pile driving. Dual acoustic thresholds for physiological injury to fish included in the tool are 206 dB PK and either 187 dB SEL (>2 g fish weight) or 183 dB SEL (<2 g fish weight) (Table 35) (FHWG 2008, Stadler and Woodbury 2009). The behavioral threshold for fish is ≥150 dB SPL (Table 35) (Andersson et al. 2007, Wysocki et al. 2007, Mueller-Blenkle et al. 2010, Purser and Radford 2011).

A technical report by an American National Standards Institute (ANSI) registered committee (Popper et al. 2014) reviewed available data and suggested metrics and methods for estimating acoustic impacts for fish. Their report includes thresholds for potential injury but does not define sound levels that may result in behavioral response, though it does indicate a high likelihood of response near impact pile driving (tens of meters), a moderate response at intermediate distances (hundreds of meters), and a low response far (thousands of meters) from the pile (Popper et al. 2014).

Injury, impairment, and behavioral thresholds for sea turtles were developed for use by the US Navy (Finneran et al. 2017) based on exposure studies (e.g., McCauley et al. 2000b). Dual criteria (PK and SEL) have been suggested by NMFS for PTS and TTS, and auditory weighting functions published by Finneran et al. (2017) are used here in conjunction with SEL thresholds for PTS and TTS . The behavioral threshold recommended in the GARFO acoustic tool (GARFO 2020b) is an SPL of 175 dB re 1 µPa (McCauley et al. 2000b, Finneran et al. 2017) (Table 35).

Table 35. Acoustic metrics and thresholds for fish and sea turtles currently used by NMFS GARFO and Bureau of Ocean Energy Management (BOEM) for impulsive pile driving. For vibratory pile setting, only behavioral thresholds apply. Fish injury thresholds, from impulsive sources were used for this analysis since non-impulsive injury criteria do not exist for fish (Popper et al. 2014).

| Faunal group | Injury, PTS ($L_{pk}$) | Injury, PTS ($L_E$) | Impairment, TTS ($L_{pk}$) | Impairment, TTS ($L_E$) | Behavior ($L_p$) |
|---|---|---|---|---|---|
| Fish equal to or greater than 2 g [a] | 206 | 187 | - | - | 150 |
| Fish less than 2 g [a] | | 183 | - | - | |
| Fish without swim bladder [b] | 213 | 216 | - | - | - |
| Fish with swim bladder not involved in hearing [b] | 207 | 203 | - | - | - |
| Fish with swim bladder involved in hearing [b] | 207 | 203 | - | - | - |
| Sea turtles [c, d] | 232 | 204 | 226 | 189 | 175 |

$L_{pk}$—peak sound pressure level (dB re 1 µPa), $L_E$—sound exposure level (dB re 1 µPa$^2$·s), $L_p$—root mean square sound pressure level (dB re 1 µPa$^2$).
A dash indicates that there are no thresholds for the specific category.
[a] NMFS recommended criteria adopted from the Fisheries Hydroacoustic Working Group (FHWG 2008).
[b] Popper et al. (2014).
[c] Finneran et al. (2017).
[d] McCauley et al. (2000b)

## 2.5. Animal Movement Modeling and Exposure Estimation

JASMINE was used to estimate the probability of exposure of animals to sound arising from pile driving operations during construction of Vineyard Northeast. Sound exposure models such as JASMINE use simulated animals (animats) to sample the predicted 3-D sound fields with movement rules derived from animal observations. An overview of the exposure modeling process using JASMINE is shown in Figure 4.

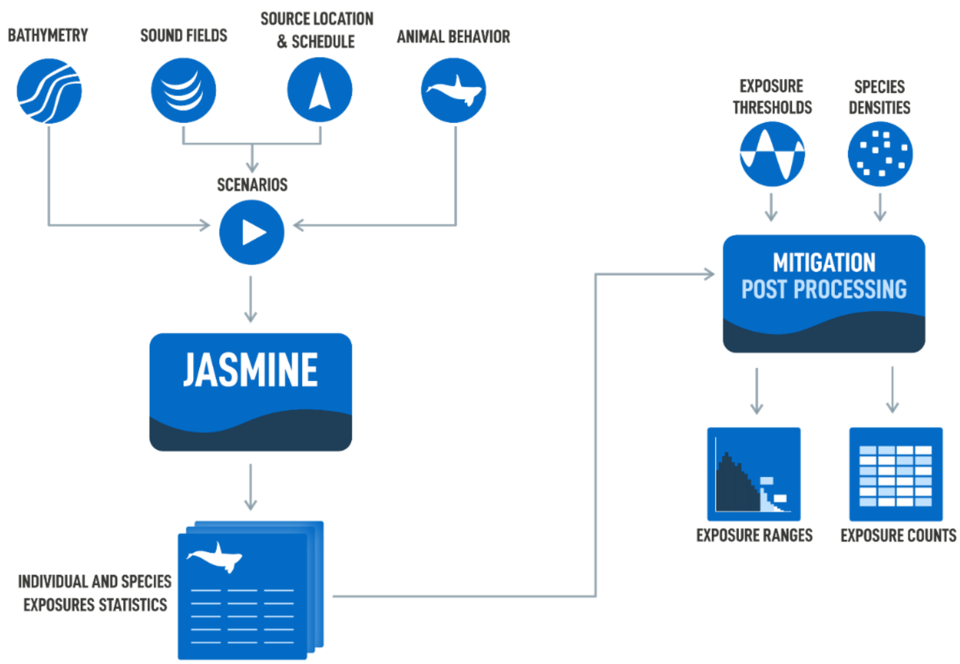



Figure 4. Exposure modeling process overview.

The parameters used for forecasting realistic behaviors (e.g., diving, foraging, and surface times) were determined and interpreted from marine species studies (e.g., tagging studies) where available, or reasonably extrapolated from related species (Appendix H, Figure 5). The predicted sound fields were sampled by the model receiver in a way that real animals are expected to by programming animats to behave like marine species that may be present near the Vineyard Northeast Lease Area. The output of the simulation is the exposure history for each animat within the simulation. An individual animat's sound exposure levels are summed over a specified duration, i.e., 24 h (Appendix H), to determine its total received acoustic energy (SEL) and maximum received PK and SPL. Received levels are then compared to the threshold criteria described in Section 2.4 within each analysis period. Appendix H provides a fuller description of animal movement modeling and the parameters used in the JASMINE simulations. Due to shifts in animal density and seasonal sound propagation effects, the number of animals predicted to be impacted by the pile driving operations is sensitive to the number of foundations installed during each month. JASMINE can be used to simulate aversive behaviors, where animals respond to sound. A subset of scenarios was run with aversion and these results are provided for demonstration purposes only (see Section 4.3.1.1).

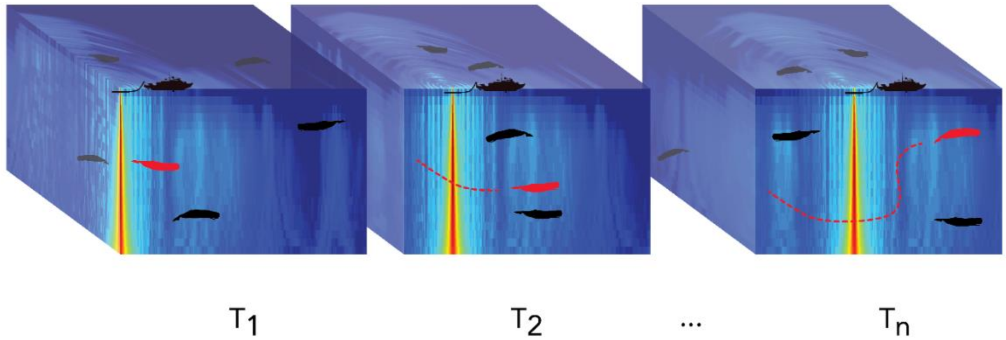



Figure 5. Depiction of animats in an environment with a moving sound field. Example animat (red) shown moving with each time step. The acoustic exposure of each animat is determined by where it is in the sound field, and its exposure history is accumulated as the simulation steps through time.

### 2.5.1. Implementing Pile Installation Schedules in JASMINE

Exposure modeling locations were chosen to represent expected construction activity in the Lease Area over a seven-day period. The pile installation schedules are described in Section 1.2.1.1.

The hammering schedule for each foundation type is determined from pile driving parameters. For a single pile, the installation time is calculated using the blow rate and blow count at each hammer energy level. A pile installation schedule is created for the simulation by assigning each strike of the pile to a time in the simulation, along with the closest associated sound field for that pile type and scenario. When multiple piles are driven per day, the same hammering schedule is used for the additional piles, with a delay between piles to allow for vessel movement and set up. Figure 6 displays the pile installation schedule for vibratory followed by impact pile driving operations.

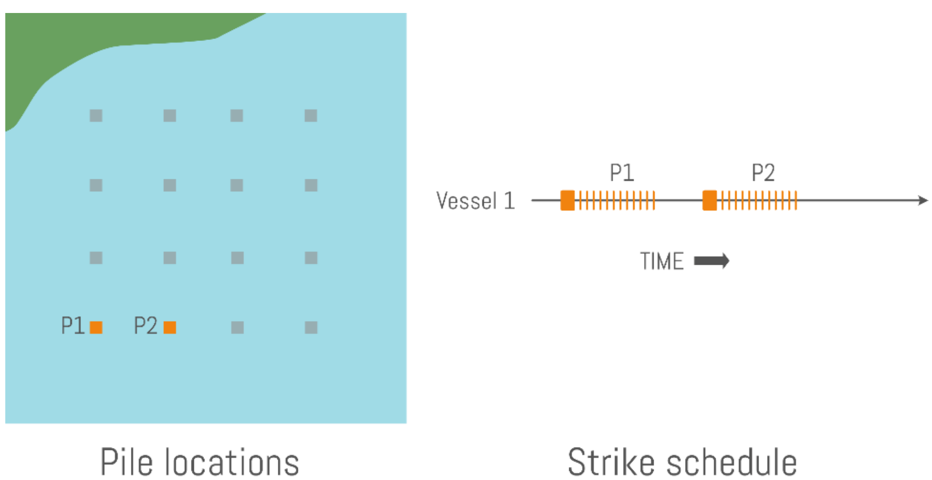



Figure 6. Pile installation schedule for vibratory pile driving followed by impact pile driving. Vertical orange tick marks show conceptual representations of each hammer strike. Solid orange bars preceding the tick marks indicate periods of vibratory pile driving.

The animal movement modeling assumed 30 minutes of vibratory setting of piles for all pile types and installation schedules. For impact piling of monopile foundations, the model assumed 15 minutes between vibratory and impact pile driving to switch equipment. A strike rate of 30 strikes per minute was used with one hour between foundation installation when more than one foundation was installed per day.

For jacket foundations, the number of strikes required to drive each pile as provided by the Proponent is a conservative estimate, in that it is likely to be an overestimate of the actual number of strikes required. The animal movement modeling is based on exposure levels in a 24 h period to capture 24-hour cumulative metrics (i.e., SEL), so pile installation is constrained to fit within 24 h. To accommodate the high number of strikes for jacket foundations within a 24-hour period, a strike rate of 48 per minute was used to model cases where 4 pin piles were installed in one day and a strike rate of 113 per minute was used to model cases where 8 pin piles were installed during one day. Additionally, the time between pile installation each day was decreased to 10 minutes and the time for swapping equipment was reduced to 6 minutes.

## 2.6. Summing Different Source Types

When evaluating the potential for injury, the total received acoustic energy (SEL) over a given time period (24 h) is needed. Vibratory setting of piles followed by impact pile driving is being considered for Vineyard Northeast for the installation of both monopile and jacket foundations. Although the potential to induce hearing loss is low during vibratory driving, it does introduce sound into the water and must be considered in the total. For this reason, the combined sound energy from vibratory and impact pile driving was computed and is shown Appendix H. The PTS onset SEL thresholds are lower for impact piling than for vibratory piling (Section 2.4.2.2), so when estimating animats exposed to potentially injurious sound levels, the lower criteria were applied to the total received sound energy level from both sources.

Exposure to sound above a behavioral response threshold is a simpler, one-time exposure calculation that is done for vibratory and impact pile driving separately because these two sound sources use different thresholds and are temporally separated. The numbers of animats exposed above these thresholds are calculated individually and then these numbers are combined to get total behavioral exposures while ensuring that animats exposed above both thresholds are not double counted.

Drilling operations may be needed to pass through large sub-surface boulders or hard sediment layers encountered during pile installation. Foundations could potentially require up to 6 hours of drilling per day in addition to impact and vibratory pile driving operations. Drilling activities produce non-impulsive sounds that may cause hearing damage, masking of communication signals, and behavioral responses in marine mammals, sea turtles and fishes (McCauley 1994, Popper et al. 2014). Maximum predicted injury exposures were <0.01 for modeled marine mammals and sea turtle species (see Appendix I). Marine mammal and sea turtle PTS is unlikely to occur because the ranges to injurious thresholds are <200 m for all species.

Maximum predicted acoustic ranges to fish injury thresholds are ~2,300 m, with the furthest acoustic ranges predicted for fish <2g. McCauley (1998) determined that effects to fish from sounds produced by marine drilling activity would likely be temporary behavioral changes within a few hundred meters of the source. The available literature suggests that continuous sound produced by drilling operations may mask acoustic signals of fish that convey important environmental information (McCauley 1994, Popper et al. 2014). Furthermore, measured source levels during drilling operations reached 120 dB at 3–5 km, may have caused fish avoidance (McCauley 1998). There are no data linking continuous noise to mortality in fish exposed to non-impulsive sound sources (Popper and Hawkins 2019). Continuous sound has been linked to TTS in some species of fish; however, exposure times to these sounds were at least 12 hours (Amoser and Ladich 2003, Smith et al. 2006).

Overall, drilling is not expected to cause injury to marine fauna but may cause behavioral impacts. However, the sounds emitted by marine drilling operations for wind farm construction are expected to be short-term and intermittent. For additional information on modeled acoustic ranges and exposure estimates for drilling activities, see Appendix I.

## 2.7. Estimating Monitoring Zones for Mitigation

Monitoring zones for mitigation purposes have traditionally been estimated by determining the acoustic distance to injury and behavioral thresholds (see Appendix E.4). The traditional method assumes that all receivers (animals) in the area remain stationary for the duration of the sound event. Because where an animal is in a sound field and the pathway it takes through the sound field as it evolves over time determines the received level for each animal, treating animals as stationary may not produce realistic estimates for the monitoring zones.

Animal movement and exposure modeling can be used to account for the movement of receivers when estimating distances for monitoring zones. The distance to the closest point of approach (CPA) for each of the species-specific animats (simulated animals) during a simulation is recorded and then the CPA distance that accounts for 95% of the animats that exceed an acoustic impact threshold is determined. The $ER_{95\%}$ (95% exposure radial distance) is the horizontal distance that includes 95% of the CPAs of animats exceeding a given impact threshold (Figure 7). $ER_{95\%}$ is reported for marine mammals and sea turtles. If used as an exclusion zone, keeping animals farther away from the source than the $ER_{95\%}$ will reduce exposure estimates by 95%.

Unlike marine mammals and sea turtles for which animal movement modeling was performed, fish were considered static (not moving) receivers, so exposure ranges were not calculated. Instead, the acoustic ranges to fish impact criteria thresholds were calculated by determining the isopleth at which thresholds could be exceeded (Appendix E.4).

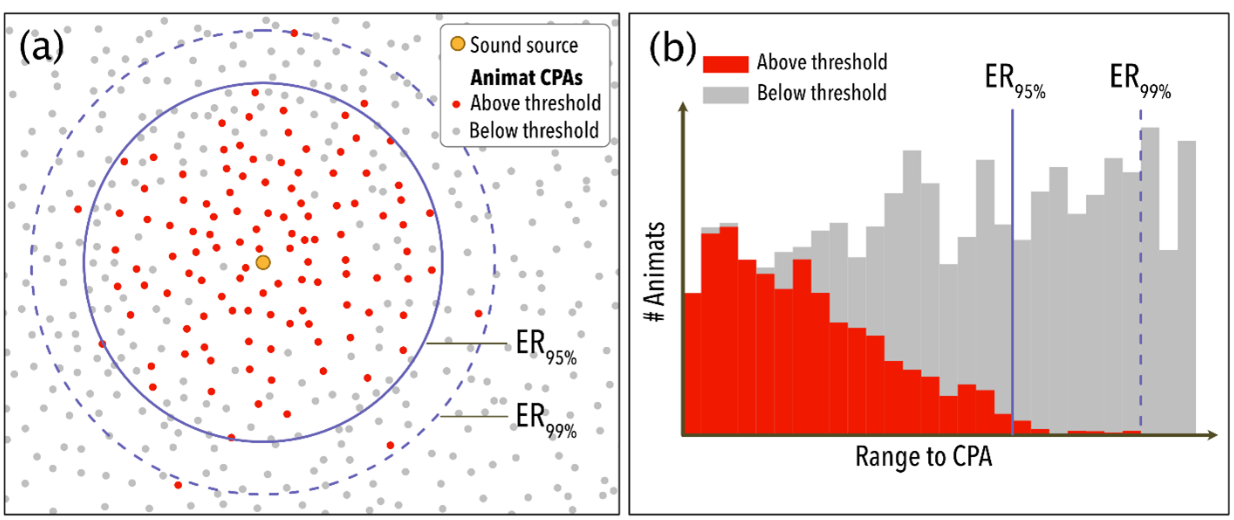



Figure 7. Example distribution of animat closest points of approach (CPAs). Panel (a) shows the horizontal distribution of animat CPAs near a sound source. Panel (b) shows the distribution of ranges to animat CPAs. The 95 and 99% Exposure Ranges (*$ER_{95\%}$* and *$ER_{99\%}$*) are indicated in both panels.

# 3. Marine Fauna Included in the Acoustic Assessment

Marine fauna included in the acoustic assessment are marine mammals (cetaceans and pinnipeds), sea turtles, and fish.

All marine mammal species are protected under the MMPA. Some marine mammal stocks may be designated as Strategic under the MMPA (2015), which requires the jurisdictional agency (NMFS for the Atlantic offshore species considered in this application) to impose additional protection measures. A stock is considered Strategic if:

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

A depleted species or population stock is defined by the MMPA as any case in which:

- the Secretary, after consultation with the Marine Mammal Commission and the Committee of Scientific Advisors on Marine Mammals established under MMPA Title II, determines that a species or population stock is below its optimum sustainable population;
- a State, to which authority for the conservation and management of a species or population stock is transferred under Section 109 of the MMPA, determines that such species or stock is below its optimum sustainable population; or
- a species or population stock is listed as an endangered or threatened species under the Endangered Species Act (2002). Some species are further protected under the ESA (2002).

Under the ESA, a species is considered endangered if it is “in danger of extinction throughout all or a significant portion of its range.” A species is considered threatened if it “is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range” (ESE 2002). Five marine mammal species known to occur in the Northwest Atlantic OCS region are ESA listed (Table 36). All four species of sea turtles (Table 39) as well as four fish species (Section 3.2) known to occur in the Northwest Atlantic OCS region are also ESA listed.

## 3.1. Marine Mammals that May Occur in the Area

Thirty-eight marine mammal species (whales, dolphins, porpoise, seals) comprising 39 stocks have been documented as present (either year–round, seasonally, or as occasional visitors) in the Northwest Atlantic Outer Continental Shelf OCS region (CeTAP 1982, USFWS 2014, Roberts et al. 2016, Hayes et al. 2022). All 38 marine mammal species identified in Table 36 are protected under the MMPA and some are also listed under the ESA. The five ESA-listed marine mammal species known to be present year-round, seasonally, or occasionally in the Offshore Development Area are the sperm whale (*Physeter macrocephalus*), North Atlantic right whale (NARW) (*Eubalaena glacialis*), fin whale (*Balaenoptera physalus physalus*), blue whale (*Balaenoptera musculus*), and sei whale (*Balaenoptera borealis*).

Southern New England waters (including the Lease Area, see Figure 1) are primarily used as opportunistic feeding areas or habitat during seasonal migratory movements that occur between the feeding areas located further north and the breeding areas located further south that are typically used by some of these large whale species. The modeling used in this assessment considered minke and sei whales to be migratory in the region.

The four species of phocids (true seals) that have ranges overlapping the Lease Area are harbor seals (*Phoca vitulina*), gray seals (*Halichoerus grypus*), harp seals (*Pagophilus groenlandicus*), and hooded seals (*Cystophora cristata*) (Hayes et al. 2022). None of these phocids are ESA-listed, but all are protected under the MMPA.

The expected occurrence of each marine mammal species in the Lease Area is listed in Table 36 and Table 37. Many of these marine mammal species do not commonly occur in this region of the Atlantic Ocean. For this assessment, species presence was categorized as:

- Common - Occurring consistently in moderate to large numbers.
- Uncommon - Occurring in low numbers or on an irregular basis.
- Rare - There are limited species records for some years; range includes the proposed Offshore Development Area but due to habitat preferences and distribution information, species are not expected to occur in the Lease Area, though rare sightings are a possibility. Records may exist for adjacent waters.

Marine mammal species considered *common* and *uncommon* were selected for quantitative assessment by acoustic impact analysis and exposure modeling. Quantitative assessment of bottlenose dolphins (*Tursiops truncatus*) presumed all impacted individuals belong to the Western North Atlantic Offshore stock because the northern limit of the range of the coastal stock does not extend into the Offshore Development Area. Quantitative assessment of *rare* species was not conducted because impacts to those species approach zero due to their low densities. The modeled species are identified in Table 38. The likelihood of incidental exposure for each species based on its presence, density, and overlap of proposed activities is described in Section 4.3.1.

Table 36. Marine cetaceans that may occur in the Project Area.

| Taxonomic Suborder-Family | Species | Scientific name | Stock | Regulatory status [a] | Relative occurrence in Beacon Wind | Abundance [b] |
|---|---|---|---|---|---|---|
| Mysticeti - Balaenopteridae | Blue whale | *Balaenoptera musculus* | Western North Atlantic | ESA-Endangered | Rare | 402 |
| Mysticeti - Balaenopteridae | Fin whale [c] | *Balaenoptera physalus* | Western North Atlantic | ESA-Endangered | Common | 6,802 |
| Mysticeti - Balaenopteridae | Humpback whale [c] | *Megaptera novaeangliae* | Gulf of Maine | MMPA | Common | 1,396 |
| Mysticeti - Balaenopteridae | Minke whale [c] | *Balaenoptera acutorostrata* | Canadian Eastern Coastal | MMPA | Common | 21,968 |
| Mysticeti - Balaenidae | North Atlantic right whale [c] | *Eubalaena glacialis* | Western North Atlantic | ESA-Endangered | Common | 338 [d] |
| Mysticeti - Balaenopteridae | Sei whale [c] | *Balaenoptera borealis* | Nova Scotia | ESA-Endangered | Common | 6,292 |
| Odontoceti - Physeteridae | Sperm whale [c] | *Physeter macrocephalus* | North Atlantic | ESA-Endangered | Uncommon | 4,349 |
| Odontoceti - Kogiidae | Dwarf sperm whale | *Kogia sima* | Western North Atlantic | MMPA | Rare | 7,750 [e] |
| Odontoceti - Kogiidae | Pygmy sperm whale | *Kogia breviceps* | Western North Atlantic | MMPA | Rare | 7,750 [e] |
| Odontoceti - Delphinidae | Atlantic spotted dolphin [c] | *Stenella frontalis* | Western North Atlantic | MMPA | Uncommon | 39,921 |
| Odontoceti - Delphinidae | Atlantic white-sided dolphin [c] | Lagenorhynchus acutus | Western North Atlantic | MMPA | Common | 93,233 |
| Odontoceti - Delphinidae | Bottlenose dolphin [c] | *Tursiops truncatus* | Western North Atlantic, offshore [f] | MMPA | Common | 62,851 |
| Odontoceti - Delphinidae | Bottlenose dolphin [c] | *Tursiops truncatus* | Western North Atlantic, Northern Migratory Coastal | MMPA-Strategic | Rare | 6,639 |
| Odontoceti - Delphinidae | Clymene dolphin | *Stenella clymene* | Western North Atlantic | MMPA | Rare | 4,237 |
| Odontoceti - Delphinidae | Common dolphin [c] | *Delphinus delphis* | Western North Atlantic | MMPA | Common | 172,974 |
| Odontoceti - Delphinidae | False killer whale | *Pseudorca crassidens* | Western North Atlantic | MMPA | Rare | 1,791 |
| Odontoceti - Delphinidae | Fraser's dolphin | *Lagenodelphis hosei* | Western North Atlantic | MMPA | Rare | Unknown |
| Odontoceti - Delphinidae | Killer whale | *Orcinus orca* | Western North Atlantic | MMPA | Rare | Unknown |
| Odontoceti - Delphinidae | Melon-headed whale | *Peponocephala electra* | Western North Atlantic | MMPA | Rare | Unknown |
| Odontoceti - Delphinidae | Pan-tropical spotted dolphin | *Stenella attenuata* | Western North Atlantic | MMPA | Rare | 6,593 |
| Odontoceti - Delphinidae | Pilot whale, long-finned [c] | *Globicephala melas* | Western North Atlantic | MMPA | Uncommon | 39,215 |
| Odontoceti - Delphinidae | Pilot whale, short-finned [c] | *Globicephala macrorhynchus* | Western North Atlantic | MMPA | Uncommon | 28,924 |
| Odontoceti - Delphinidae | Pygmy killer whale | *Feresa attenuata* | Western North Atlantic | MMPA | Rare | Unknown |

| Taxonomic Suborder-Family | Species | Scientific name | Stock | Regulatory status [a] | Relative occurrence in Beacon Wind | Abundance [b] |
|---|---|---|---|---|---|---|
| Odontoceti - Delphinidae | Risso's dolphin [c] | *Grampus griseus* | Western North Atlantic | MMPA | Uncommon | 35,215 |
| Odontoceti - Delphinidae | Rough-toothed dolphin | *Steno bredanensis* | Western North Atlantic | MMPA | Rare | 136 |
| Odontoceti - Delphinidae | Spinner dolphin | *Stenella longirostris* | Western North Atlantic | MMPA | Rare | 4,102 |
| Odontoceti - Delphinidae | Striped dolphin | *Stenella coeruleoalba* | Western North Atlantic | MMPA | Rare | 67,036 |
| Odontoceti - Delphinidae | White-beaked dolphin | *Lagenorhynchus albirostris* | Western North Atlantic | MMPA | Rare | 536,016 |
| Odontoceti - Ziphiidae | Cuvier's beaked whale | *Ziphius cavirostris* | Western North Atlantic | MMPA | Rare | 5,744 |
| Odontoceti - Ziphiidae | Blainville's beaked whale | *Mesoplodon densirostris* | Western North Atlantic | MMPA | Rare | 10,107 [g] |
| Odontoceti - Ziphiidae | Gervais' beaked whale | *Mesoplodon europaeus* | Western North Atlantic | MMPA | Rare | 10,107 [g] |
| Odontoceti - Ziphiidae | Sowerby's beaked whale | *Mesoplodon bidens* | Western North Atlantic | MMPA | Rare | 10,107 [g] |
| Odontoceti - Ziphiidae | True's beaked whale | *Mesoplodon mirus* | Western North Atlantic | MMPA | Rare | 10,107 [g] |
| Odontoceti - Ziphiidae | Northern bottlenose whale | *Hyperoodon ampullatus* | Western North Atlantic | MMPA | Rare | Unknown |
| Odontoceti - Phocoenidae | Harbor porpoise [c] | *Phocoena phocoena* | Gulf of Maine/Bay of Fundy | MMPA | Common | 95,543 |

[a] Denotes the highest federal regulatory classification. 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) that is declining and likely to be listed as Threatened under the ESA; or 3) that is listed as Threatened or Endangered under the ESA or as depleted under the MMPA (Hayes et al. 2022).

[b] Best available abundance estimate is from NOAA Fisheries Stock Assessment Reports (Hayes et al. 2022).

[c] Modeled species.

[d] Best available abundance estimate is from NOAA Fisheries Stock Assessment (Hayes et al. 2023) . NARW consortium has released the 2022 report card results predicting a NARW population of 340 for 2021 (Pettis et al. 2023). However, the consortium "alters" the methods of Pace et al. (2017, 2021) to subtract additional mortality. This method is used in order to estimate all mortality, not just the observed mortality, therefore the 2022 SAR (Hayes et al. 2023) will be used to report an unaltered output of the Pace et al. (2017, 2021) model (DoC and NOAA 2020).

[e] This estimate includes both dwarf and pygmy sperm whales. Source: Hayes et al. (2022)

[f] Bottlenose dolphins occurring in the Offshore Development Area likely belong to the Western North Atlantic Offshore stock (Hayes et al. 2022).

[g] This estimate includes all undifferentiated Mesoplodon spp. Beaked whales in the Atlantic. Sources: Kenney and Vigness-Raposa (2009), Rhode Island Ocean Special Area Management Plan (2011), Waring et al. (2011, 2013, 2015), Hayes et al. (2022)

Table 37. Earless Seals (Phocidae) that may occur in the Project Area.

| Species | Scientific name | Stock | Regulatory status [a] | Relative occurrence in Beacon Wind | Abundance [b] |
|---|---|---|---|---|---|
| Gray seal [c] | *Halichoerus grypus* | Western North Atlantic | MMPA | Common | 27,300 [d] |
| Harbor seal [c] | *Phoca vitulina* | Western North Atlantic | MMPA | Common | 61,336 |
| Harp seal [c] | *Pagophilus groenlandicus* | Western North Atlantic | MMPA | Uncommon | Unknown [e] |
| Hooded seal | Cystophora cristata | Western North Atlantic | MMPA | Rare | Unknown |

[a] Denotes the highest federal regulatory classification. 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) that is declining and likely to be listed as Threatened under the ESA; or 3) that is listed as Threatened or Endangered under the ESA or as depleted under the MMPA (Hayes et al. 2022).

[b] Best available abundance estimate is from NOAA Fisheries Stock Assessment Reports (Hayes et al. 2022).

[c] Modeled species.

[d] Estimate of gray seal population in US waters. Data are derived from pup production estimates; (Hayes et al. 2022) notes that uncertainty about the relationship between whelping areas along with a lack of reproductive and mortality data make it difficult to reliably assess the population trend.

[e] Hayes et al. (2022) report insufficient data to estimate the population size of harp seals in US waters; the best estimate for the whole population is 7.6 million.

Mean monthly marine mammal density estimates (animals per 100 square kilometers [animals/100 km2]) were obtained using the 2022 Duke University Marine Geospatial Ecology Laboratory model results (Roberts et al. 2016, 2022), which were recently updated for all species. The 2022 updated NARW model (v12) provides model predictions for three eras, 2003–2019, 2003–2009, and 2010–2019, to reflect the apparent shift in NARW distribution around 2010. The modeling reported herein used the 2010–2019 density predictions as recommended by Roberts et al. (2022). Similarly, the 2022 updated humpback whale model (v11) provides model predictions for three eras, 2002–2019, 2002–2008, and 2009–2019. The modeling reported herein used the 2009-2019 density predictions as recommended by Roberts et al. (2022).

For cases with impact pile driving only, densities were calculated within a perimeter set at 8.3 km from the Lease Area (Figure 8 and Table 38). The perimeter distance was based on the largest 10 dB-attenuated exposure range over all species, foundations, installation rates, and threshold criteria, with the exception of the Wood et al. (2012) thresholds. Wood et al. (2012) exposure ranges were not considered in this estimate because they include a small subset of very long ranges for migrating mysticetes and harbor porpoise.

For cases with vibratory setting of piles followed by impact pile driving densities were calculated within buffered polygons of various ranges around the Lease Area perimeter (see Appendix H). The following ranges were pre-selected: 1, 5, 10, 15, 20, 30, 40, and 50 km. For each species, foundation type, and attenuation level, the most appropriate density perimeter was selected from this list. The range was selected using the 95th percentile exposure range (ER95%) for each case, using the next highest range. For example, if the ER95% was 8.5 km, the 10 km perimeter would be used. In cases where the ER95% was larger than 50 km, the 50-km perimeter was used. The 50 km limit is derived from studies of mysticetes that demonstrate received levels, distance from the source, and behavioral context are known to influence the probability of behavioral response (Dunlop et al. 2017).

The mean species density for each month was determined by calculating the unweighted mean of all 5 × 5 km grid cells partially or fully within the analysis perimeter (Figure 8). Densities were computed for an entire year to coincide with proposed pile driving activities. In cases where monthly densities were unavailable, annual mean densities were used instead.

There are two cases in this study for which the MGEL/Duke models report densities for species guilds: seals and pilot whales. When calculating exposures for individual pilot whale and seal species, the guild densities provided by Roberts et al. (2016, 2022) were scaled by the relative abundances of the species in each guild, using the best available estimates of local abundance, to get species-specific density estimates surrounding the Lease Area. In estimating local abundances, all distribution data from the two pilot whale species and three seal species were downloaded from the Ocean Biodiversity Information System (OBIS) data repository (available at https://obis.org/). After reviewing the available datasets, it was deemed that data available in OBIS in Rhode Island and Massachusetts waters are the best available for the three seals species because of their overlap with the Lease Area. For seals, OBIS reported 86 observations of gray seals, 129 observations of harbor seals, and 93 observations of harp seals. Therefore, the proportions of 0.28 (86/308), 0.42 (129/308), and 0.30 (93/308) were used to scale the seals guild densities for the three seal species, respectively. The best data available for pilot whales came from AMAPPS data in Rhode Island and Massachusetts waters. The proportions of 0.80 for long-finned and 0.20 for short-finned pilot whales were used (Palka et al 2021).

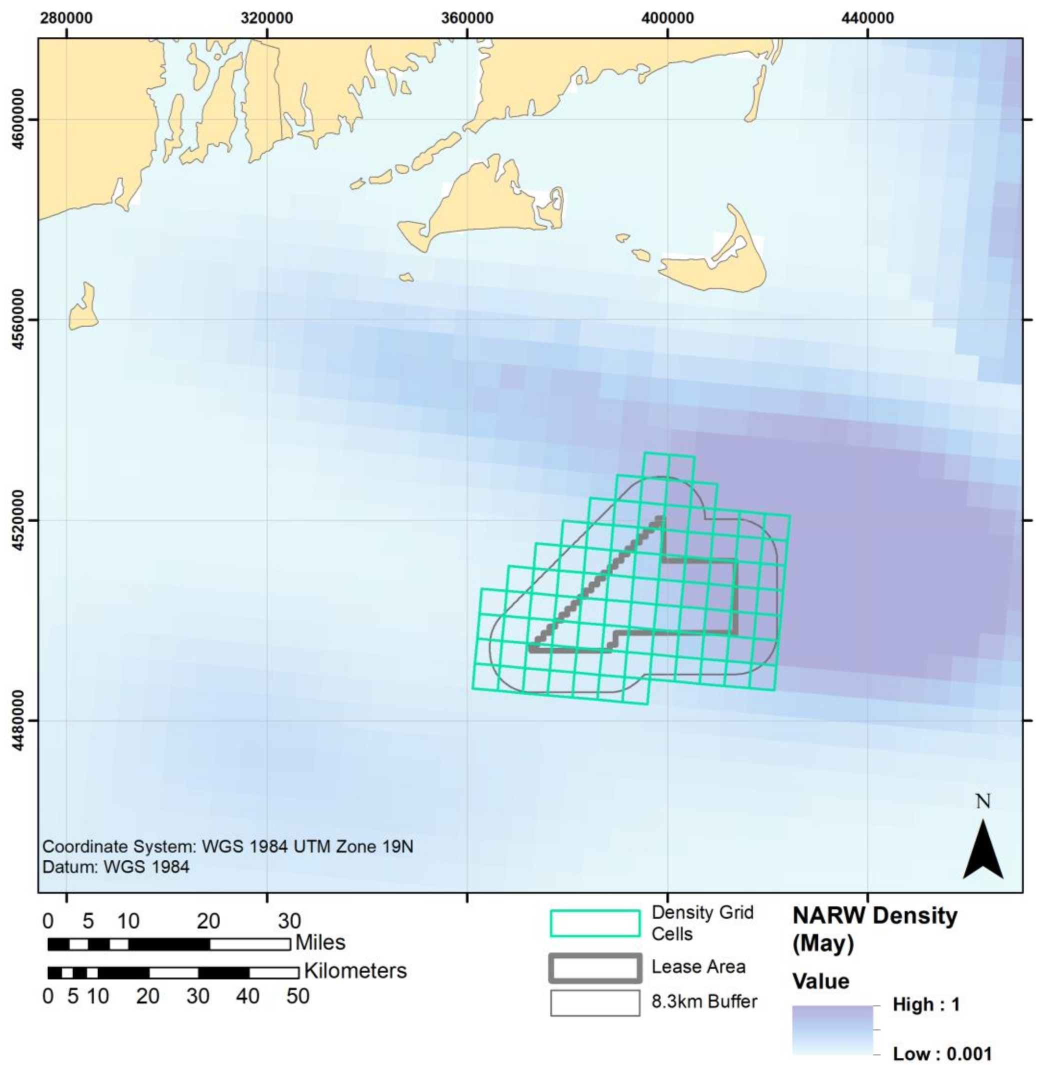



Figure 8. Marine mammal (e.g., NARW) density map showing highlighted grid cells used to calculate mean monthly species density estimates within an 8.3 km perimeter around Lease Area OCS-A 0522 (Roberts et al. 2016, 2022), used for cases with impact pile driving alone. For cases with vibratory setting of piles followed by impact pile driving, the most appropriate density perimeter was selected for each species, foundation type, and attenuation level.

Table 38. Mean monthly marine mammal density estimates (animals/100 $km^2$) [a] for all species in an 8.3 km perimeter around the Lease Area, used for cases with impact pile driving alone.

| Species of interest | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual mean | May to December mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fin whale [b] | 0.228 | 0.169 | 0.154 | 0.153 | 0.321 | 0.362 | 0.491 | 0.391 | 0.263 | 0.087 | 0.062 | 0.154 | 0.236 | 0.266 |
| Minke whale (migrating) | 0.113 | 0.137 | 0.147 | 0.758 | 1.530 | 1.976 | 1.033 | 0.547 | 0.581 | 0.518 | 0.053 | 0.077 | 0.623 | 0.789 |
| Humpback whale | 0.027 | 0.029 | 0.057 | 0.196 | 0.346 | 0.369 | 0.265 | 0.155 | 0.189 | 0.278 | 0.218 | 0.030 | 0.180 | 0.231 |
| North Atlantic right whale [b] | 1.019 | 1.129 | 0.980 | 0.855 | 0.675 | 0.162 | 0.110 | 0.051 | 0.083 | 0.103 | 0.218 | 0.669 | 0.505 | 0.259 |
| Sei whale (migrating) [b] | 0.034 | 0.025 | 0.054 | 0.114 | 0.191 | 0.065 | 0.017 | 0.013 | 0.020 | 0.041 | 0.093 | 0.063 | 0.061 | 0.063 |
| Atlantic white-sided dolphin | 2.484 | 1.371 | 1.023 | 1.696 | 3.881 | 4.011 | 2.707 | 1.144 | 2.236 | 3.302 | 2.458 | 3.539 | 2.488 | 2.910 |
| Atlantic spotted dolphin | 0.001 | 0.000 | 0.002 | 0.008 | 0.029 | 0.051 | 0.052 | 0.085 | 0.416 | 0.498 | 0.119 | 0.010 | 0.106 | 0.158 |
| Common dolphin | 9.259 | 3.519 | 3.419 | 5.017 | 7.754 | 16.790 | 19.292 | 24.257 | 38.672 | 33.170 | 17.583 | 14.659 | 16.116 | 21.522 |
| Bottlenose dolphin, offshore | 0.433 | 0.104 | 0.078 | 0.229 | 0.972 | 1.631 | 2.044 | 2.240 | 2.173 | 1.911 | 1.613 | 1.290 | 1.227 | 1.734 |
| Risso's dolphin | 0.040 | 0.005 | 0.004 | 0.023 | 0.137 | 0.097 | 0.116 | 0.280 | 0.329 | 0.158 | 0.138 | 0.185 | 0.126 | 0.180 |
| Long-finned pilot whale [c] | 0.259 | 0.259 | 0.259 | 0.259 | 0.259 | 0.259 | 0.259 | 0.259 | 0.259 | 0.259 | 0.259 | 0.259 | 0.259 | 0.259 |
| Short-finned pilot whale [c] | 0.065 | 0.065 | 0.065 | 0.065 | 0.065 | 0.065 | 0.065 | 0.065 | 0.065 | 0.065 | 0.065 | 0.065 | 0.065 | 0.065 |
| Sperm whale [b] | 0.048 | 0.017 | 0.017 | 0.004 | 0.018 | 0.030 | 0.059 | 0.190 | 0.117 | 0.093 | 0.052 | 0.032 | 0.056 | 0.074 |
| Harbor porpoise (sensitive) | 11.191 | 11.861 | 11.289 | 10.468 | 8.349 | 1.925 | 1.984 | 1.743 | 2.007 | 2.491 | 2.598 | 8.204 | 6.176 | 3.663 |
| Gray seal [c] | 5.401 | 5.138 | 3.613 | 3.544 | 4.621 | 0.461 | 0.135 | 0.113 | 0.202 | 0.524 | 2.709 | 4.824 | 2.607 | 1.699 |
| Harbor seal [c] | 8.102 | 7.708 | 5.420 | 5.315 | 6.931 | 0.691 | 0.202 | 0.169 | 0.304 | 0.786 | 4.063 | 7.236 | 3.911 | 2.548 |
| Harp seal [c] | 5.787 | 5.505 | 3.871 | 3.797 | 4.951 | 0.494 | 0.144 | 0.121 | 0.217 | 0.561 | 2.902 | 5.169 | 2.793 | 1.820 |

[a] Density estimates are from habitat-based density modeling of the entire Atlantic Exclusive Economic Zone (EEZ) (Roberts et al. 2016, 2022).
[b] Listed as Endangered under the ESA.
[c] Density adjusted by relative abundance. Harp seal uses gray seal density.

## 3.2. Sea Turtles and Fish Species of Concern that May Occur in the Area

Four species of sea turtles may occur in the Vineyard Northeast Lease Area (Table 39), and all are listed as threatened or endangered: loggerhead sea turtle (*Caretta caretta*), Kemp's ridley sea turtle (*Lepidochelys kempii*), green sea turtle (*Chelonia mydas*), and leatherback sea turtle (*Dermochelys coriacea*). Many species of sea turtle prefer coastal waters; however, both the leatherback and loggerhead sea turtles are known to occupy deep-water habitats and are considered common during summer and fall in Southern New England waters. Kemp's Ridley sea turtles are thought to be regular visitors and green sea turtles, although uncommon, may be present during those seasons when water temperatures are highest.

There are four ESA listed Threatened or Endangered fish species that may occur off the northeast Atlantic coast – the shortnose sturgeon (*Acipenser brevirostrum*), Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), Atlantic salmon (*Salmo salar)*, and giant manta ray (*Manta birostris*).

Atlantic sturgeon distribution varies by season, but they are primarily found in shallow coastal waters (bottom depth less than 20 m) during the summer months (May to September) and move to deeper waters (20-50 m) in winter and early spring (December to March) (Dunton et al. 2010). Shortnose sturgeon occur primarily in fresh and estuarine waters and occasionally enter the coastal ocean. Adults ascend rivers to spawn from February to April, and eggs are deposited over hard bottom, in shallow, fast-moving water (Dadswell et al. 1984). Because of their preference for mainland rivers and fresh and estuarine waters, shortnose sturgeon are unlikely to be found in the vicinity of the Lease Area. Atlantic salmon is an anadromous species that historically ranged from northern Quebec southeast to Newfoundland and southwest to Long Island Sound. The Gulf of Maine Distinct Population Segment (DPS) of the Atlantic salmon that spawns within eight coastal watersheds within Maine is federally listed as Endangered. In 2009, the DPS was expanded to include all areas of the Gulf of Maine between the Androscoggin River and the Dennys River (NOAA Fisheries 2022). It is possible that adult Atlantic salmon may occur off the Massachusetts coast while migrating to rivers to spawn. However, only certain Gulf of Maine populations are listed as Endangered, and Gulf of Maine salmon are unlikely to be encountered south of Cape Cod (BOEM 2014).

The giant manta ray is found worldwide in tropical, subtropical, and temperate bodies of water and is commonly found offshore, in oceanic waters, and near productive coastlines. As such, giant manta rays can be found in cool water, as low as 19°C, although temperature preference appears to vary by region. For example, off the US East Coast, giant manta rays are commonly found in waters from 19 to 22°C, whereas those off the Yucatan peninsula and Indonesia are commonly found in waters between 25 to 30°C. Individuals have been observed as far north as New Jersey in the Western Atlantic basin indicating that the Offshore Development Area is located at the northern boundary of the species' range (NOAA Fisheries 2021).

Table 39. Sea turtle species potentially occurring within the regional waters of the Western North Atlantic Outer Continental Shelf (OCS) and Lease Area.

| Species | Scientific name | Regulatory status [a] | Relative occurrence in Project Area |
|---|---|---|---|
| Leatherback sea turtle [b] | *Dermochelys coriacea* | ESA Endangered | Common |
| Loggerhead sea turtle [b] | *Caretta caretta* | ESA Threatened | Common |
| Kemp's ridley sea turtle [b] | *Lepidochelys kempii* | ESA Endangered | Uncommon |
| Green sea turtle [b] | *Chelonia mydas* | ESA Threatened | Uncommon |

[a] Listing status as stated in NOAA Fisheries n.d., MA NHESP 2019; RI DEM 2011; NYSDEC 2020a.
[b] Modeled species.

## 3.3. Sea Turtle Density Estimates

Sea turtle density within the Lease Area were estimated using the East Coast sea turtle density models developed by the U.S. Naval Undersea Warfare Center (NUWC; DiMatteo et al. 2023). The data are long-term monthly average estimates of density and are expressed as the number of individuals per square kilometer. Sea turtle densities used in exposure estimates are provided in Table 40.

For cases with impact pile driving only, densities were calculated within a perimeter set at 8.3 km from the Lease Area (Figure 8 and Table 38). For cases with vibratory setting of piles followed by impact pile driving densities were calculated within buffered polygons of various ranges around the Lease Area perimeter (see Appendix H). The following ranges were pre-selected: 1, 5, 10, 15, 20, 30, 40, and 50 km. For each species, foundation type, and attenuation level, the most appropriate density perimeter was selected from this list. The range was selected using the 95$^{th}$ percentile exposure range ($ER_{95\%}$) for each case, using the next highest range.

Table 40. Sea turtle density estimates (animals/100 km$^2$) [a] for all modeled species in the Lease Area.

| Common name | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual mean | May to Dec mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley sea turtle | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.004 | 0.003 | 0.003 | 0.002 | 0.000 | 0.000 | 0.001 | 0.002 |
| Leatherback sea turtle | 0.001 | 0.000 | 0.000 | 0.000 | 0.004 | 0.084 | 0.244 | 0.403 | 0.572 | 0.333 | 0.054 | 0.004 | 0.142 | 0.212 |
| Loggerhead sea turtle | 0.002 | 0.001 | 0.001 | 0.002 | 0.003 | 0.012 | 0.029 | 0.030 | 0.036 | 0.034 | 0.014 | 0.004 | 0.014 | 0.020 |
| Green sea turtle | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.017 | 0.102 | 0.142 | 0.114 | 0.017 | 0.003 | 0.000 | 0.033 | 0.049 |

[a] Density estimates are from DiMatteo et al. (2023).

# 4. Results

Sound fields were modeled at two modeling locations for monopile foundations and jacket foundation pin piles, representing the range of water depths within the Lease Area .This section summarizes the source modeling results (Section 4.1), the acoustic propagation modeling results (Section 4.1.2), animal movement modeling results for marine mammals and sea turtles (Sections 4.2.1 and 4.4), and the acoustic radial distance to thresholds for fish (Section 4.5).

## 4.1. Modeled Sound Sources

### 4.1.1. Impact Pile Driving

Forcing functions were computed for the monopiles and pin piles using GRLWEAP 2010 (GRLWEAP, Pile Dynamics 2010) and are shown in Figures 9–14. The model assumed direct contact between the hammer, helmet, and pile (i.e., no cushion material). The forcing functions serve as the inputs to JASCO's pile driving source models used to estimate equivalent acoustic source characteristics detailed in Appendix D. Decidecade band levels at 10 m and 750 m for the modeled piles are shown in Figures 15 through 20. The broadband single-strike SEL per hammer energy at 10 m and 750 m for each scenario are shown in Tables 41 to 52.

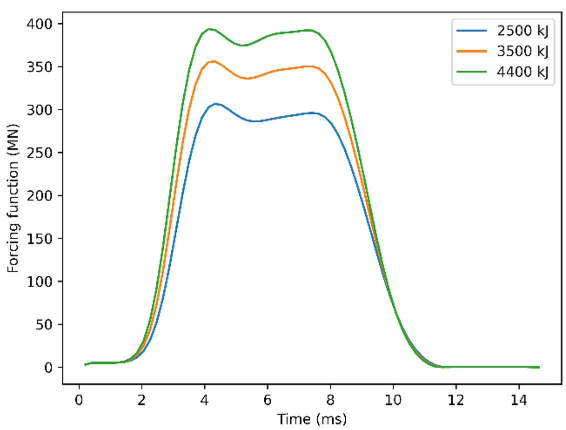



Figure 9. Modeled forcing functions versus time for a 14 m typical monopile as a function of hammer energy (MHU 5500).

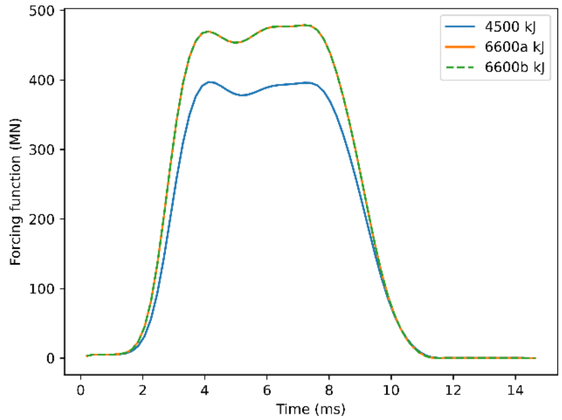



Figure 10. Modeled forcing functions versus time for a 14 m difficult to drive monopile as a function of hammer energy (MHU 5500 scaled to 6600 kJ).

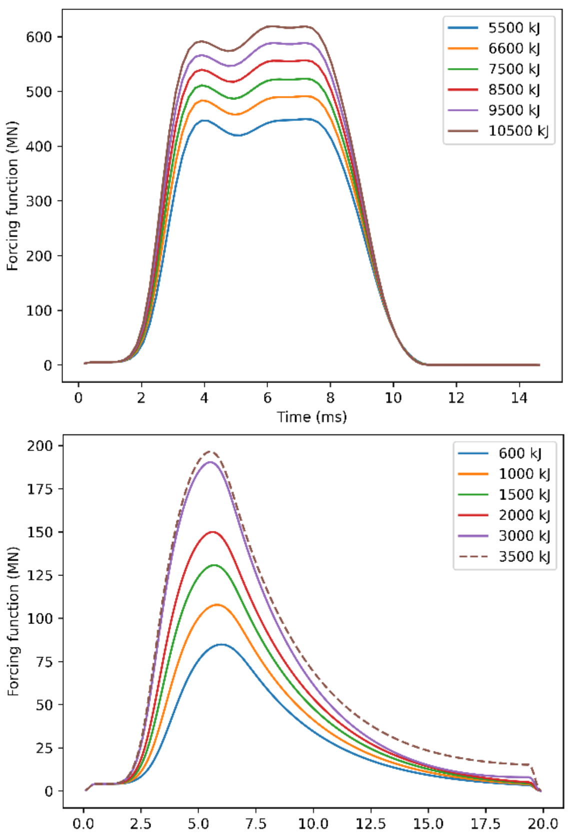



Figure 11. Modeled forcing functions versus time for a 4 m typical jacket foundation pin pile as a function of hammer energy (MHU 3500S).

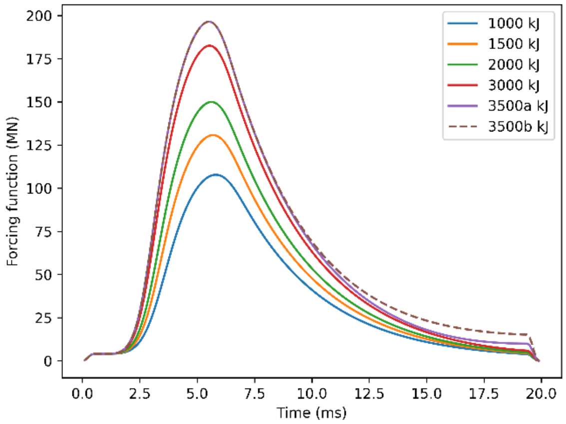



Figure 12. Modeled forcing functions versus time for a 4 m difficult to drive jacket as a function of hammer energy (MHU 3500S).

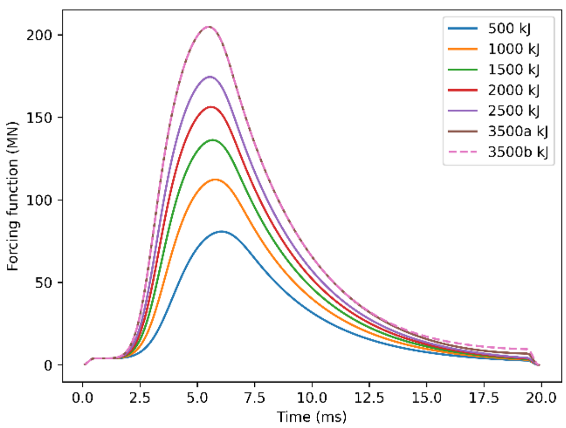



Figure 13. Modeled forcing function versus time for a 4.25 m typical jacket foundation pin pile as a function of hammer energy (MHU 3500S).

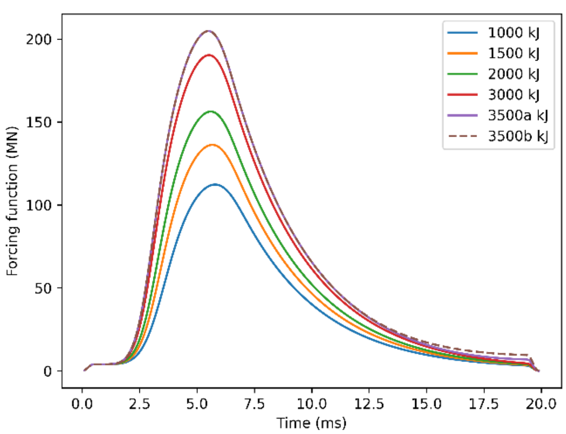



Figure 14. Modeled forcing function versus time for a 4.25 m difficult to drive jacket foundation pin pile as a function of hammer energy (MHU 3500S).

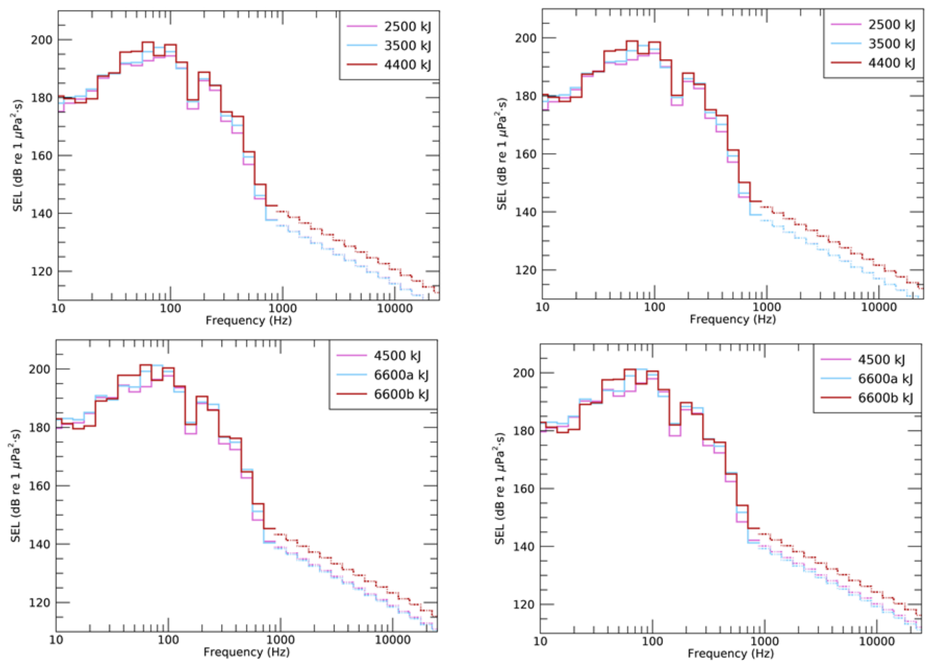



Figure 15. Decidecade band levels at 10 m from location L01 for a 14 m typical monopile assuming an installation scenario with (top row) the MHU 5500 kJ hammer and (bottom row) the MHU 5500 hammer scaled to 6600 kJ with average sound speed profiles for (left) summer and (right) winter.

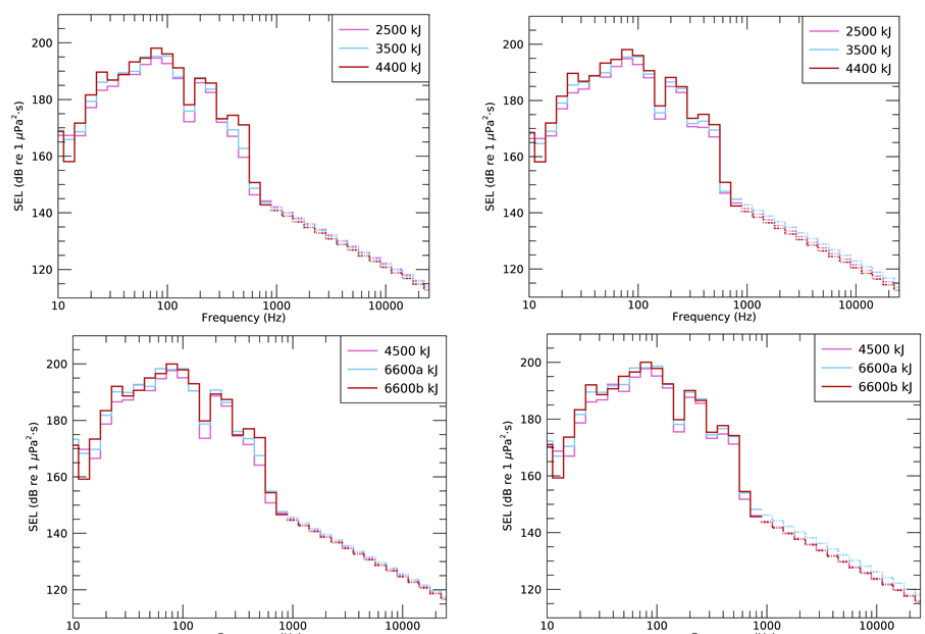



Figure 16. Decidecade band levels at 10 m from location L02 for a 14 m typical monopile assuming an expected installation scenario (top row) MHU 5500 kJ hammer and (bottom row) MHU 5500 hammer scaled to 6600 kJ with average sound speed profiles for (left) summer and (right) winter.

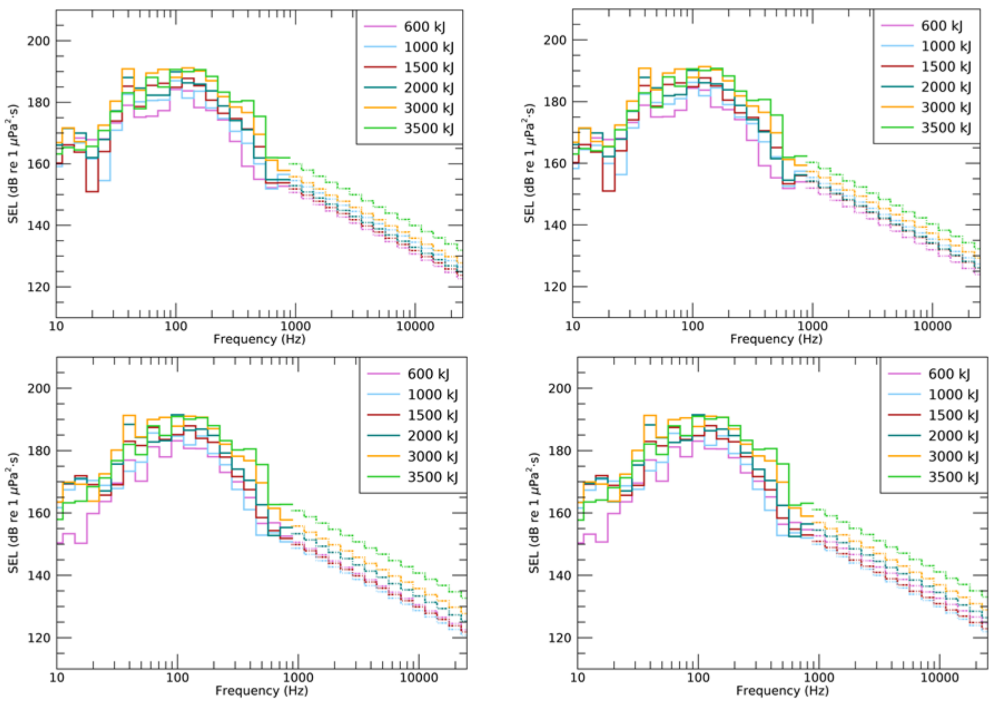



Figure 17. Decidecade band levels at 10 m from (top row) location L01 and (bottom row) location L02 for a 4 m diameter jacket foundation pin pile assuming an expected installation scenario MHU 3500S kJ hammer with average sound speed profiles for (left) summer and (right) winter.

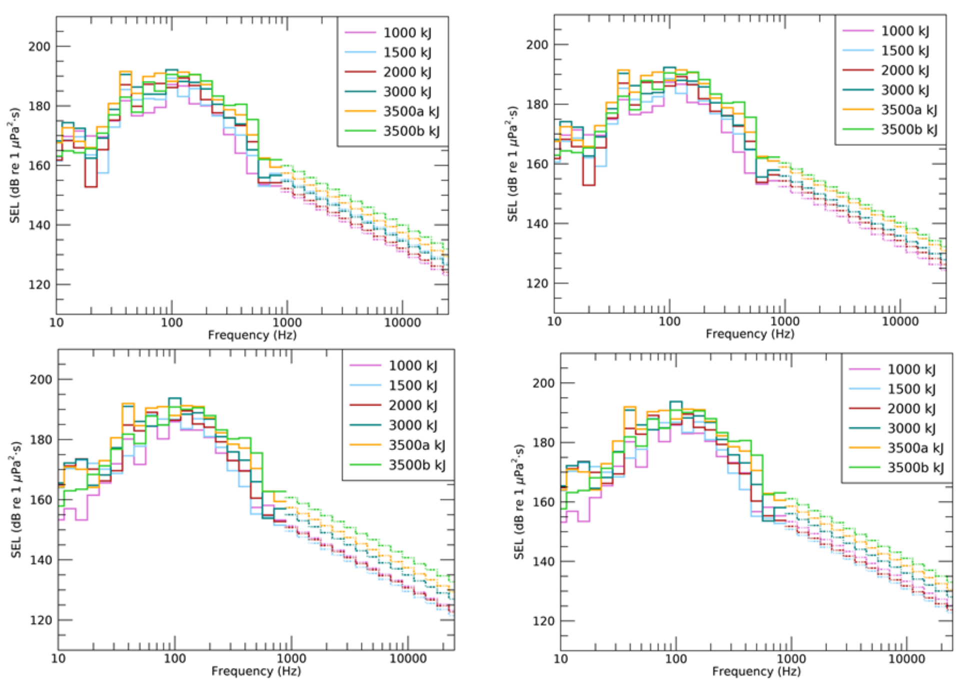



Figure 18. Decidecade band levels at 10 m from (top row) location L01 and (bottom row) location L02 for a 4 m diameter jacket foundation pin pile assuming an expected installation scenario MHU 3500S kJ hammer with average sound speed profiles for (left) summer and (right) winter.

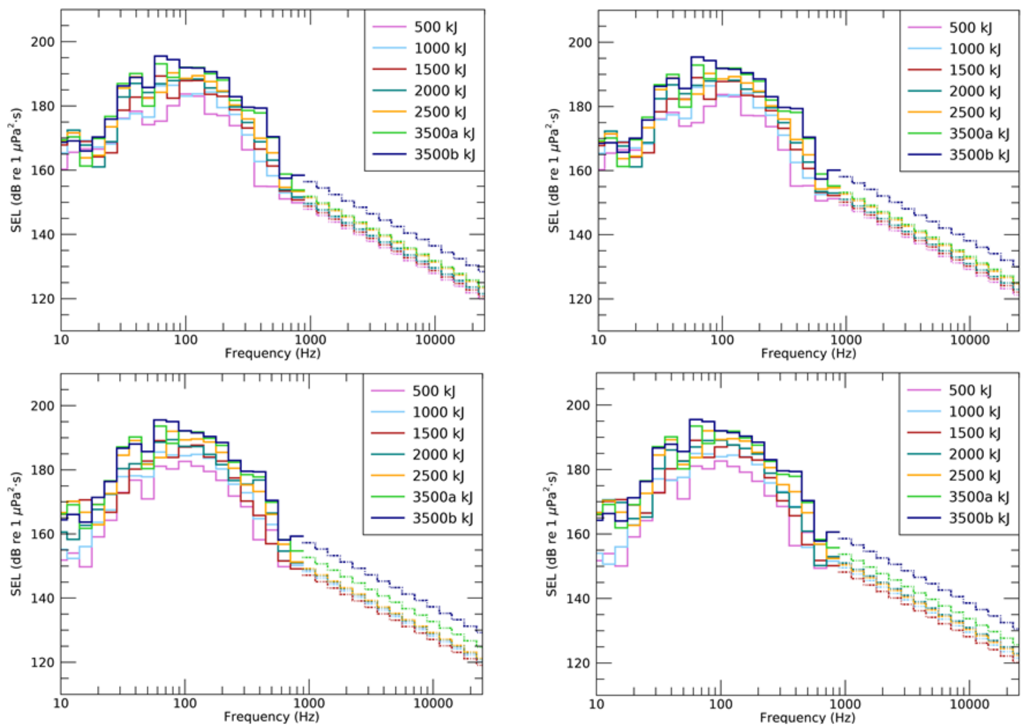



Figure 19. Decidecade band levels at 10 m from (top row) location L01 and (bottom row) location L02 for a 4.25 m diameter jacket foundation pin pile assuming an expected installation scenario MHU 3500S kJ hammer with average sound speed profiles for (left) summer and (right) winter.

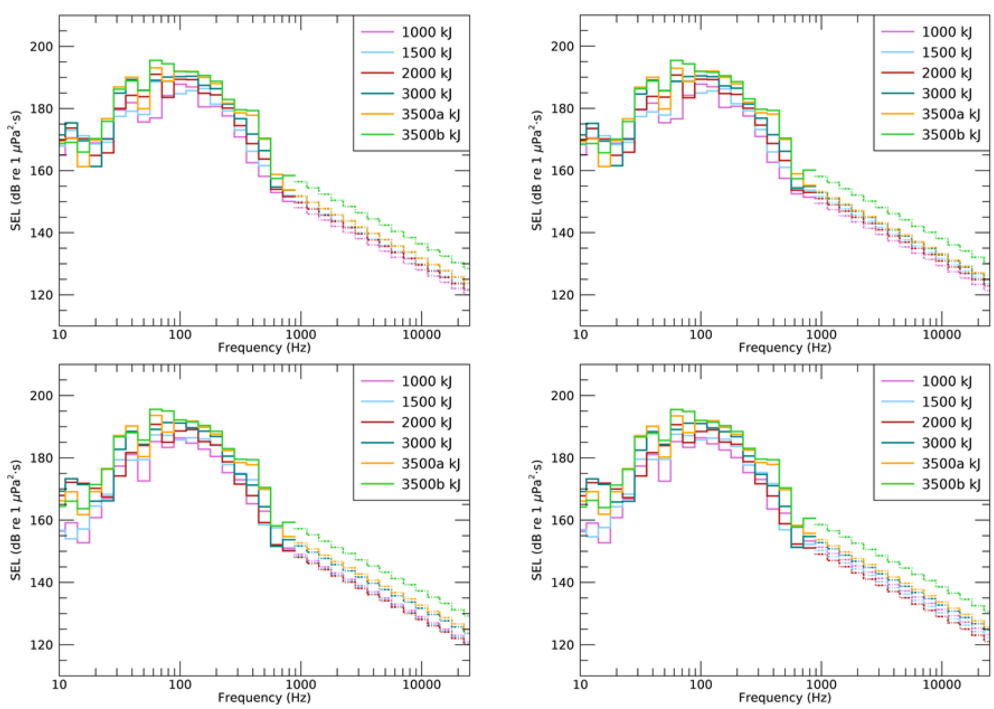



Figure 20. Decidecade band levels at 10 m from (top row) location L01 and (bottom row) location L02 for a 4.25 m diameter jacket foundation pin pile assuming an expected installation scenario MHU 3500S kJ hammer with average sound speed profiles for (left) summer and (right) winter.

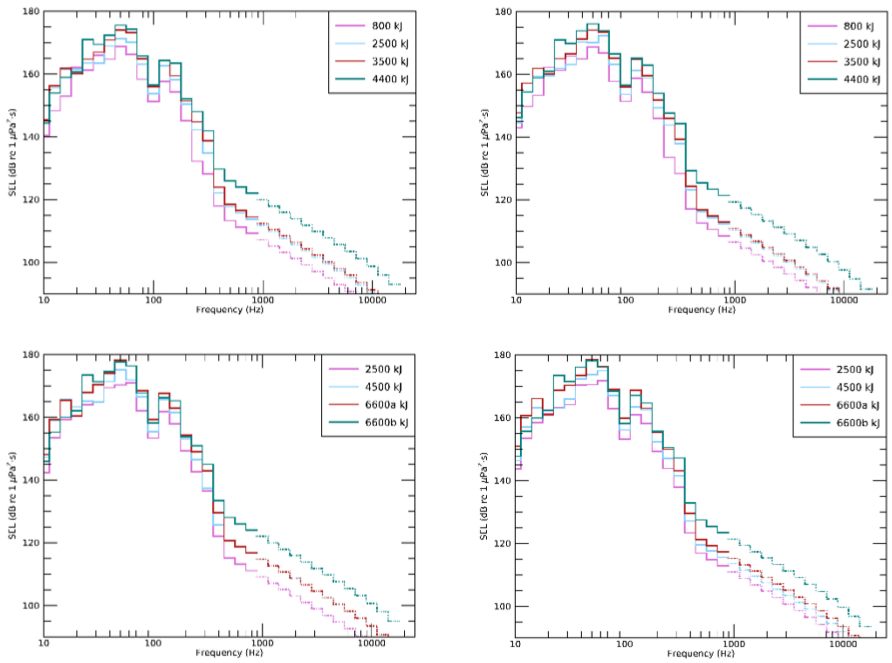



Figure 21. Decidecade band levels at 750 m from location L01 for a 14 m typical monopile assuming an installation scenario with (top row) the MHU 5500 kJ hammer and (bottom row) the MHU 5500 hammer scaled to 6600 kJ with average sound speed profiles for (left) summer and (right) winter.

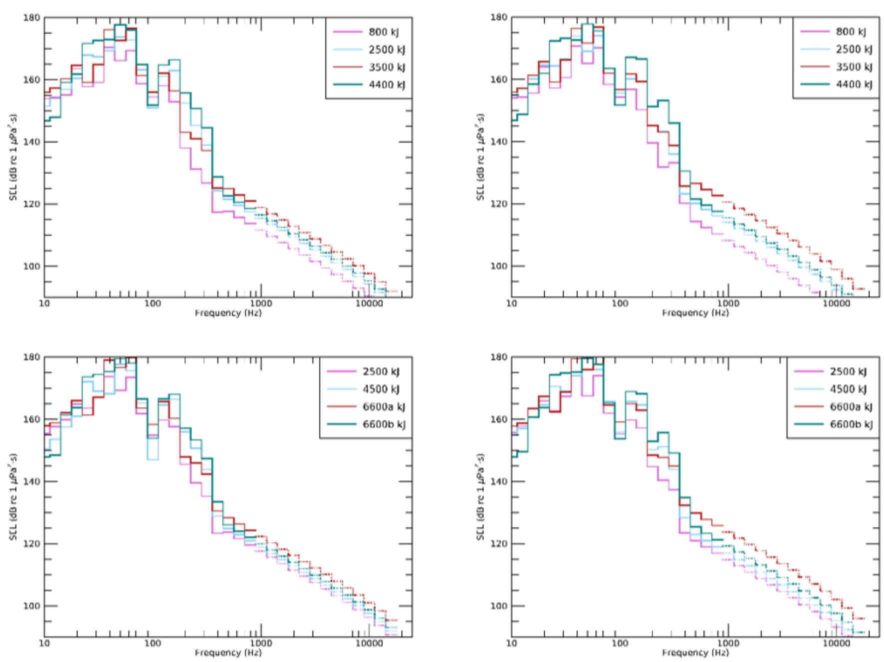



Figure 22. Decidecade band levels at 750 m from location L02 for a 14 m typical monopile assuming an expected installation scenario (top row) MHU 5500 kJ hammer and (bottom row) MHU 5500 hammer scaled to 6600 kJ with average sound speed profiles for (left) summer and (right) winter.

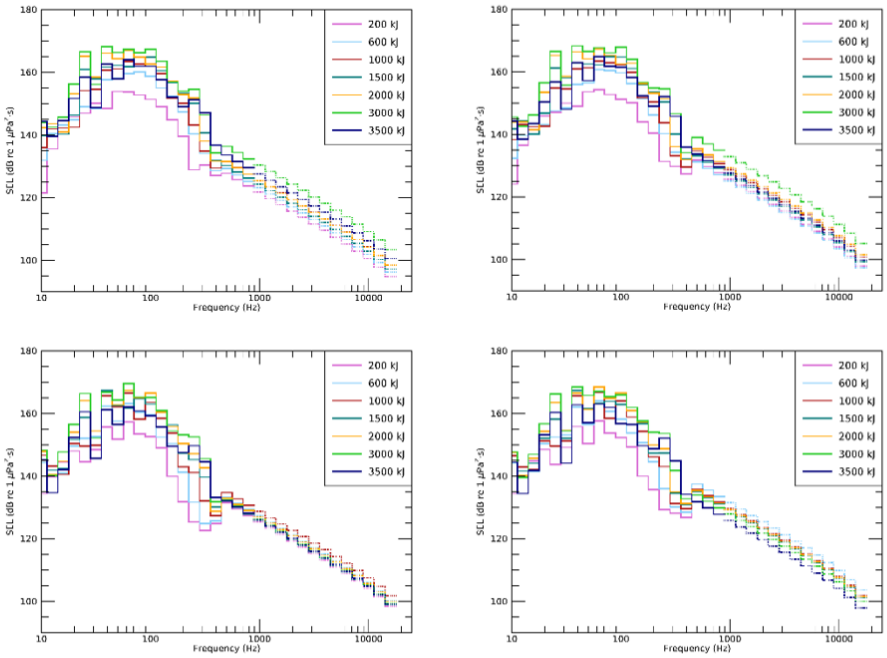



Figure 23. Decidecade band levels at 750 m from (top row) location L01 and (bottom row) location L02 for a 4 m diameter jacket foundation pin pile assuming an expected installation scenario MHU 3500S kJ hammer with average sound speed profiles for (left) summer and (right) winter.

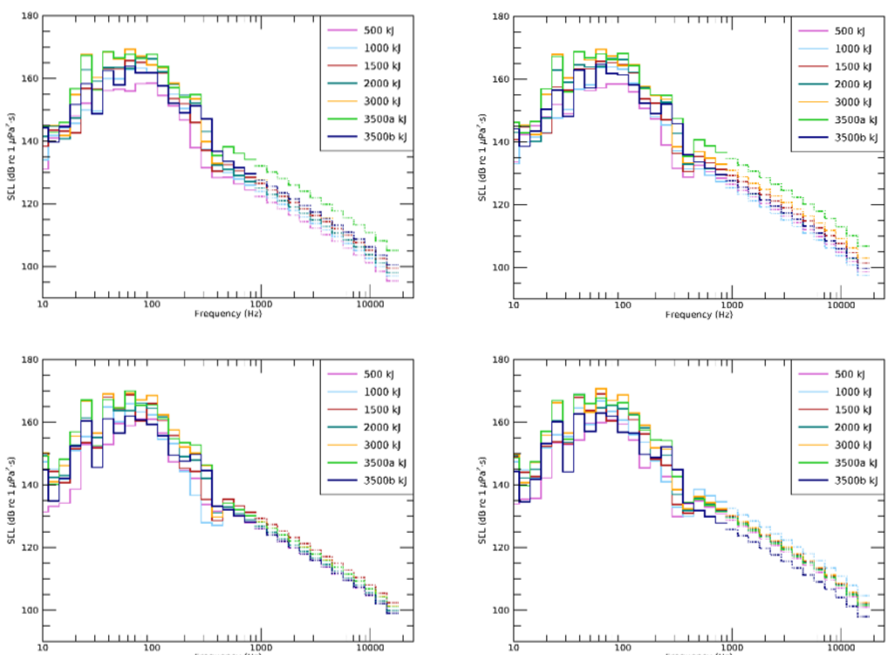



Figure 24. Decidecade band levels at 750 m from (top row) location L01 and (bottom row) location L02 for a 4 m diameter jacket foundation pin pile assuming an expected installation scenario MHU 3500S kJ hammer with average sound speed profiles for (left) summer and (right) winter.

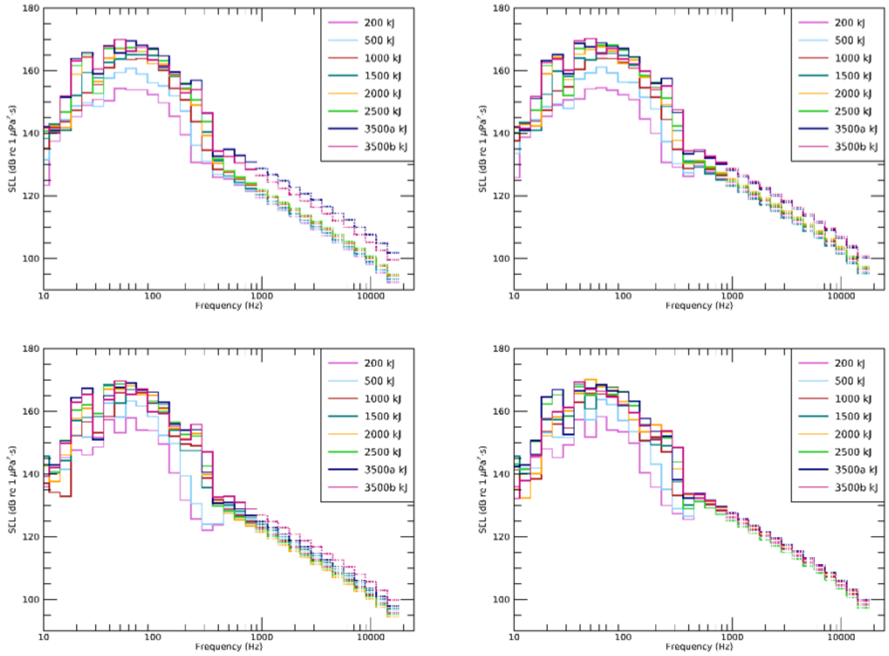



Figure 25. Decidecade band levels at 750 m from (top row) location L01 and (bottom row) location L02 for a 4.25 m diameter jacket foundation pin pile assuming an expected installation scenario MHU 3500S kJ hammer with average sound speed profiles for (left) summer and (right) winter.

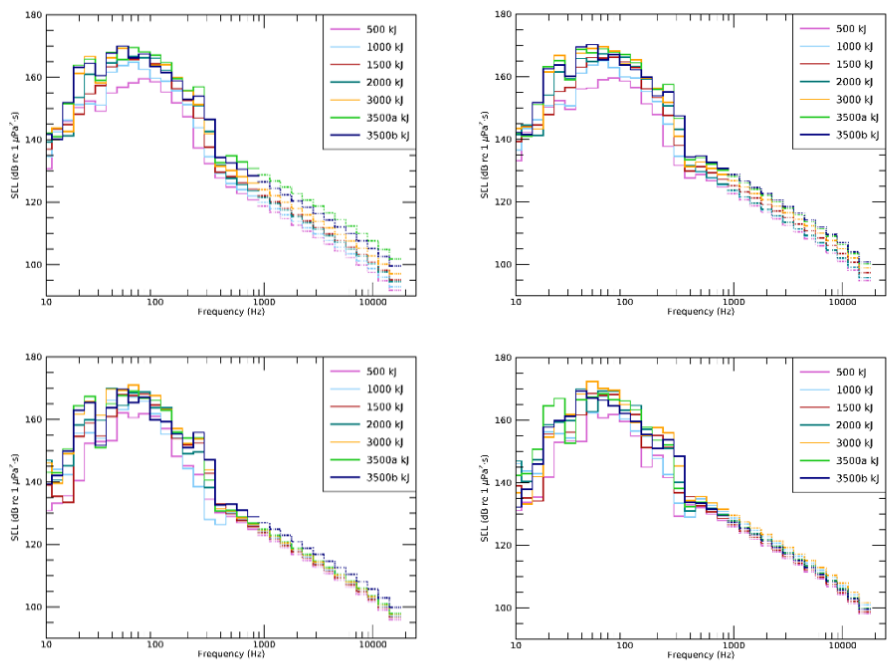



Figure 26. Decidecade band levels at 750 m from (top row) location L01 and (bottom row) location L02 for a 4.25 m diameter jacket foundation pin pile assuming an expected installation scenario MHU 3500S kJ hammer with average sound speed profiles for (left) summer and (right) winter.

Table 41. Broadband SEL (dB re 1 µPa$^2$·s) per modeled energy level for Location L01 at 10 m and 750 m from a 14 m diameter monopile installed using a MHU 5500 hammer, for summer and winter conditions.

| Energy level (kJ) | SEL @ 10 m Summer | SEL @ 10 m Winter | SEL @ 750 m Summer | SEL@ 750 m Winter |
|---|---|---|---|---|
| 800 | 197.8 | 197.8 | 173.4 | 173.5 |
| 2500 | 201.1 | 201.1 | 176.0 | 176.7 |
| 3500 | 203.0 | 202.9 | 178.2 | 178.5 |
| 4400 | 204.8 | 204.7 | 180.1 | 180.5 |

Table 42. Broadband SEL (dB re 1 µPa$^2$·s) per modeled energy level for Location L02 at 10 m and 750 m from a 14 m diameter monopile installed using a MHU 5500 hammer, for summer and winter conditions.

| Energy level (kJ) | SEL @ 10 m Summer | SEL @ 10 m Winter | SEL @ 750 m Summer | SEL@ 750 m Winter |
|---|---|---|---|---|
| 800 | 195.7 | 195.7 | 174.6 | 174.8 |
| 2500 | 199.9 | 199.9 | 178.6 | 178.6 |
| 3500 | 201.6 | 201.5 | 180.4 | 180.6 |
| 4400 | 203.1 | 203.0 | 182.3 | 182.3 |

Table 43. Broadband SEL (dB re 1 µPa$^2$·s) per modeled energy level for Location L01 at 10 m and 750 m from a 14 m diameter monopile installed using a MHU 6000 hammer, for summer and winter conditions.

| Energy level (kJ) | SEL @ 10 m Summer | SEL @ 10 m Winter | SEL @ 750 m Summer | SEL@ 750 m Winter |
|---|---|---|---|---|
| 800 | 201.4 | 201.3 | 176.1 | 176.7 |
| 2500 | 203.7 | 203.6 | 179.0 | 179.5 |
| 3500 | 206.1 | 206.1 | 181.6 | 181.9 |
| 4400 | 206.8 | 206.7 | 182.2 | 182.6 |

Table 44. Broadband SEL (dB re 1 µPa$^2$·s) per modeled energy level for Location L02 at 10 m and 750 m from a 14 m diameter monopile installed using a MHU 6000 hammer, for summer and winter conditions.

| Energy level (kJ) | SEL @ 10 m Summer | SEL @ 10 m Winter | SEL @ 750 m Summer | SEL@ 750 m Winter |
|---|---|---|---|---|
| 800 | 199.8 | 199.8 | 178.2 | 178.4 |
| 2500 | 202.6 | 202.6 | 181.5 | 181.5 |
| 3500 | 204.6 | 204.5 | 183.6 | 183.7 |
| 4400 | 205.0 | 204.9 | 184.2 | 184.3 |

Table 45. Broadband SEL (dB re 1 µPa²·s) per modeled energy level for Location L01 at 10 m and 750 m from a 4 m diameter jacket installed using a MHU 3500 hammer, for summer and winter conditions.

| Energy level (kJ) | SEL @ 10 m Summer | SEL @ 10 m Winter | SEL @ 750 m Summer | SEL@ 750 m Winter |
|---|---|---|---|---|
| 200 | 183.5 | 183.4 | 160.7 | 161.0 |
| 600 | 189.5 | 189.5 | 166.5 | 166.6 |
| 1000 | 191.8 | 191.7 | 169.1 | 169.3 |
| 1500 | 194.3 | 194.2 | 171.7 | 172.1 |
| 2000 | 195.5 | 195.4 | 173.3 | 173.4 |
| 3000 | 198.7 | 198.7 | 175.1 | 175.2 |
| 3500 | 197.6 | 197.6 | 170.0 | 170.0 |

Table 46. Broadband SEL (dB re 1 µPa²·s) per modeled energy level for Location L02 at 10 m and 750 m from a 4 m diameter jacket installed using a MHU 3500 hammer, for summer and winter conditions.

| Energy level (kJ) | SEL @ 10 m Summer | SEL @ 10 m Winter | SEL @ 750 m Summer | SEL@ 750 m Winter |
|---|---|---|---|---|
| 200 | 183.4 | 183.3 | 162.3 | 162.3 |
| 600 | 189.1 | 189.0 | 168.4 | 168.5 |
| 1000 | 192.1 | 192.1 | 171.3 | 171.4 |
| 1500 | 194.2 | 194.2 | 172.1 | 172.1 |
| 2000 | 196.2 | 196.2 | 173.8 | 174.0 |
| 3000 | 198.9 | 198.8 | 174.5 | 174.6 |
| 3500 | 197.6 | 197.6 | 168.6 | 169.3 |

Table 47. Broadband SEL (dB re 1 µPa²·s) per modeled energy level for Location L01 at 10 m and 750 m from a 4 m diameter jacket installed using a MHU 3500 hammer, for summer and winter conditions.

| Energy level (kJ) | SEL @ 10 m Summer | SEL @ 10 m Winter | SEL @ 750 m Summer | SEL@ 750 m Winter |
|---|---|---|---|---|
| 500 | 188.1 | 187.9 | 165.1 | 165.5 |
| 1000 | 192.3 | 192.3 | 169.3 | 169.4 |
| 1500 | 194.0 | 193.9 | 171.4 | 171.5 |
| 2000 | 195.8 | 195.7 | 173.3 | 173.6 |
| 3000 | 197.5 | 197.5 | 175.5 | 175.6 |
| 3500 (a) | 199.1 | 199.0 | 175.4 | 175.6 |
| 3500 (b) | 197.5 | 197.6 | 169.9 | 170.0 |

Table 48. Broadband SEL (dB re 1 µPa²·s) per modeled energy level for Location L02 at 10 m and 750 m from a 4 m diameter jacket installed using a MHU 3500 hammer, for summer and winter conditions.

| Energy level (kJ) | SEL @ 10 m Summer | SEL @ 10 m Winter | SEL @ 750 m Summer | SEL@ 750 m Winter |
|---|---|---|---|---|
| 500 | 187.9 | 187.8 | 167.4 | 167.1 |
| 1000 | 191.8 | 191.7 | 171.1 | 171.1 |
| 1500 | 194.3 | 194.2 | 173.6 | 173.7 |
| 2000 | 195.7 | 195.6 | 173.6 | 173.6 |
| 3000 | 198.3 | 198.3 | 175.9 | 176.1 |
| 3500 (a) | 199.2 | 199.2 | 174.9 | 175.0 |
| 3500 (b) | 197.5 | 197.6 | 168.5 | 169.2 |

Table 49. Broadband SEL (dB re 1 µPa²·s) per modeled energy level for Location L01 at 10 m and 750 m from a 4.25 m diameter jacket installed using a MHU 3500 hammer, for summer and winter conditions.

| Energy level (kJ) | SEL @ 10 m Summer | SEL @ 10 m Winter | SEL @ 750 m Summer | SEL@ 750 m Winter |
|---|---|---|---|---|
| 200 | 184.3 | 184.2 | 161.4 | 161.6 |
| 500 | 189.4 | 189.3 | 166.6 | 166.9 |
| 1000 | 192.8 | 192.7 | 170.2 | 170.6 |
| 1500 | 195.1 | 195.0 | 172.6 | 173.3 |
| 2000 | 196.3 | 196.2 | 173.8 | 174.1 |
| 2500 | 197.3 | 197.2 | 175.1 | 175.6 |
| 3500 (a) | 199.8 | 199.7 | 176.2 | 176.3 |
| 3500 (b) | 201.2 | 201.1 | 175.8 | 176.2 |

Table 50. Broadband SEL (dB re 1 µPa²·s) per modeled energy level for Location L02 at 10 m and 750 m from a 4.25 m diameter jacket installed using a MHU 3500 hammer, for summer and winter conditions.

| Energy level (kJ) | SEL @ 10 m Summer | SEL @ 10 m Winter | SEL @ 750 m Summer | SEL@ 750 m Winter |
|---|---|---|---|---|
| 200 | 184.2 | 184.1 | 163.2 | 163.2 |
| 500 | 189.0 | 188.9 | 168.6 | 168.9 |
| 1000 | 192.6 | 192.5 | 172.3 | 172.3 |
| 1500 | 194.8 | 194.7 | 173.9 | 173.9 |
| 2000 | 195.7 | 196.3 | 174.4 | 175.0 |
| 2500 | 198.0 | 197.9 | 174.8 | 174.7 |
| 3500 (a) | 199.9 | 199.8 | 175.5 | 175.5 |
| 3500 (b) | 201.3 | 201.2 | 174.6 | 174.7 |

Table 51. Broadband SEL (dB re 1 µPa²·s) per modeled energy level for Location L01 at 10 m and 750 m from a 4.25 m diameter jacket installed using a MHU 3500 hammer, for summer and winter conditions.

| Energy level (kJ) | SEL @ 10 m Summer | SEL @ 10 m Winter | SEL @ 750 m Summer | SEL@ 750 m Winter |
|---|---|---|---|---|
| 500 | 188.7 | 188.6 | 165.8 | 166.3 |
| 1000 | 193.1 | 193.0 | 170.5 | 170.7 |
| 1500 | 194.9 | 194.9 | 172.3 | 172.9 |
| 2000 | 196.6 | 196.5 | 174.1 | 174.8 |
| 3000 | 198.3 | 198.2 | 175.9 | 176.2 |
| 3500 (a) | 199.8 | 199.7 | 176.2 | 176.3 |
| 3500 (b) | 201.2 | 201.1 | 175.8 | 176.2 |

Table 52. Broadband SEL (dB re 1 µPa²·s) per modeled energy level for Location L02 at 10 m and 750 m from a 4.25 m diameter jacket installed using a MHU 3500 hammer, for summer and winter conditions.

| Energy level (kJ) | SEL @ 10 m Summer | SEL @ 10 m Winter | SEL @ 750 m Summer | SEL@ 750 m Winter |
|---|---|---|---|---|
| 500 | 188.4 | 188.3 | 168.4 | 168.2 |
| 1000 | 192.7 | 192.6 | 172.5 | 172.7 |
| 1500 | 194.6 | 194.6 | 174.4 | 174.6 |
| 2000 | 196.2 | 196.2 | 175.4 | 175.4 |
| 3000 | 198.4 | 198.3 | 177.0 | 177.1 |
| 3500 (a) | 199.9 | 199.8 | 175.5 | 175.5 |
| 3500 (b) | 201.3 | 201.2 | 174.6 | 174.7 |

### 4.1.2. Vibratory Pile Driving

Figures 27–29 show 1-second long forcing functions for the jacket and monopile under vibratory hammers calculated using GRLWEAP 2010 (GRLWEAP, Pile Dynamics 2010) with the addition of non-linearities (see Section 2.2.2). Decidecade band levels at 10 m for the modeled piles are shown in Figures 30–35. Observed peaks correspond to the frequency of vibration of the hammer and subsequent harmonics. The broadband single-strike SEL per hammer energy at 10 m and 750 m for each scenario are shown in Tables 53–2339 for vibratory pile driving.

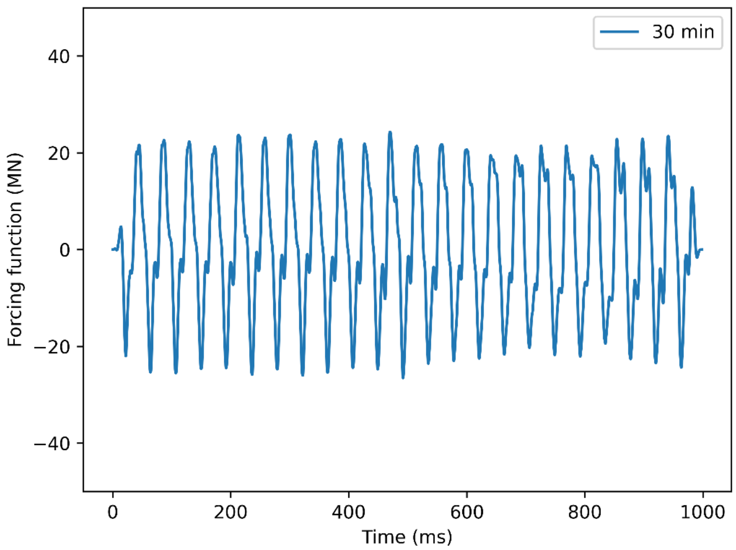



Figure 27. Modeled one second vibratory forcing function for a 4 m diameter pin pile.

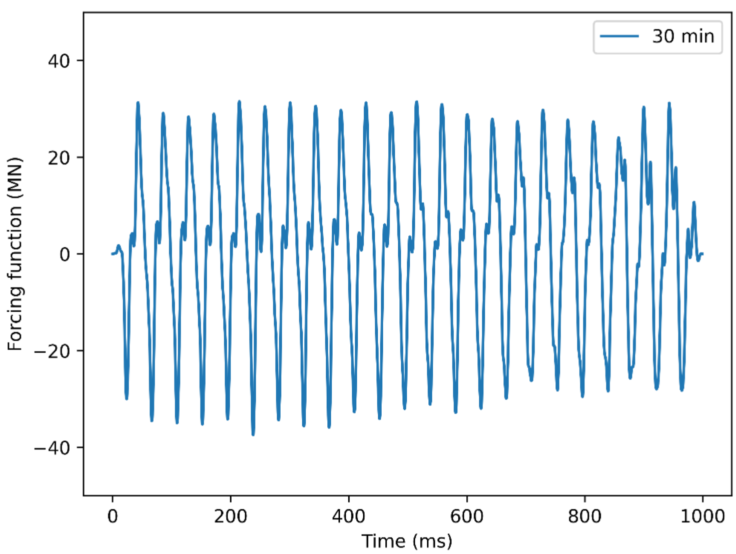



Figure 28. Modeled one second vibratory forcing function for a 4.25 m diameter pin pile.

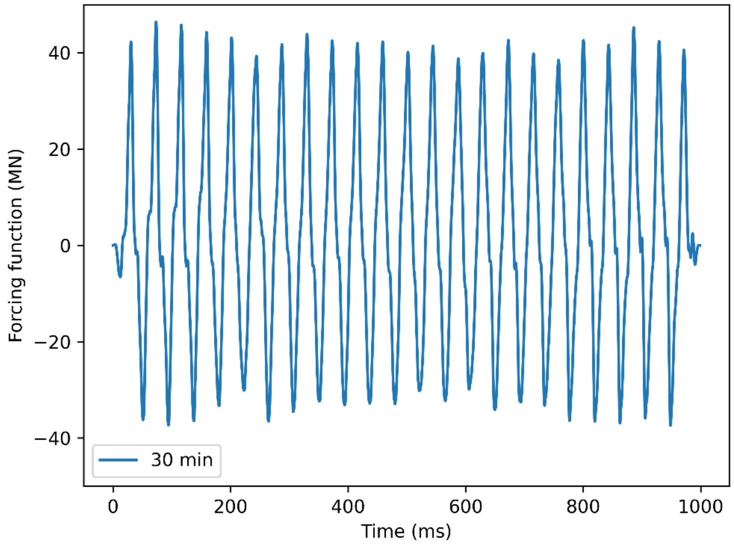



Figure 29. Modeled one second vibratory forcing function for a 14 m diameter monopile.

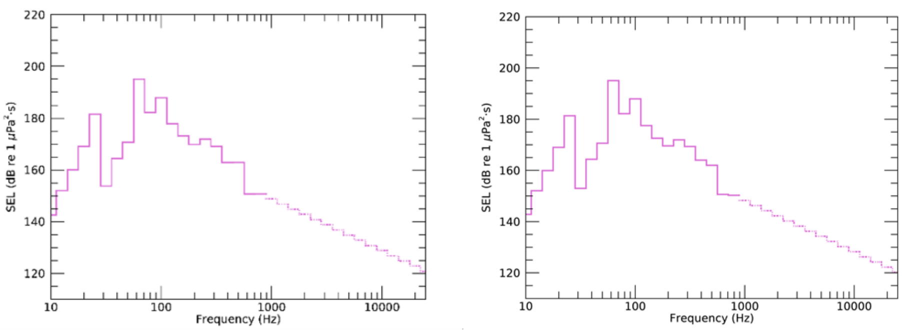



Figure 30. Jacket foundation (4 m diameter pile, TR-CV320 hammer) at location L01: Decidecade band levels for vibratory pile driving at 10 m horizontal range from the pile for (left) summer and (right) winter conditions. The values at higher frequencies (1–25 kHz, dashed lines) have been extrapolated assuming constant decay rates.

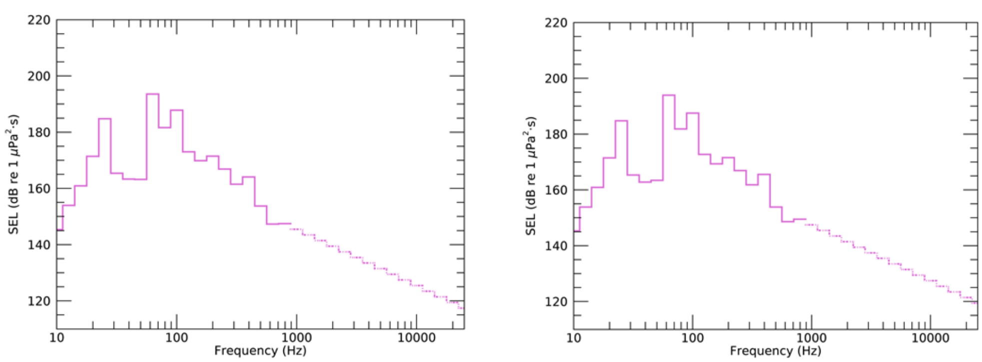



Figure 31. Jacket foundation (4 m diameter pile, TR-CV320 hammer) at location L02: Decidecade band levels for vibratory pile driving at 10 m horizontal range from the pile for (left) summer and (right) winter conditions. The values at higher frequencies (1–25 kHz, dashed lines) have been extrapolated assuming constant decay rates.

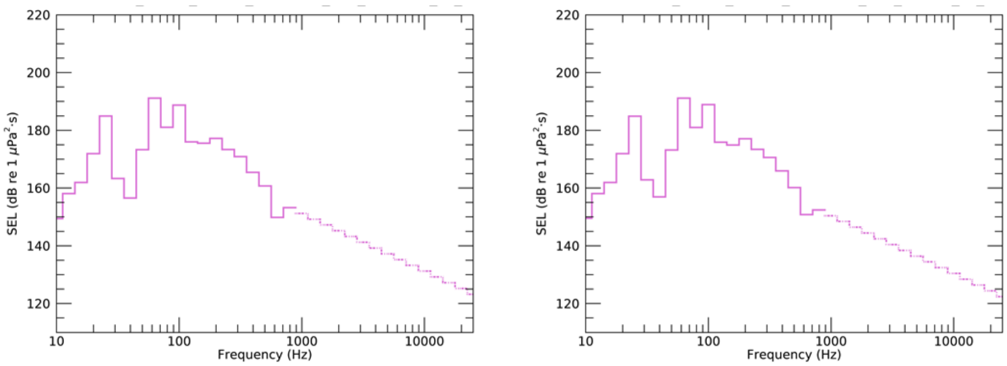



Figure 32. Jacket foundation (4.25 m diameter pile, TR-CV320 hammer) at location L01: Decidecade band levels for vibratory pile driving at 10 m horizontal range from the pile for (left) summer and (right) winter conditions. The values at higher frequencies (1–25 kHz, dashed lines) have been extrapolated assuming constant decay rates.

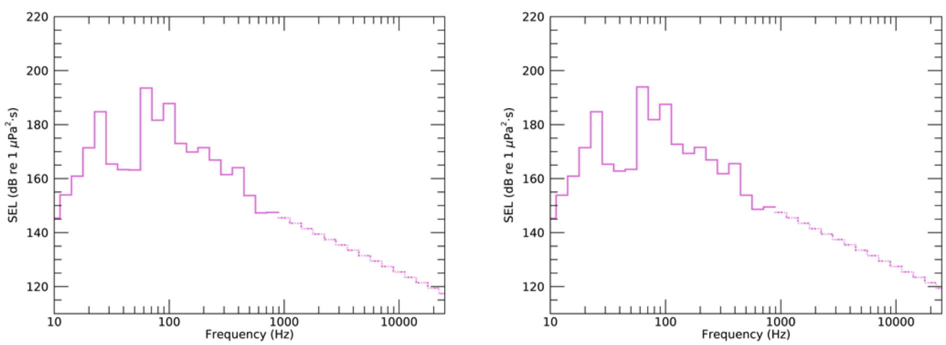



Figure 33. Jacket foundation (4.25 m diameter pile, TR-CV320 hammer) at location L02: Decidecade band levels for vibratory pile driving at 10 m horizontal range from the pile for (left) summer and (right) winter conditions. The values at higher frequencies (1–25 kHz, dashed lines) have been extrapolated assuming constant decay rates.

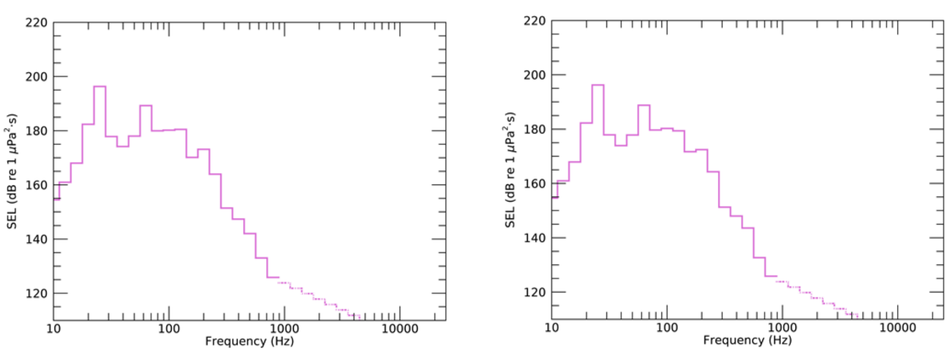
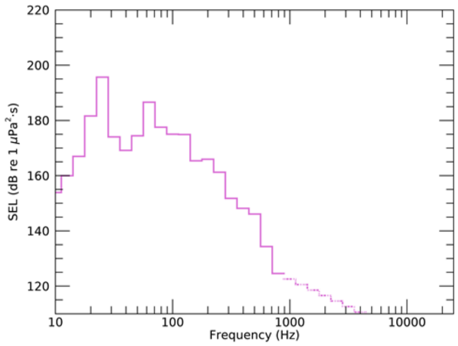



Figure 34. Monopile foundation (14 m diameter pile, TR-CV640 hammer) at location L01: Decidecade band levels for vibratory pile driving at 10 m horizontal range from the pile for (left) summer and (right) winter conditions. The values at higher frequencies (1–25 kHz, dashed lines) have been extrapolated assuming constant decay rates.



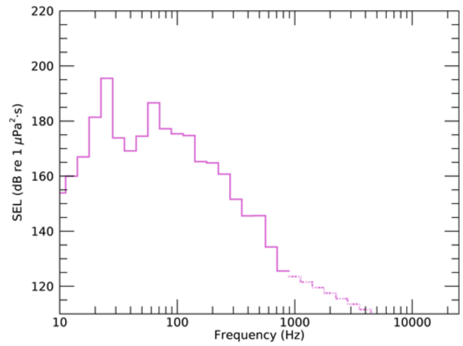




Figure 35. Monopile foundation (14 m diameter pile, TR-CV640 hammer) at location L02: Decidecade band levels for vibratory pile driving at 10 m horizontal range from the pile for (left) summer and (right) winter conditions. The values at higher frequencies (1–25 kHz, dashed lines) have been extrapolated assuming constant decay rates.

Table 53. Broadband SEL (dB re 1 µPa²·s) per modeled energy level for Location L01 at 10 m and 750 m from a 14 m diameter monopile installed using a TR CV640 hammer, for summer and winter conditions.

| Vibratory duration (min) | SEL @ 10 m Summer | SEL @ 10 m Winter | SEL @ 750 m Summer | SEL @ 750 m Winter |
|---|---|---|---|---|
| 30 | 197.6 | 197.5 | 173.1 | 173.8 |

Table 54. Broadband SEL (dB re 1 µPa²·s) per modeled energy level for Location L02 at 10 m and 750 m from a 14 m diameter monopile installed using a TR CV640 hammer, for summer and winter conditions.

| Vibratory duration (min) | SEL @ 10 m Summer | SEL @ 10 m Winter | SEL @ 750 m Summer | SEL @ 750 m Winter |
|---|---|---|---|---|
| 30 | 196.5 | 196.4 | 174.0 | 173.6 |

Table 55. Broadband SEL (dB re 1 µPa²·s) per modeled energy level for Location L01 at 10 m and 750 m from a 4 m diameter jacket installed using a TR CV320 hammer, for summer and winter conditions.

| Vibratory duration (min) | SEL @ 10 m Summer | SEL @ 10 m Winter | SEL @ 750 m Summer | SEL @ 750 m Winter |
|---|---|---|---|---|
| 30 | 196.3 | 196.3 | 174.1 | 174.8 |

Table 56. Broadband SEL (dB re 1 µPa²·s) per modeled energy level for Location L02 at 10 m and 750 m from a 4 m diameter jacket installed using a TR CV320 hammer, for summer and winter conditions.

| Vibratory duration (min) | SEL @ 10 m Summer | SEL @ 10 m Winter | SEL @ 750 m Summer | SEL @ 750 m Winter |
|---|---|---|---|---|
| 30 | 195.3 | 195.5 | 174.9 | 174.3 |

Table 57. Broadband SEL (dB re 1 µPa$^2$·s) per modeled energy level for Location L01 at 10 m and 750 m from a 4.25 m diameter jacket installed using a TR CV320 hammer, for summer and winter conditions.

| Vibratory duration (min) | SEL @ 10 m Summer | SEL @ 10 m Winter | SEL @ 750 m Summer | SEL @ 750 m Winter |
|---|---|---|---|---|
| 30 | 194.3 | 194.3 | 170.6 | 171.4 |

Table 58. Broadband SEL (dB re 1 µPa$^2$·s) per modeled energy level for Location L02 at 10 m and 750 m from a 4.25 m diameter jacket installed using a TR CV320 hammer, for summer and winter conditions.

| Vibratory duration (min) | SEL @ 10 m Summer | SEL @ 10 m Winter | SEL @ 750 m Summer | SEL @ 750 m Winter |
|---|---|---|---|---|
| 30 | 193.5 | 193.4 | 171.8 | 171.8 |

## 4.2. Modeled Sound Fields

Two dimensional (2-D) sound fields were calculated in 16 uniformly spaced azimuths for monopiles and pin piles using the source characteristics (see Section 4.1 and Appendix D.1) at two representative locations for both foundation types (see Figure 2). Environmental parameters (bathymetry, geoacoustic information, and sound speed profiles) chosen for the propagation modeling and the modeling procedures are found in Appendix E. Appendix F and G shows subsequent ranges to various isopleths for single hammer strikes at the different hammer energy levels.

The hammering schedule for each foundation type was determined from pile driving parameters provided in Section 2.2. For vibratory and impact pile driving, the installation time was calculated using the blow rate and blow count at each hammer energy level and the time of vibratory piling was added. For the cumulative SEL, 30 min of vibratory piling for monopile and pin piles followed by impact pile driving were considered. For impact pile driving of all modeled monopiles, the strike rate is 30 strikes per minute. For impact pile driving of 14 m monopiles, the total strike count is 7900. Considering both vibratory and impact piling, the total hours per monopile installation is ~4.89 h per 14 m monopile,. For impact pile driving of 4 per day 4.25 m pin piles, the strike rate was 48 strikes per minute and the total strike count is 15,200. For impact pile driving of 8 per day 4.25 m pin piles, the strike rate was 113 strikes per minute and the total strike count is 15,200 per pile. Considering both vibratory (30 min) and impact piling, the total hours per 4.25 m pin pile installation is ~5.78 h for 4 per day pin piles and ~2.74 h for 8 per day pin piles.

### 4.2.1. Summary Acoustic Ranges

This section presents a high-level summary of the underwater acoustic modeling performed for all impact and vibratory piling scenarios considered. The maximum acoustic ranges to threshold are shown across all modeling locations, seasons, hammer energies, and drivabilities for each pile type to demonstrate the maximum acoustic impact from the PDE. Installation is assumed with impact pile driving, and with vibratory pile setting followed by impact pile driving (see Tables 3 to 14 for drivability details). Acoustic ranges are shown for 10 dB attenuation. More detailed results are presented in Appendix F for impact pile driving only and in Appendix G for vibratory pile setting followed by impact pile driving.

#### 4.2.1.1. 14 m monopile

Table 59. Maximum acoustic ranges ($R_{95\%}$ in km) for a monopile foundation (14 m diameter, TRC V640 and MHU5500 hammer scaled to 4400 kJ and 6600 kJ, 30 min vibratory pile-setting followed by impact) across Summer and Winter seasons with 10 dB attenuation (Finneran et al. 2017, NMFS 2018).

| Hearing Group | $L_E$ Threshold (dB) | Impact Pile Driving | Impact + Vibratory Pile Driving |
|---|---|---|---|
| LF | 183 | 7.22 | 7.43 |
| MF | 185 | - | - |
| HF | 155 | 0.12 | 0.13 |
| PPW | 185 | 1.07 | 1.14 |
| TUW | 204 | 1.81 | 1.89 |

$L_E$ = frequency-weighted sound exposure level (dB re 1 µPa²·s).

Table 60. Maximum acoustic ranges ($R_{95\%}$ in km) to fish injury thresholds for a monopile foundation (14m diameter, TRC V640 and MHU5500 hammer scaled to 4400 kJ and 6600 kJ, 30 min vibratory pile-setting followed by impact) across Summer and Winter seasons with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB) | Impact Pile Driving | Impact + Vibratory Pile Driving |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$[a] | 187 | 9.957 | 10.372 |
| Fish ≥ 2g | $L_{pk}$[a] | 206 | 0.128 | 0.128 |
| Fish < 2 g | $L_E$[a] | 183 | 13.468 | 13.888 |
| Fish < 2 g | $L_{pk}$[a] | 206 | 0.128 | 0.128 |
| Fish without swim bladder | $L_E$[b] | 216 | 0.412 | 0.467 |
| Fish without swim bladder | $L_{pk}$[b] | 213 | 0.028 | 0.028 |
| Fish with swim bladder not involved in hearing | $L_E$[b] | 203 | 2.666 | 2.774 |
| Fish with swim bladder not involved in hearing | $L_{pk}$[b] | 207 | 0.108 | 0.108 |
| Fish with swim bladder involved in hearing | $L_E$[b] | 203 | 2.666 | 2.774 |
| Fish with swim bladder involved in hearing | $L_{pk}$[b] | 207 | 0.108 | 0.108 |

$L_{pk}$ = unweighted peak sound pressure (dB re 1 µPa); $L_E$ = sound exposure level (dB re 1 µPa²·s)
A dash indicates that distances could not be calculated because thresholds were not reached.
[a] NMFS recommended criteria adopted from the Fisheries Hydroacoustic Working Group (FHWG 2008).
[b] Popper et al. (2014).

Table 61. Maximum acoustic ranges ($R_{95\%}$ in km) to behavioral $L_p$ thresholds for a monopile foundation (14 m diameter, TRC V640 and MHU5500 hammer scaled to 4400 kJ and 6600 kJ, 30 min vibratory pile-setting followed by impact) across Summer and Winter seasons (Finneran et al. 2017, NMFS 2018, GARFO 2019) with 10 dB attenuation.

| Species | Impact Thresholds (dB) | Impact Pile Driving | Vibratory Thresholds (dB) | Vibratory Pile Driving |
|---|---|---|---|---|
| Marine Mammals | 160 | 7.49 | 120 | 40.6 |
| Fish | 150 | 15.7 | 150 | 4.28 |
| Sea Turtles | 175 | 2.08 | 175 | 0.12 |

$L_p$= unweighted sound pressure (dB re 1 µPa).

#### 4.2.1.2. Jacket Foundations

##### 4.2.1.2.1. 4 m Jacket

Table 62. Maximum acoustic ranges ($R_{95\%}$ in km) for a jacket foundation (8 post-piled pin piles, 4 m diameter, TRC V320 and MHU3500 hammer, 30 min of vibratory pile-setting followed by impact) across Summer and Winter seasons at both modeling locations, with 10 dB attenuation (Finneran et al. 2017, NMFS 2018).

| Hearing Group | $L_E$ Threshold (dB) | Impact Pile Driving | Impact + Vibratory Pile Driving |
|---|---|---|---|
| LF | 183 | 13.7 | 14.0 |
| MF | 185 | 0.03 | 0.03 |
| HF | 155 | 1.54 | 1.52 |
| PPW | 185 | 2.32 | 2.33 |
| TUW | 204 | 2.82 | 2.89 |

$L_E$ = frequency-weighted sound exposure level (dB re 1 µPa²·s).

Table 63. Maximum acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle injury thresholds for a jacket foundation (8 post-piled pin piles, 4 m diameter, TRC V320 and MHU3500 hammer, 30 min of vibratory pile-setting followed by impact) across Summer and Winter seasons with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB) | Impact Pile Driving | Impact + Vibratory Pile Driving |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$[a] | 187 | 15.9 | 18.3 |
| Fish ≥ 2g | $L_{pk}$[a] | 206 | 0.09 | 0.09 |
| Fish < 2 g | $L_E$[a] | 183 | 24.7 | 29.1 |
| Fish < 2 g | $L_{pk}$[a] | 206 | 0.09 | 0.09 |
| Fish without swim bladder | $L_E$[b] | 216 | 0.60 | 0.75 |
| Fish without swim bladder | $L_{pk}$[b] | 213 | - | - |
| Fish with swim bladder not involved in hearing | $L_E$[b] | 203 | 3.30 | 4.04 |
| Fish with swim bladder not involved in hearing | $L_{pk}$[b] | 207 | 0.08 | 0.08 |
| Fish with swim bladder involved in hearing | $L_E$[b] | 203 | 3.30 | 4.04 |
| Fish with swim bladder involved in hearing | $L_{pk}$[b] | 207 | 0.08 | 0.08 |

$L_{pk}$ = unweighted peak sound pressure (dB re 1 µPa); $L_E$ = sound exposure level (dB re 1 µPa²·s)
A dash indicates that distances could not be calculated because thresholds were not reached.
[a] NMFS recommended criteria adopted from the Fisheries Hydroacoustic Working Group (FHWG 2008).
[b] Popper et al. (2014).

Table 64. Maximum acoustic ranges ($R_{95\%}$ in km) to behavioral $L_p$ thresholds for a jacket foundation (8 post-piled pin piles, 4 m diameter, TRC V320 and MHU3500 hammer, 30 min of vibratory pile-setting followed by impact) across Summer and Winter seasons (Finneran et al. 2017, NMFS 2018, GARFO 2019) with 10 dB attenuation.

| Species | Impact Thresholds (dB) | Impact Pile Driving | Vibratory Thresholds (dB) | Vibratory Pile Driving |
|---|---|---|---|---|
| Marine Mammals | 160 | 5.33 | 120 | 84.1 |
| Fish | 150 | 16.2 | 150 | 4.03 |
| Sea Turtles | 175 | 0.91 | 175 | 0.14 |

$L_p$= unweighted sound pressure (dB re 1 µPa).

### 4.2.1.2.2. 4.25 m Jacket

Table 65. Maximum acoustic ranges ($R_{95\%}$ in km) for a jacket foundation (8 post-piled pin piles, 4.25 m diameter, TRC V320 and MHU3500 hammer, 30 min of vibratory pile-setting followed by impact) across Summer and Winter seasons with 10 dB attenuation (Finneran et al. 2017, NMFS 2018).

| Hearing Group | $L_E$ Threshold (dB) | Impact Pile Driving | Impact + Vibratory Pile Driving |
|---|---|---|---|
| LF | 183 | 17.0 | 17.1 |
| MF | 185 | 0.03 | 0.03 |
| HF | 155 | 1.32 | 1.32 |
| PPW | 185 | 2.79 | 2.81 |
| TUW | 204 | 3.70 | 3.75 |

$L_E$ = frequency-weighted sound exposure level (dB re 1 µPa$^2$·s).

Table 66. Maximum acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle injury thresholds for a jacket foundation (8 post-piled pin piles, 4.25 m diameter, TRC V320 and MHU3500 hammer, 30 min of vibratory pile-setting followed by impact) across Summer and Winter seasons with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB) | Impact Pile Driving | Impact + Vibratory Pile Driving |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$[a] | 187 | 21.1 | 23.5 |
| Fish ≥ 2g | $L_{pk}$[a] | 206 | 0.11 | 0.11 |
| Fish < 2 g | $L_E$[a] | 183 | 34.8 | 40.0 |
| Fish < 2 g | $L_{pk}$[a] | 206 | 0.11 | 0.11 |
| Fish without swim bladder | $L_E$[b] | 216 | 0.85 | 1.04 |
| Fish without swim bladder | $L_{pk}$[b] | 213 | 0.02 | 0.02 |
| Fish with swim bladder not involved in hearing | $L_E$[b] | 203 | 4.42 | 4.94 |
| Fish with swim bladder not involved in hearing | $L_{pk}$[b] | 207 | 0.1 | 0.1 |
| Fish with swim bladder involved in hearing | $L_E$[b] | 203 | 4.42 | 4.94 |
| Fish with swim bladder involved in hearing | $L_{pk}$[b] | 207 | 0.1 | 0.1 |

$L_{pk}$ = unweighted peak sound pressure (dB re 1 µPa); $L_E$= sound exposure level (dB re 1 µPa$^2$·s)
A dash indicates that distances could not be calculated because thresholds were not reached.
[a] NMFS recommended criteria adopted from the Fisheries Hydroacoustic Working Group (FHWG 2008).
[b] Popper et al. (2014).

Table 67. Maximum acoustic ranges ($R_{95\%}$ in km) to behavioral $L_p$ thresholds for a jacket foundation (8 post-piled pin piles, 4.25 m diameter, TRC V320 and MHU3500 hammer, 30 min of vibratory pile-setting followed by impact) across Summer and Winter seasons (Finneran et al. 2017, NMFS 2018, GARFO 2019) with 10 dB attenuation.

| Species | Impact Thresholds (dB) | Impact Pile Driving | Vibratory Thresholds (dB) | Vibratory Pile Driving |
|---|---|---|---|---|
| Marine Mammals | 160 | 5.74 | 120 | 53.8 |
| Fish | 150 | 16.9 | 150 | 3.28 |
| Sea Turtles | 175 | 1.13 | 175 | 0.10 |

$L_p$= unweighted sound pressure (dB re 1 µPa).

## 4.3. Exposure Estimates

Exposure estimates were calculated for marine mammals and sea turtles using each of the proposed construction schedules (see Section 1.2.1.1). Each construction schedule includes a combination of foundations installed with vibratory setting of piles followed by impact pile driving and foundations installed with impact pile driving alone.

Sections 4.3.1 and 4.3.2 include results for each species and metric, assuming 10 dB attenuation and a summer sound speed profile. The Proponent expects to implement noise abatement systems to reduce sound levels by a minimum of 10 dB but expects to achieve 12 dB or greater; higher levels of attenuation may be achieved as technology continues to evolve. For full results, including all modeled attenuation levels (10, 12, and 15 dB), see Appendix H.

### 4.3.1. Marine Mammals

Table 68. Construction Schedule A, all years (14 m monopile). Mean number of marine mammals predicted to receive sound levels above exposure criteria with 10 dB attenuation. Construction schedule assumptions are summarized in Section 1.2.1.1.

| Hearing Group | Species | Year 1 PTS ($L_{E,w,24h}$) | Year 1 PTS ($L_{pk}$) | Year 1 Behavior ($L_p$ [a]) | Year 1 Behavior ($L_{p,w}$ [b]) | Year 2 PTS ($L_{E,w,24h}$) | Year 2 PTS ($L_{pk}$) | Year 2 Behavior ($L_p$ [a]) | Year 2 Behavior ($L_{p,w}$ [b]) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 15.46 | 0.10 | 256.43 | 49.16 | 15.37 | 0.10 | 253.85 | 48.79 |
| LF | Minke whale (migrating) | 42.37 | 0.18 | 455.64 | 736.46 | 42.12 | 0.18 | 451.39 | 730.65 |
| LF | Humpback whale | 10.05 | 0.04 | 126.13 | 29.77 | 9.97 | 0.04 | 124.76 | 29.49 |
| LF | North Atlantic right whale [c] | 3.57 | <0.01 | 68.76 | 15.06 | 3.54 | <0.01 | 68.10 | 14.93 |
| LF | Sei whale [c] (migrating) | 0.80 | <0.01 | 16.12 | 21.60 | 0.80 | <0.01 | 15.96 | 21.42 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 1567.87 | 182.54 | 0 | 0 | 1550.65 | 180.76 |
| MF | Atlantic spotted dolphin | 0 | 0 | 107.06 | 4.68 | 0 | 0 | 104.34 | 4.57 |
| MF | Common dolphin | 0 | 0 | 25442.19 | 3202.32 | 0 | 0 | 25042.97 | 3159.26 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 1146.66 | 135.75 | 0 | 0 | 1132.35 | 134.48 |
| MF | Risso's dolphin | 0 | 0 | 436.89 | 13.78 | 0 | 0 | 429.15 | 13.59 |
| MF | Long-finned pilot whale | 0 | 0 | 227.67 | 20.00 | 0 | 0 | 224.93 | 19.82 |
| MF | Short-finned pilot whale | 0 | 0 | 58.95 | 4.80 | 0 | 0 | 58.23 | 4.76 |
| MF | Sperm whale [c] | 0 | 0 | 72.90 | 5.90 | 0 | 0 | 72.04 | 5.85 |
| HF | Harbor porpoise (sensitive) | 0 | 2.62 | 1373.58 | 2198.45 | 0 | 2.61 | 1359.86 | 2182.97 |
| PW | Gray seal | 0.08 | 0 | 353.48 | 16.87 | 0.08 | 0 | 350.2 | 16.76 |
| PW | Harbor seal | 0.06 | <0.01 | 493.31 | 28.89 | 0.06 | <0.01 | 488.73 | 29.69 |
| PW | Harp seal | 0.10 | 0.06 | 441.05 | 25.22 | 0.10 | 0.06 | 436.96 | 25.05 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA. $L_{pk}$—peak sound pressure level (dB re 1 µPa), $L_E$—sound exposure level (dB re 1 µPa$^2$·s), $L_p$—root mean square sound pressure level (dB re 1 µPa$^2$).

Table 69. Construction Schedule B, years 1 and 2 (jacket). Mean number of marine mammals predicted to receive sound levels above exposure criteria with 10 dB attenuation. Construction schedule assumptions are summarized in Section 1.2.1.1.

| Hearing Group | Species | Year 1 PTS ($L_{E,w,24h}$) | Year 1 PTS ($L_{pk}$) | Year 1 Behavior ($L_p$ [a]) | Year 1 Behavior ($L_{p,w}$ [b]) | Year 2 PTS ($L_{E,w,24h}$) | Year 2 PTS ($L_{pk}$) | Year 2 Behavior ($L_p$ [a]) | Year 2 Behavior ($L_{p,w}$ [b]) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 16.69 | 0.12 | 145.93 | 34.01 | 15.97 | 0.12 | 173.30 | 33.67 |
| LF | Minke whale (migrating) | 48.09 | 0.07 | 378.32 | 573.24 | 45.74 | 0.07 | 418.18 | 561.76 |
| LF | Humpback whale | 10.25 | 0 | 81.16 | 20.61 | 10.03 | 0 | 91.16 | 20.41 |
| LF | North Atlantic right whale [c] | 4.99 | <0.01 | 64.09 | 12.00 | 4.84 | <0.01 | 69.09 | 11.86 |
| LF | Sei whale [c] (migrating) | 1.02 | <0.01 | 13.68 | 21.35 | 1.01 | <0.01 | 14.52 | 21.12 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 1344.04 | 167.26 | 0 | 0 | 1435.12 | 165.77 |
| MF | Atlantic spotted dolphin | 0 | 0 | 111.15 | 4.64 | 0 | 0 | 120.30 | 4.57 |
| MF | Common dolphin | 0 | 0 | 27460.48 | 3778.53 | 0 | 0 | 30475.98 | 3731.20 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 1013.99 | 150.04 | 0 | 0 | 1141.06 | 147.76 |
| MF | Risso's dolphin | 0 | 0 | 345.70 | 15.94 | 0 | 0 | 412.73 | 15.75 |
| MF | Long-finned pilot whale | 0 | 0 | 214.25 | 22.36 | 0 | 0 | 244.84 | 22.09 |
| MF | Short-finned pilot whale | 0 | 0 | 52.29 | 5.26 | 0 | 0 | 59.72 | 5.20 |
| MF | Sperm whale [c] | 0 | 0 | 67.70 | 7.53 | 0 | 0 | 81.20 | 7.31 |
| HF | Harbor porpoise (sensitive) | 0 | 4.63 | 1174.82 | 3385.74 | 0 | 4.29 | 1317.19 | 3354.80 |
| PW | Gray seal | 0.25 | 0 | 302.85 | 20.51 | 0.25 | 0 | 326.32 | 20.26 |
| PW | Harbor seal | 0.19 | <0.01 | 532.09 | 44.60 | 0.16 | <0.01 | 573.82 | 44.23 |
| PW | Harp seal | 0.28 | 0 | 433.28 | 35.91 | 0.26 | 0 | 467.15 | 35.55 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA. $L_{pk}$—peak sound pressure level (dB re 1 µPa), $L_E$—sound exposure level (dB re 1 µPa$^2$·s), $L_p$—root mean square sound pressure level (dB re 1 µPa$^2$).

Table 70. Construction Schedule B, years 3 and 4 (jacket). Mean number of marine mammals predicted to receive sound levels above exposure criteria with 10 dB attenuation. Construction schedule assumptions are summarized in Section 1.2.1.1.

| Hearing Group | Species | Year 3 PTS ($L_{E,w,24h}$) | Year 3 PTS ($L_{pk}$) | Year 3 Behavior ($L_p$ [a]) | Year 3 Behavior ($L_{p,w}$ [b]) | Year 4 PTS ($L_{E,w,24h}$) | Year 4 PTS ($L_{pk}$) | Year 4 Behavior ($L_p$ [a]) | Year 4 Behavior ($L_{p,w}$ [b]) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 16.65 | 0.11 | 141.84 | 33.25 | 16.21 | 0.12 | 172.26 | 34.14 |
| LF | Minke whale (migrating) | 47.73 | 0.07 | 370.13 | 562.85 | 46.69 | 0.08 | 421.38 | 574.93 |
| LF | Humpback whale | 10.17 | 0 | 79.40 | 20.23 | 10.27 | 0 | 91.93 | 20.89 |
| LF | North Atlantic right whale [c] | 4.97 | <0.01 | 63.20 | 11.88 | 4.94 | <0.01 | 69.64 | 12.09 |
| LF | Sei whale [c] (migrating) | 1.02 | <0.01 | 13.54 | 21.14 | 1.03 | <0.01 | 14.64 | 21.48 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 1325.68 | 164.54 | 0 | 0 | 1465.51 | 170.98 |
| MF | Atlantic spotted dolphin | 0 | 0 | 110.13 | 4.59 | 0 | 0 | 128.16 | 4.89 |
| MF | Common dolphin | 0 | 0 | 26854.24 | 3690.02 | 0 | 0 | 31118.80 | 3862.95 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 990.92 | 146.27 | 0 | 0 | 1149.29 | 151.23 |
| MF | Risso's dolphin | 0 | 0 | 335.21 | 15.57 | 0 | 0 | 415.59 | 16.19 |
| MF | Long-finned pilot whale | 0 | 0 | 208.89 | 21.87 | 0 | 0 | 245.98 | 22.58 |
| MF | Short-finned pilot whale | 0 | 0 | 51.01 | 5.14 | 0 | 0 | 60.00 | 5.31 |
| MF | Sperm whale [c] | 0 | 0 | 65.41 | 7.35 | 0 | 0 | 80.22 | 7.43 |
| HF | Harbor porpoise (sensitive) | 0 | 4.53 | 1150.50 | 3332.79 | 0 | 4.40 | 1318.97 | 3402.54 |
| PW | Gray seal | 0.25 | 0 | 299.85 | 20.45 | 0.25 | 0 | 327.04 | 20.46 |
| PW | Harbor seal | 0.19 | <0.01 | 525.38 | 44.40 | 0.16 | <0.01 | 575.24 | 44.66 |
| PW | Harp seal | 0.28 | 0 | 428.08 | 35.75 | 0.26 | 0 | 468.30 | 35.91 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA. $L_{pk}$—peak sound pressure level (dB re 1 µPa), $L_E$—sound exposure level (dB re 1 µPa$^2$·s), $L_p$—root mean square sound pressure level (dB re 1 µPa$^2$).

#### 4.3.1.1. Effect of Aversion

The mean exposure estimates reported in Table 68 do not consider animals avoiding loud sounds (aversion) or implementation of mitigation measures other than sound attenuation using NAS. Some marine mammals are well known for their aversive responses to anthropogenic sound (e.g., harbor porpoise), although it is assumed that most species will avert from noise. The Wood et al. (2012) step function includes a probability of response that is based primarily on observed aversive behavior in field studies. Additional exposure estimates with aversion based on the Wood et al. (2012) response probabilities were calculated for NARW and harbor porpoise in this study. For comparative purposes only, the results are shown with and without aversion for one sample year of one construction schedule (Table 71). Aversion was not applied to exposure estimates and only presented here for comparison.

Table 71. Construction schedule B, year 1 (jacket): Mean number of marine mammals predicted to receive sound levels above exposure criteria with 10 dB attenuation and with and without aversion for aversive species. Construction schedule assumptions are summarized in Section 1.2.1.1.

| Species | PTS ($L_{E,w,24h}$) No aversion | PTS ($L_{pk}$) No aversion | Behavior ($L_p$ [a]) No aversion | Behavior ($L_{p,w}$ [b]) No aversion | PTS ($L_{E,w,24h}$) With aversion | PTS ($L_{pk}$) With aversion | Behavior ($L_p$ [a]) With aversion | Behavior ($L_{p,w}$ [b]) With aversion |
|---|---|---|---|---|---|---|---|---|
| North Atlantic right whale [c] | 4.99 | <0.01 | 64.09 | 12.00 | 0.21 | 0 | 46.71 | 6.44 |
| Harbor porpoise | 0 | 4.63 | 1174.82 | 3385.74 | 0 | 0 | 351.87 | 2659.40 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA. $L_{pk}$—peak sound pressure level (dB re 1 µPa), $L_E$—sound exposure level (dB re 1 µPa2·s), $L_p$—root mean square sound pressure level (dB re 1 µPa$^2$).

### 4.3.2. Sea Turtles

As was done for marine mammals (see Section 4.3.1), the numbers of individual sea turtles predicted to receive sound levels above threshold criteria were determined using animal movement modeling. The construction schedules described in Section 1.2.1.1 were used to calculate the total number of real-world individual turtles predicted to receive sound levels above injury and behavior thresholds (Finneran et al. 2017) in the Lease Area. Tables 72–73 include results assuming broadband attenuation of 10 dB, calculated in the same way as the marine mammal exposures.

Table 72. Construction schedule A (14 m monopile): Mean number of sea turtles predicted to receive sound levels above exposure criteria with 10 dB attenuation. Construction schedule assumptions are summarized in Section 1.2.1.1

| Species | Year 1 Injury $L_{E,w,24h}$ (dB re 1 µPa$^2$·s) | Year 1 Injury $L_{pk}$ (dB re 1 µPa) | Year 1 Behavior $L_p$ (dB re 1 µPa$^2$) | Year 2 Injury $L_{E,w,24h}$ (dB re 1 µPa$^2$·s) | Year 2 Injury $L_{pk}$ (dB re 1 µPa) | Year 2 Behavior $L_p$ (dB re 1 µPa$^2$) |
|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | <0.01 | 0 | 0.04 | <0.01 | 0 | 0.04 |
| Leatherback turtle [a] | 0.44 | 0 | 1.45 | 0.43 | 0 | 1.43 |
| Loggerhead turtle | <0.01 | 0 | 0.35 | <0.01 | 0 | 0.35 |
| Green turtle | 0.26 | 0 | 1.48 | 0.26 | 0 | 1.46 |

[a] Listed as Endangered under the ESA.

Table 73. Construction Schedule B, years 1 and 2 (jacket): Mean number of sea turtles predicted to receive sound levels above exposure criteria with 10 dB attenuation. Construction schedule assumptions are summarized in Section 1.2.1.1.

| Species | Year 1 Injury $L_{E,w,24h}$ (dB re 1 µPa²·s) | Year 1 Injury $L_{pk}$ (dB re 1 µPa) | Year 1 Behavior $L_p$ (dB re 1 µPa²) | Year 2 Injury $L_{E,w,24h}$ (dB re 1 µPa²·s) | Year 2 Injury $L_{pk}$ (dB re 1 µPa) | Year 2 Behavior $L_p$ (dB re 1 µPa²) |
|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | <0.01 | 0 | 0.03 | <0.01 | 0 | 0.03 |
| Leatherback turtle [a] | 0.52 | 0 | 0.43 | 0.45 | 0 | 0.44 |
| Loggerhead turtle | <0.01 | 0 | 0.31 | <0.01 | 0 | 0.29 |
| Green turtle | 0.38 | 0 | 1.09 | 0.31 | 0 | 1.00 |

[a] Listed as Endangered under the ESA.

Table 74. Construction Schedule B, years 3 and 4 (jacket): Mean number of sea turtles predicted to receive sound levels above exposure criteria with 10 dB attenuation. Construction schedule assumptions are summarized in Section 1.2.1.1.

| Species | Year 3 Injury $L_{E,w,24h}$ (dB re 1 µPa²·s) | Year 3 Injury $L_{pk}$ (dB re 1 µPa) | Year 3 Behavior $L_p$ (dB re 1 µPa²) | Year 4 Injury $L_{E,w,24h}$ (dB re 1 µPa²·s) | Year 4 Injury $L_{pk}$ (dB re 1 µPa) | Year 4 Behavior $L_p$ (dB re 1 µPa²) |
|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | <0.01 | 0 | 0.03 | <0.01 | 0 | 0.03 |
| Leatherback turtle [a] | 0.52 | 0 | 0.42 | 0.46 | 0 | 0.45 |
| Loggerhead turtle | <0.01 | 0 | 0.30 | <0.01 | 0 | 0.30 |
| Green turtle | 0.38 | 0 | 1.06 | 0.31 | 0 | 1.02 |

[a] Listed as Endangered under the ESA.

## 4.4. Exposure Range Estimates

Exposure ranges, or $ER_{95\%}$, are the horizontal distances that include 95% of the CPAs of animats exceeding a given impact threshold. These were calculated for marine mammals and sea turtles, and these results are summarized in Figure 36. Section 4.4 includes tabular results for each of the foundation types and installation schedules, assuming 10 dB attenuation and a summer sound speed profile. For full results, including all modeled attenuation levels and both summer and winter sound speed profiles, see Appendix H.

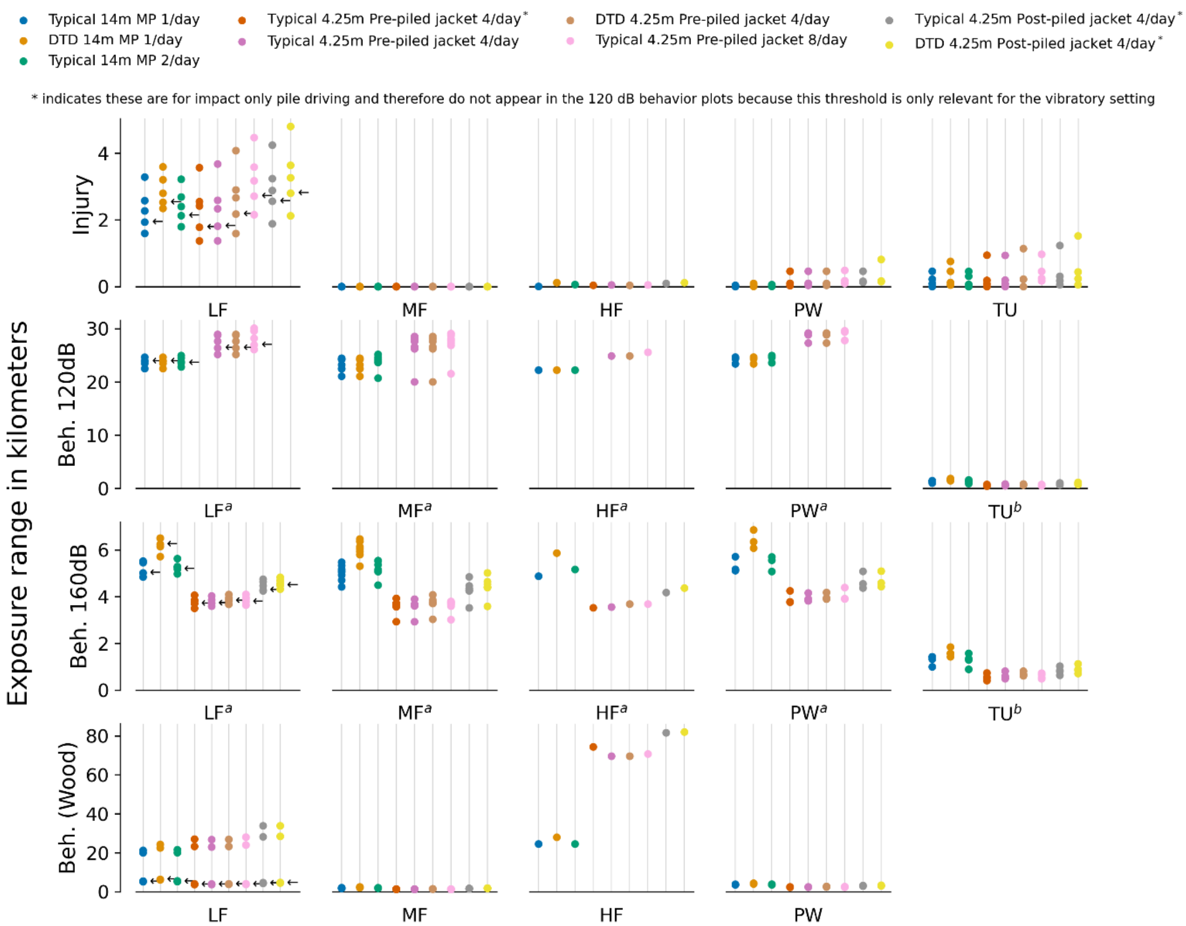



Figure 36. Maximum exposure ranges ($ER_{95\%}$) for injury and behavior thresholds, shown for each hearing group, assuming an attenuation of 10 dB and summer sound speed profile. Each dot represents a species within the indicated hearing group (LF = low frequency cetacean, MF = mid-frequency cetacean, HF = high frequency cetacean, PW = phocid pinniped in water, and TU = turtle), and dot color represents a combination of foundation type (Monopile [MP] or pre-/post-piled jacket), size, drivability (Typical or Difficult to Drive [DTD]), and installation schedule (number of piles installed per day). Shown are all the different foundation type/drivability/installation schedule combinations used in the construction schedules. WTG jacket foundations were modeled as pre-piled and ESP jacket foundations as post-piled. Note the difference in y-axis scaling between the injury and behavior plots. Arrows indicate NARWs. Superscript a indicates that the NOAA (2005) behavioral thresholds for marine mammals were used, and superscript b indicates that the Finneran et al. (2017) behavioral threshold for turtles was used.

### 4.4.1. Marine Mammals

The exposure ranges, $ER_{95\%}$, to injury and behavior thresholds are summarized in Tables 75–83, assuming 10 dB broadband attenuation and a summer acoustic propagation environment for all modeled foundation types. Exposure ranges are reported for both 1 and 2 piles per day for monopile foundations, and for 4 and 8 pin piles per day for jacket foundations. Results for different seasons and at different attenuation levels can be found in Appendix H.

#### 4.4.1.1. Exposure ranges - Impact Only

Table 75. Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, four per day, summer): Impact only exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with 10 dB attenuation.

| Functional Group | Species | PTS ($L_{E,w,24h}$) | PTS ($L_{pk}$) | Behavior ($L_p$ [a]) | Behavior ($L_{p,w}$ [b]) |
|---|---|---|---|---|---|
| LF | Fin whale [c] | 3.56 | <0.01 | 4.06 | 4.07 |
| LF | Minke whale (migrating) | 1.37 | <0.01 | 3.50 | 23.25 |
| LF | Humpback whale | 2.55 | 0 | 3.85 | 3.87 |
| LF | North Atlantic right whale [c] | 1.78 | <0.01 | 3.70 | 3.68 |
| LF | Sei whale [c] (migrating) | 2.42 | <0.01 | 3.82 | 27.00 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 3.60 | 1.34 |
| MF | Atlantic spotted dolphin | 0 | 0 | 3.92 | 1.32 |
| MF | Common dolphin | 0 | 0 | 3.56 | 1.40 |
| MF | Bottlenose dolphin | 0 | 0 | 2.93 | 1.24 |
| MF | Risso's dolphin | 0 | 0 | 3.71 | 1.35 |
| MF | Long-finned pilot whale | 0 | 0 | 3.58 | 1.33 |
| MF | Short-finned pilot whale | 0 | 0 | 3.59 | 1.38 |
| MF | Sperm whale [c] | 0 | 0 | 3.71 | 1.35 |
| HF | Harbor porpoise (sensitive) | 0 | 0.04 | 3.52 | 74.45 |
| PW | Gray seal | 0.46 | 0 | 4.24 | 2.53 |
| PW | Harbor seal | 0.10 | 0 | 3.77 | 2.28 |
| PW | Harp seal | 0.03 | 0 | 3.76 | 2.41 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA. $L_{pk}$—peak sound pressure level (dB re 1 µPa), $L_E$—sound exposure level (dB re 1 µPa$^2$·s), $L_p$—root mean square sound pressure level (dB re 1 µPa$^2$).

Table 76. Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, four per day, summer): Impact only exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with 10 dB attenuation.

| Functional Group | Species | PTS ($L_{E,w,24h}$) | PTS ($L_{pk}$) | Behavior ($L_p$ [a]) | Behavior ($L_{p,w}$ [b]) |
|---|---|---|---|---|---|
| LF | Fin whale [c] | 4.24 | <0.01 | 4.63 | 4.68 |
| LF | Minke whale (migrating) | 1.88 | <0.01 | 4.24 | 28.18 |
| LF | Humpback whale | 3.23 | 0 | 4.46 | 4.47 |
| LF | North Atlantic right whale [c] | 2.56 | <0.01 | 4.28 | 4.29 |
| LF | Sei whale [c] (migrating) | 2.88 | <0.01 | 4.74 | 33.84 |
| MF | Atlantic white sided dolphin | 0 | 0 | 4.24 | 1.66 |
| MF | Atlantic spotted dolphin | 0 | 0 | 4.84 | 1.66 |
| MF | Common dolphin | 0 | 0 | 4.25 | 1.71 |
| MF | Bottlenose dolphin | 0 | 0 | 3.51 | 1.56 |
| MF | Risso's dolphin | 0 | 0 | 4.46 | 1.66 |
| MF | Long-finned pilot whale | 0 | 0 | 4.25 | 1.69 |
| MF | Short-finned pilot whale | 0 | 0 | 4.32 | 1.62 |
| MF | Sperm whale [c] | 0 | 0 | 4.36 | 1.65 |
| HF | Harbor porpoise (sensitive) | 0 | 0.10 | 4.17 | 81.68 |
| PW | Gray seal | 0.46 | 0 | 5.08 | 3.19 |
| PW | Harbor seal | 0.13 | 0 | 4.36 | 2.96 |
| PW | Harp seal | 0.16 | 0 | 4.54 | 2.92 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA. $L_{pk}$—peak sound pressure level (dB re 1 μPa), $L_E$—sound exposure level (dB re 1 μPa$^2$·s), $L_p$—root mean square sound pressure level (dB re 1 μPa$^2$).

Table 77. Post-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, four per day, summer): Impact only exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with 10 dB attenuation.

| Functional Group | Species | PTS ($L_{E,w,24h}$) | PTS ($L_{pk}$) | Behavior ($L_p$ [a]) | Behavior ($L_{p,w}$ [b]) |
|---|---|---|---|---|---|
| LF | Fin whale [c] | 4.80 | <0.01 | 4.68 | 4.76 |
| LF | Minke whale (migrating) | 2.12 | <0.01 | 4.32 | 28.44 |
| LF | Humpback whale | 3.63 | 0 | 4.55 | 4.57 |
| LF | North Atlantic right whale [c] | 2.80 | <0.01 | 4.48 | 4.48 |
| LF | Sei whale [c] (migrating) | 3.26 | <0.01 | 4.82 | 33.84 |
| MF | Atlantic white sided dolphin | 0 | 0 | 4.39 | 1.82 |
| MF | Atlantic spotted dolphin | 0 | 0 | 5.01 | 1.82 |
| MF | Common dolphin | 0 | 0 | 4.38 | 1.86 |
| MF | Bottlenose dolphin | 0 | 0 | 3.58 | 1.77 |
| MF | Risso's dolphin | 0 | 0 | 4.64 | 1.81 |
| MF | Long-finned pilot whale | 0 | 0 | 4.39 | 1.78 |
| MF | Short-finned pilot whale | 0 | 0 | 4.42 | 1.78 |
| MF | Sperm whale [c] | 0 | 0 | 4.53 | 1.83 |
| HF | Harbor porpoise (sensitive) | 0 | 0.12 | 4.37 | 82.11 |
| PW | Gray seal | 0.81 | 0 | 5.09 | 3.33 |
| PW | Harbor seal | 0.17 | <0.01 | 4.43 | 3.03 |
| PW | Harp seal | 0.15 | 0 | 4.58 | 3.11 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA. $L_{pk}$—peak sound pressure level (dB re 1 μPa), $L_E$—sound exposure level (dB re 1 μPa$^2$·s), $L_p$—root mean square sound pressure level (dB re 1 μPa$^2$).

#### 4.4.1.2. Exposure Ranges - Vibratory Setting Followed by Impact Pile Driving

Table 78. Monopile foundation (14 m diameter, typical, 5500 kJ hammer, one per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with 10 dB attenuation.

| Functional Group | Species | PTS Vibratory + impact piling ($L_{E,w,24h}$) | PTS Vibratory + impact piling ($L_{pk}$) | Behavior Impact piling ($L_p$ [a]) | Behavior Impact piling ($L_{p,w}$ [b]) | Behavior Vibratory piling ($L_p$ [a]) |
|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 3.28 | <0.01 | 5.50 | 5.42 | 24.63 |
| LF | Minke whale (migrating) | 1.59 | <0.01 | 4.84 | 19.98 | 22.48 |
| LF | Humpback whale | 2.57 | <0.01 | 5.45 | 5.46 | 23.47 |
| LF | North Atlantic right whale [c] | 1.93 | 0 | 5.01 | 5.14 | 23.86 |
| LF | Sei whale [c] (migrating) | 2.27 | <0.01 | 5.52 | 21.23 | 23.94 |
| MF | Atlantic white sided dolphin | 0 | 0 | 4.70 | 1.84 | 22.49 |
| MF | Atlantic spotted dolphin | 0 | 0 | 5.47 | 2.10 | 24.23 |
| MF | Common dolphin | 0 | 0 | 4.92 | 1.79 | 23.20 |
| MF | Bottlenose dolphin | 0 | 0 | 4.41 | 1.79 | 21.05 |
| MF | Risso's dolphin | 0 | 0 | 5.33 | 1.97 | 24.43 |
| MF | Long-finned pilot whale | 0 | 0 | 5.05 | 1.77 | 22.44 |
| MF | Short-finned pilot whale | 0 | 0 | 5.16 | 1.78 | 24.31 |
| MF | Sperm whale [c] | 0 | 0 | 5.10 | 1.82 | 24.19 |
| HF | Harbor porpoise (sensitive) | 0 | 0.01 | 4.88 | 24.56 | 22.27 |
| PW | Gray seal | 0.04 | 0 | 5.70 | 3.86 | 24.34 |
| PW | Harbor seal | 0 | 0 | 5.11 | 3.59 | 23.38 |
| PW | Harp seal | <0.01 | <0.01 | 5.16 | 3.56 | 24.65 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA. $L_{pk}$—peak sound pressure level (dB re 1 µPa), $L_E$—sound exposure level (dB re 1 µPa²·s), $L_p$—root mean square sound pressure level (dB re 1 µPa²).

Table 79. Monopile foundation (14 m diameter, typical, 5500 kJ hammer, two per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with 10 dB attenuation.

| Functional Group | Species | PTS Vibratory + impact piling ($L_{E,w,24h}$) | PTS Vibratory + impact piling ($L_{pk}$) | Behavior Impact piling ($L_p$ [a]) | Behavior Impact piling ($L_{p,w}$ [b]) | Behavior Vibratory piling ($L_p$ [a]) |
|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 3.22 | 0 | 5.62 | 5.60 | 24.93 |
| LF | Minke whale (migrating) | 1.79 | <0.01 | 4.97 | 20.04 | 22.80 |
| LF | Humpback whale | 2.68 | 0 | 5.26 | 5.29 | 23.77 |
| LF | North Atlantic right whale [c] | 2.12 | 0 | 5.18 | 5.24 | 23.56 |
| LF | Sei whale [c] (migrating) | 2.40 | <0.01 | 5.28 | 21.55 | 24.49 |
| MF | Atlantic white sided dolphin | 0 | 0 | 5.07 | 1.95 | 23.70 |
| MF | Atlantic spotted dolphin | 0 | 0 | 5.53 | 2.06 | 25.16 |
| MF | Common dolphin | 0 | 0 | 5.10 | 1.90 | 23.77 |
| MF | Bottlenose dolphin | 0 | 0 | 4.49 | 1.83 | 20.70 |
| MF | Risso's dolphin | 0 | 0 | 5.36 | 1.93 | 24.58 |
| MF | Long-finned pilot whale | 0 | 0 | 5.15 | 1.80 | 23.64 |
| MF | Short-finned pilot whale | 0 | 0 | 5.07 | 1.92 | 24.04 |
| MF | Sperm whale [c] | 0 | 0 | 5.54 | 2.01 | 24.24 |
| HF | Harbor porpoise (sensitive) | 0 | 0.07 | 5.16 | 24.58 | 22.22 |
| PW | Gray seal | 0.06 | 0 | 5.69 | 3.90 | 24.59 |
| PW | Harbor seal | 0.02 | <0.01 | 5.07 | 3.67 | 23.57 |
| PW | Harp seal | <0.01 | 0 | 5.55 | 3.55 | 24.93 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA. $L_{pk}$—peak sound pressure level (dB re 1 µPa), $L_E$—sound exposure level (dB re 1 µPa$^2$·s), $L_p$—root mean square sound pressure level (dB re 1 µPa$^2$).

Table 80. Monopile foundation (14 m diameter, difficult to drive, 6600 kJ hammer, one per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with 10 dB attenuation.

| Functional Group | Species | PTS Vibratory + impact piling ($L_{E,w,24h}$) | PTS Vibratory + impact piling ($L_{pk}$) | Behavior Impact piling ($L_p$ [a]) | Behavior Impact piling ($L_{p,w}$ [b]) | Behavior Vibratory piling ($L_p$ [a]) |
|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 3.59 | <0.01 | 6.49 | 6.33 | 24.63 |
| LF | Minke whale (migrating) | 2.34 | <0.01 | 5.71 | 22.48 | 22.48 |
| LF | Humpback whale | 3.20 | <0.01 | 6.14 | 6.12 | 23.47 |
| LF | North Atlantic right whale [c] | 2.53 | 0 | 6.24 | 6.26 | 23.86 |
| LF | Sei whale [c] (migrating) | 2.80 | <0.01 | 6.50 | 24.27 | 23.94 |
| MF | Atlantic white sided dolphin | 0 | 0 | 5.93 | 2.22 | 22.49 |
| MF | Atlantic spotted dolphin | 0 | 0 | 6.37 | 2.50 | 24.23 |
| MF | Common dolphin | 0 | 0 | 5.79 | 2.22 | 23.20 |
| MF | Bottlenose dolphin | 0 | 0 | 5.30 | 2.10 | 21.05 |
| MF | Risso's dolphin | 0 | 0 | 6.36 | 2.32 | 24.43 |
| MF | Long-finned pilot whale | 0 | 0 | 6.04 | 2.31 | 22.44 |
| MF | Short-finned pilot whale | 0 | 0 | 6.13 | 2.25 | 24.31 |
| MF | Sperm whale [c] | 0 | 0 | 6.46 | 2.44 | 24.19 |
| HF | Harbor porpoise (sensitive) | 0 | 0.13 | 5.87 | 27.99 | 22.27 |
| PW | Gray seal | 0.04 | 0 | 6.85 | 4.37 | 24.34 |
| PW | Harbor seal | 0.09 | 0 | 6.07 | 3.99 | 23.38 |
| PW | Harp seal | <0.01 | <0.01 | 6.34 | 4.28 | 24.65 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA. $L_{pk}$—peak sound pressure level (dB re 1 µPa), $L_E$—sound exposure level (dB re 1 µPa²·s), $L_p$—root mean square sound pressure level (dB re 1 µPa²).

Table 81. Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, four per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with 10 dB attenuation.

| Functional Group | Species | PTS Vibratory + impact piling ($L_{E,w,24h}$) | PTS Vibratory + impact piling ($L_{pk}$) | Behavior Impact piling ($L_p$ [a]) | Behavior Impact piling ($L_{p,w}$ [b]) | Behavior Vibratory piling ($L_p$ [a]) |
|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 3.67 | <0.01 | 4.03 | 4.01 | 28.91 |
| LF | Minke whale (migrating) | 1.37 | <0.01 | 3.59 | 22.95 | 25.14 |
| LF | Humpback whale | 2.59 | 0 | 3.85 | 3.86 | 27.63 |
| LF | North Atlantic right whale [c] | 1.81 | <0.01 | 3.71 | 3.71 | 26.36 |
| LF | Sei whale [c] (migrating) | 2.33 | <0.01 | 3.72 | 26.76 | 28.77 |
| MF | Atlantic white sided dolphin | 0 | 0 | 3.60 | 1.31 | 26.19 |
| MF | Atlantic spotted dolphin | 0 | 0 | 3.89 | 1.31 | 28.53 |
| MF | Common dolphin | 0 | 0 | 3.64 | 1.39 | 26.43 |
| MF | Bottlenose dolphin | 0 | 0 | 2.92 | 1.24 | 19.99 |
| MF | Risso's dolphin | 0 | 0 | 3.68 | 1.27 | 28.22 |
| MF | Long-finned pilot whale | 0 | 0 | 3.61 | 1.30 | 26.58 |
| MF | Short-finned pilot whale | 0 | 0 | 3.65 | 1.38 | 27.59 |
| MF | Sperm whale [c] | 0 | 0 | 3.63 | 1.32 | 28.07 |
| HF | Harbor porpoise (sensitive) | 0 | 0.05 | 3.56 | 69.58 | 24.92 |
| PW | Gray seal | 0.46 | 0 | 4.15 | 2.52 | 29.17 |
| PW | Harbor seal | 0.10 | 0 | 3.81 | 2.41 | 27.29 |
| PW | Harp seal | 0.04 | 0 | 3.90 | 2.39 | 28.83 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA. $L_{pk}$—peak sound pressure level (dB re 1 µPa), $L_E$—sound exposure level (dB re 1 µPa$^2$·s), $L_p$—root mean square sound pressure level (dB re 1 µPa$^2$).

Table 82. Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, eight per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with 10 dB attenuation.

| Functional Group | Species | PTS Vibratory + impact piling ($L_{E,w,24h}$) | PTS Vibratory + impact piling ($L_{pk}$) | Behavior Impact piling ($L_p$ [a]) | Behavior Impact piling ($L_{p,w}$ [b]) | Behavior Vibratory piling ($L_p$ [a]) |
|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 4.46 | <0.01 | 4.09 | 4.09 | 30.07 |
| LF | Minke whale (migrating) | 2.15 | <0.01 | 3.63 | 23.98 | 26.07 |
| LF | Humpback whale | 3.58 | 0 | 3.90 | 3.90 | 28.18 |
| LF | North Atlantic right whale [c] | 2.71 | 0 | 3.78 | 3.78 | 26.93 |
| LF | Sei whale [c] (migrating) | 3.17 | <0.01 | 3.95 | 28.01 | 29.56 |
| MF | Atlantic white sided dolphin | 0 | 0 | 3.59 | 1.34 | 27.29 |
| MF | Atlantic spotted dolphin | 0 | 0 | 3.79 | 1.32 | 28.71 |
| MF | Common dolphin | 0 | 0 | 3.74 | 1.39 | 26.85 |
| MF | Bottlenose dolphin | 0 | 0 | 3.01 | 1.27 | 21.52 |
| MF | Risso's dolphin | 0 | 0 | 3.77 | 1.26 | 29.05 |
| MF | Long-finned pilot whale | 0 | 0 | 3.68 | 1.33 | 27.72 |
| MF | Short-finned pilot whale | 0 | 0 | 3.67 | 1.33 | 28.03 |
| MF | Sperm whale [c] | 0 | 0 | 3.75 | 1.26 | 29.06 |
| HF | Harbor porpoise (sensitive) | 0 | 0.05 | 3.68 | 70.85 | 25.59 |
| PW | Gray seal | 0.48 | 0 | 4.38 | 2.64 | 29.58 |
| PW | Harbor seal | 0.18 | <0.01 | 3.90 | 2.35 | 27.77 |
| PW | Harp seal | 0.09 | 0 | 3.91 | 2.41 | 29.36 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA. $L_{pk}$—peak sound pressure level (dB re 1 µPa), $L_E$—sound exposure level (dB re 1 µPa$^2$·s), $L_p$—root mean square sound pressure level (dB re 1 µPa$^2$).

Table 83. Pre-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, four per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with 10 dB attenuation.

| Functional Group | Species | PTS Vibratory + impact piling ($L_{E,w,24h}$) | PTS Vibratory + impact piling ($L_{pk}$) | Behavior Impact piling ($L_p$ [a]) | Behavior Impact piling ($L_{p,w}$ [b]) | Behavior Vibratory piling ($L_p$ [a]) |
|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 4.07 | <0.01 | 4.09 | 4.08 | 28.91 |
| LF | Minke whale (migrating) | 1.59 | <0.01 | 3.67 | 23.25 | 25.14 |
| LF | Humpback whale | 2.90 | 0 | 3.88 | 3.90 | 27.63 |
| LF | North Atlantic right whale [c] | 2.17 | <0.01 | 3.82 | 3.81 | 26.36 |
| LF | Sei whale [c] (migrating) | 2.66 | <0.01 | 3.94 | 26.84 | 28.77 |
| MF | Atlantic white sided dolphin | 0 | 0 | 3.71 | 1.48 | 26.19 |
| MF | Atlantic spotted dolphin | 0 | 0 | 4.08 | 1.52 | 28.53 |
| MF | Common dolphin | 0 | 0 | 3.74 | 1.50 | 26.43 |
| MF | Bottlenose dolphin | 0 | 0 | 3.03 | 1.37 | 19.99 |
| MF | Risso's dolphin | 0 | 0 | 3.84 | 1.46 | 28.22 |
| MF | Long-finned pilot whale | 0 | 0 | 3.70 | 1.45 | 26.58 |
| MF | Short-finned pilot whale | 0 | 0 | 3.79 | 1.47 | 27.59 |
| MF | Sperm whale [c] | 0 | 0 | 3.75 | 1.46 | 28.07 |
| HF | Harbor porpoise (sensitive) | 0 | 0.05 | 3.69 | 69.66 | 24.92 |
| PW | Gray seal | 0.46 | 0 | 4.17 | 2.76 | 29.17 |
| PW | Harbor seal | 0.09 | 0 | 3.89 | 2.50 | 27.29 |
| PW | Harp seal | 0.04 | 0 | 3.94 | 2.55 | 28.83 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA. $L_{pk}$—peak sound pressure level (dB re 1 µPa), $L_E$—sound exposure level (dB re 1 µPa$^2$·s), $L_p$—root mean square sound pressure level (dB re 1 µPa$^2$).

### 4.4.2. Sea Turtles

Similar to the results presented for marine mammals (Section 4.4.1), the exposure ranges ($ER_{95\%}$) for sea turtles are summarized in Tables 84–146, assuming 10 dB broadband attenuation and a summer acoustic propagation environment. Results for different seasons and at different attenuation levels can be found in Appendix H.

#### 4.4.2.1. Exposure ranges - Impact Only

Table 84. Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, four per day, summer): Impact only exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with 10 dB attenuation.

| Species | Injury ($L_{E,\,w,\,24h}$) | Injury ($L_{pk}$) | Behavior ($L_p$) |
|---|---|---|---|
| Kemp's ridley turtle [a] | 0.08 | 0 | 0.55 |
| Leatherback turtle [a] | 0.94 | 0 | 0.73 |
| Loggerhead turtle | 0 | 0 | 0.40 |
| Green turtle | 0.19 | 0 | 0.52 |

[a] Listed as Endangered under the ESA.

Table 85. Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, four per day, summer): Impact only exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with 10 dB attenuation.

| Species | Injury ($L_{E,\,w,\,24h}$) | Injury ($L_{pk}$) | Behavior ($L_p$) |
|---|---|---|---|
| Kemp's ridley turtle [a] | 0.18 | 0 | 0.80 |
| Leatherback turtle [a] | 1.23 | 0 | 1.02 |
| Loggerhead turtle | 0.06 | 0 | 0.63 |
| Green turtle | 0.31 | 0 | 0.83 |

[a] Listed as Endangered under the ESA.

Table 86. Post-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, four per day, summer): Impact only exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with 10 dB attenuation.

| Species | Injury ($L_{E,\,w,\,24h}$) | Injury ($L_{pk}$) | Behavior ($L_p$) |
|---|---|---|---|
| Kemp's ridley turtle [a] | 0.24 | 0 | 0.84 |
| Leatherback turtle [a] | 1.52 | 0 | 1.12 |
| Loggerhead turtle | 0.06 | 0 | 0.70 |
| Green turtle | 0.44 | 0 | 0.89 |

[a] Listed as Endangered under the ESA.

#### 4.4.2.2. Exposure ranges - Vibratory Setting Followed by Impact Pile Driving

Table 87. Monopile foundation (14 m diameter, typical, 5500 kJ hammer, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with 10 dB attenuation.

| Species | 1 pile/day Injury ($L_{E,W,24h}$) | 1 pile/day Injury ($L_{pk}$) | 1 pile/day Behavior ($L_p$) | 2 piles/day Injury ($L_{E,W,24h}$) | 2 piles/day Injury ($L_{pk}$) | 2 piles/day Behavior ($L_p$) |
|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 0.09 | 0 | 1.32 | 0.07 | 0 | 1.34 |
| Leatherback turtle [a] | 0.46 | 0 | 1.42 | 0.45 | 0 | 1.57 |
| Loggerhead turtle | 0 | 0 | 0.99 | 0 | 0 | 0.89 |
| Green turtle | 0.22 | 0 | 1.42 | 0.31 | 0 | 1.29 |

[a] Listed as Endangered under the ESA.

Table 88. Monopile foundation (14 m diameter, difficult to drive, 6600 kJ hammer, one per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with 10 dB attenuation.

| Species | Injury ($L_{E,W,24h}$) | Injury ($L_{pk}$) | Behavior ($L_p$) |
|---|---|---|---|
| Kemp's ridley turtle [a] | 0.12 | 0 | 1.57 |
| Leatherback turtle [a] | 0.75 | 0 | 1.84 |
| Loggerhead turtle | 0.05 | 0 | 1.42 |
| Green turtle | 0.46 | 0 | 1.57 |

[a] Listed as Endangered under the ESA.

Table 89. Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with 10 dB attenuation.

| Species | Four piles/day Injury ($L_{E,W,24h}$) | Four piles/day Injury ($L_{pk}$) | Four piles/day Behavior ($L_p$) | Eight piles/day Injury ($L_{E,W,24h}$) | Eight piles/day Injury ($L_{pk}$) | Eight piles/day Behavior ($L_p$) |
|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 0.08 | 0 | 0.51 | 0.25 | 0 | 0.53 |
| Leatherback turtle [a] | 0.93 | 0 | 0.81 | 0.97 | 0 | 0.72 |
| Loggerhead turtle | 0 | 0 | 0.48 | 0.17 | 0 | 0.48 |
| Green turtle | 0.19 | 0 | 0.59 | 0.45 | 0 | 0.66 |

[a] Listed as Endangered under the ESA.

Table 90. Pre-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, four per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with 10 dB attenuation.

| Species | Injury ($L_{E,W,24h}$) | Injury ($L_{pk}$) | Behavior ($L_p$) |
|---|---|---|---|
| Kemp's ridley turtle [a] | 0.22 | 0 | 0.62 |
| Leatherback turtle [a] | 1.14 | 0 | 0.81 |
| Loggerhead turtle | 0 | 0 | 0.61 |
| Green turtle | 0.22 | 0 | 0.68 |

[a] Listed as Endangered under the ESA.

## 4.5. Fish Acoustic Range Estimates

Although some fish may move during pile driving, they were considered static receivers and acoustic distances where sound levels could exceed fish regulatory thresholds were determined using a maximum-over-depth approach and finding the distance that encompasses at least 95% of the azimuthal area that would be exposed to sound at or above the specified level (see Appendix F and G). The calculated acoustic distances for fish to the GARFO (2020) and Popper et al. (2014) thresholds (Andersson et al. 2007, Wysocki et al. 2007, FHWG 2008, Stadler and Woodbury 2009, Mueller-Blenkle et al. 2010, Purser and Radford 2011, Popper et al. 2014) with 10 dB of broadband attenuation are shown in Tables 91-161 for vibratory pile setting with impact piling (tables with 0, 12, and 15 dB attenuation can be found in Appendix G). Results for impact piling only can be found in Appendix F.

### 4.5.1. Monopile Foundations

Table 91. Typical monopile foundation (14 m diameter, TRC V640 and MHU5500) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 2500 kJ | Summer 3500 kJ | Summer 4400 kJ | Winter Vibr. | Winter 2500 kJ | Winter 3500 kJ | Winter 4400 kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | 0.05 | 0.06 | 0.06 | NA | 0.05 | 0.06 | 0.06 |
| Fish ≥ 2g | $L_p$ | 150 | 2.58 | 6.85 | 7.44 | 8.54 | 2.74 | 7.85 | 8.50 | 9.94 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | 0.05 | 0.06 | 0.06 | NA | 0.05 | 0.06 | 0.06 |
| Fish < 2 g | $L_p$ | 150 | 2.58 | 6.85 | 7.44 | 8.54 | 2.74 | 7.85 | 8.50 | 9.94 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | NA | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | 0.03 | 0.05 | 0.06 | NA | 0.03 | 0.05 | 0.06 |

Table 92. Typical monopile foundation (14 m diameter, TRC V640 and MHU5500) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 5.31 | 5.87 |
| Fish < 2 g | 183 | 6.81 | 7.80 |
| Fish without swim bladder | 216 | 0.22 | 0.23 |
| Fish with swim bladder | 203 | 1.40 | 1.47 |

Table 93. Typical monopile foundation (14 m diameter, TRC V640 and MHU5500) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 2500 kJ | Summer 3500 kJ | Summer 4400 kJ | Winter Vibr. | Winter 2500 kJ | Winter 3500 kJ | Winter 4400 kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | 0.07 | 0.09 | 0.10 | NA | 0.06 | 0.09 | 0.10 |
| Fish ≥ 2g | $L_p$ | 150 | 4.13 | 9.50 | 10.81 | 12.01 | 4.28 | 11.01 | 12.38 | 13.69 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | 0.07 | 0.09 | 0.10 | NA | 0.06 | 0.09 | 0.10 |
| Fish < 2 g | $L_p$ | 150 | 4.13 | 9.50 | 10.81 | 12.01 | 4.28 | 11.01 | 12.38 | 13.69 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | NA | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | 0.02 | 0.08 | 0.09 | NA | 0.02 | 0.08 | 0.09 |

Table 94. Typical monopile foundation (14 m diameter, TRC V640 and MHU5500) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 7.77 | 8.44 |
| Fish < 2 g | 183 | 10.00 | 11.37 |
| Fish without swim bladder | 216 | 0.3 | 0.29 |
| Fish with swim bladder | 203 | 1.93 | 2.04 |

Table 95. Difficult-to-drive monopile foundation (14 m diameter, TRC V640 and MHU6600) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 4500 kJ | Summer 6600 (a) kJ | Summer 6600 (b) kJ | Winter Vibr. | Winter 4500 kJ | Winter 6600 (a) kJ | Winter 6600 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | 0.07 | 0.08 | 0.08 | NA | 0.07 | 0.09 | 0.08 |
| Fish ≥ 2g | $L_p$ | 150 | 2.58 | 8.42 | 8.94 | 9.59 | 2.74 | 9.71 | 10.59 | 11.61 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | 0.07 | 0.08 | 0.08 | NA | 0.07 | 0.09 | 0.08 |
| Fish < 2 g | $L_p$ | 150 | 2.58 | 8.42 | 8.94 | 9.59 | 2.74 | 9.71 | 10.59 | 11.61 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | 0.03 | 0.03 | NA | - | 0.03 | 0.03 |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | 0.06 | 0.07 | 0.07 | NA | 0.06 | 0.07 | 0.07 |

Table 96. Difficult-to-drive monopile foundation (14 m diameter, TRC V640 and MHU6600) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 6.43 | 7.30 |
| Fish < 2 g | 183 | 8.23 | 9.49 |
| Fish without swim bladder | 216 | 0.37 | 0.39 |
| Fish with swim bladder | 203 | 1.87 | 1.97 |

Table 97. Difficult-to-drive monopile foundation (14 m diameter, TRC V640 and MHU6600) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 4500 kJ | Summer 6600 (a) kJ | Summer 6600 (b) kJ | Winter Vibr. | Winter 4500 kJ | Winter 6600 (a) kJ | Winter 6600 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | 0.10 | 0.13 | 0.13 | NA | 0.10 | 0.13 | 0.13 |
| Fish ≥ 2g | $L_{p}$ | 150 | 4.13 | 12.06 | 13.31 | 13.51 | 4.28 | 13.97 | 15.47 | 15.74 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | 0.10 | 0.13 | 0.13 | NA | 0.10 | 0.13 | 0.13 |
| Fish < 2 g | $L_{p}$ | 150 | 4.13 | 12.06 | 13.31 | 13.51 | 4.28 | 13.97 | 15.47 | 15.74 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | 0.02 | 0.02 | NA | - | 0.02 | 0.02 |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | 0.09 | 0.11 | 0.11 | NA | 0.09 | 0.11 | 0.11 |

Table 98. Difficult-to-drive monopile foundation (14 m diameter, TRC V640 and MHU6600) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 9.23 | 10.37 |
| Fish < 2 g | 183 | 12.22 | 13.89 |
| Fish without swim bladder | 216 | 0.47 | 0.47 |
| Fish with swim bladder | 203 | 2.67 | 2.77 |

## 4.5.2. Jacket Foundations

Table 99. Typical jacket foundation with 4 pin piles (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | 0.02 | 0.04 | 0.06 | - | NA | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_p$ | 150 | 2.57 | 3.66 | 4.33 | 4.89 | 5.23 | 7.10 | 5.15 | 2.81 | 3.90 | 4.70 | 5.34 | 5.74 | 8.34 | 5.17 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | 0.02 | 0.04 | 0.06 | - | NA | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish < 2 g | $L_p$ | 150 | 2.57 | 3.66 | 4.33 | 4.89 | 5.23 | 7.10 | 5.15 | 2.81 | 3.90 | 4.70 | 5.34 | 5.74 | 8.34 | 5.17 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |

Table 100. Typical jacket foundation with 4 pin piles (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L01 for different energy levels with 10 dB attenuation

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 6.37 | 7.20 |
| Fish < 2 g | 183 | 8.38 | 9.79 |
| Fish without swim bladder | 216 | 0.31 | 0.32 |
| Fish with swim bladder | 203 | 1.68 | 1.73 |

Table 101. Typical jacket foundation with 4 pin piles (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | - | 0.04 | 0.06 | - | NA | - | - | - | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_p$ | 150 | 3.83 | 4.76 | 5.90 | 7.11 | 8.48 | 11.38 | 5.32 | 4.03 | 4.98 | 6.24 | 7.81 | 9.41 | 12.63 | 5.03 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | - | 0.04 | 0.06 | - | NA | - | - | - | 0.04 | 0.06 | - |
| Fish < 2 g | $L_p$ | 150 | 3.83 | 4.76 | 5.90 | 7.11 | 8.48 | 11.38 | 5.32 | 4.03 | 4.98 | 6.24 | 7.81 | 9.41 | 12.63 | 5.03 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | - | 0.02 | 0.06 | - | NA | - | - | - | - | 0.06 | - |

Table 102. Typical jacket foundation with 4 pin piles (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 9.26 | 10.24 |
| Fish < 2 g | 183 | 13.20 | 15.27 |
| Fish without swim bladder | 216 | 0.29 | 0.28 |
| Fish with swim bladder | 203 | 1.92 | 1.96 |

Table 103. Typical jacket foundation with 4 pin piles (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | 0.02 | 0.04 | 0.06 | - | NA | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_p$ | 150 | 2.57 | 3.66 | 4.33 | 4.89 | 5.23 | 7.10 | 5.15 | 2.81 | 3.90 | 4.70 | 5.34 | 5.74 | 8.34 | 5.17 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | 0.02 | 0.04 | 0.06 | - | NA | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish < 2 g | $L_p$ | 150 | 2.57 | 3.66 | 4.33 | 4.89 | 5.23 | 7.10 | 5.15 | 2.81 | 3.90 | 4.70 | 5.34 | 5.74 | 8.34 | 5.17 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |

Table 104. Typical jacket foundation with 4 pin piles (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 7.34 | 8.41 |
| Fish < 2 g | 183 | 9.47 | 11.79 |
| Fish without swim bladder | 216 | 0.41 | 0.42 |
| Fish with swim bladder | 203 | 2.04 | 2.15 |

Table 105. Typical jacket foundation with 4 pin piles (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | - | 0.04 | 0.06 | - | NA | - | - | - | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ | 150 | 3.83 | 4.76 | 5.90 | 7.11 | 8.48 | 11.38 | 5.32 | 4.03 | 4.98 | 6.24 | 7.81 | 9.41 | 12.63 | 5.03 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | - | 0.04 | 0.06 | - | NA | - | - | - | 0.04 | 0.06 | - |
| Fish < 2 g | $L_{p}$ | 150 | 3.83 | 4.76 | 5.90 | 7.11 | 8.48 | 11.38 | 5.32 | 4.03 | 4.98 | 6.24 | 7.81 | 9.41 | 12.63 | 5.03 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | - | 0.02 | 0.06 | - | NA | - | - | - | - | 0.06 | - |

Table 106. Typical jacket foundation with 4 pin piles (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 11.20 | 12.61 |
| Fish < 2 g | 183 | 15.45 | 18.34 |
| Fish without swim bladder | 216 | 0.42 | 0.40 |
| Fish with swim bladder | 203 | 2.48 | 2.54 |

Table 107. Typical jacket foundation with 8 pin piles (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | 0.02 | 0.04 | 0.06 | - | NA | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_p$ | 150 | 2.57 | 3.66 | 4.33 | 4.89 | 5.23 | 7.10 | 5.15 | 2.81 | 3.90 | 4.70 | 5.34 | 5.74 | 8.34 | 5.17 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | 0.02 | 0.04 | 0.06 | - | NA | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish < 2 g | $L_p$ | 150 | 2.57 | 3.66 | 4.33 | 4.89 | 5.23 | 7.10 | 5.15 | 2.81 | 3.90 | 4.70 | 5.34 | 5.74 | 8.34 | 5.17 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |

Table 108. Typical jacket foundation with 8 pin piles (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 7.87 | 9.04 |
| Fish < 2 g | 183 | 10.27 | 12.81 |
| Fish without swim bladder | 216 | 0.47 | 0.48 |
| Fish with swim bladder | 203 | 2.30 | 2.40 |

Table 109. Typical jacket foundation with 8 pin piles (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | - | 0.04 | 0.06 | - | NA | - | - | - | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ | 150 | 3.83 | 4.76 | 5.90 | 7.11 | 8.48 | 11.38 | 5.32 | 4.03 | 4.98 | 6.24 | 7.81 | 9.41 | 12.63 | 5.03 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | - | 0.04 | 0.06 | - | NA | - | - | - | 0.04 | 0.06 | - |
| Fish < 2 g | $L_{p}$ | 150 | 3.83 | 4.76 | 5.90 | 7.11 | 8.48 | 11.38 | 5.32 | 4.03 | 4.98 | 6.24 | 7.81 | 9.41 | 12.63 | 5.03 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | - | 0.02 | 0.06 | - | NA | - | - | - | - | 0.06 | - |

Table 110. Typical jacket foundation with 8 pin piles (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 12.19 | 13.89 |
| Fish < 2 g | 183 | 16.69 | 20.80 |
| Fish without swim bladder | 216 | 0.47 | 0.48 |
| Fish with swim bladder | 203 | 2.76 | 2.81 |

Table 111. Typical jacket foundation with 8 pin piles (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | 0.02 | 0.04 | 0.06 | - | NA | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_p$ | 150 | 2.57 | 3.66 | 4.33 | 4.89 | 5.23 | 7.10 | 5.15 | 2.81 | 3.90 | 4.70 | 5.34 | 5.74 | 8.34 | 5.17 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | 0.02 | 0.04 | 0.06 | - | NA | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish < 2 g | $L_p$ | 150 | 2.57 | 3.66 | 4.33 | 4.89 | 5.23 | 7.10 | 5.15 | 2.81 | 3.90 | 4.70 | 5.34 | 5.74 | 8.34 | 5.17 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |

Table 112. Typical jacket foundation with 8 pin piles (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 8.90 | 10.81 |
| Fish < 2 g | 183 | 11.87 | 15.10 |
| Fish without swim bladder | 216 | 0.64 | 0.66 |
| Fish with swim bladder | 203 | 2.73 | 2.85 |

Table 113. Typical jacket foundation with 8 pin piles (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | - | 0.04 | 0.06 | - | NA | - | - | - | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_p$ | 150 | 3.83 | 4.76 | 5.90 | 7.11 | 8.48 | 11.38 | 5.32 | 4.03 | 4.98 | 6.24 | 7.81 | 9.41 | 12.63 | 5.03 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | - | 0.04 | 0.06 | - | NA | - | - | - | 0.04 | 0.06 | - |
| Fish < 2 g | $L_p$ | 150 | 3.83 | 4.76 | 5.90 | 7.11 | 8.48 | 11.38 | 5.32 | 4.03 | 4.98 | 6.24 | 7.81 | 9.41 | 12.63 | 5.03 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | - | 0.02 | 0.06 | - | NA | - | - | - | - | 0.06 | - |

Table 114. Typical jacket foundation with 8 pin piles (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 14.29 | 16.81 |
| Fish < 2 g | 183 | 19.46 | 26.22 |
| Fish without swim bladder | 216 | 0.63 | 0.64 |
| Fish with swim bladder | 203 | 3.45 | 3.57 |

Table 115. Typical jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | 0.06 | 0.06 | 0.06 | 0.07 | 0.05 | NA | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_p$ | 150 | 2.10 | 3.62 | 4.62 | 5.22 | 5.62 | 5.83 | 7.22 | 8.29 | 2.27 | 3.87 | 5.03 | 5.78 | 6.27 | 6.46 | 8.44 | 9.88 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | 0.06 | 0.06 | 0.06 | 0.07 | 0.05 | NA | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_p$ | 150 | 2.10 | 3.62 | 4.62 | 5.22 | 5.62 | 5.83 | 7.22 | 8.29 | 2.27 | 3.87 | 5.03 | 5.78 | 6.27 | 6.46 | 8.44 | 9.88 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | 0.05 | 0.06 | 0.06 | 0.06 | 0.05 | NA | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |

Table 116. Typical jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 7.57 | 8.87 |
| Fish < 2 g | 183 | 9.72 | 12.53 |
| Fish without swim bladder | 216 | 0.40 | 0.41 |
| Fish with swim bladder | 203 | 2.13 | 2.25 |

Table 117. Typical jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | - | 0.02 | 0.07 | 0.06 | 0.05 | NA | - | - | - | 0.03 | 0.07 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_p$ | 150 | 3.13 | 4.77 | 5.79 | 6.79 | 7.94 | 9.42 | 12.13 | 11.66 | 3.28 | 4.99 | 6.06 | 7.29 | 8.80 | 11.30 | 13.73 | 11.50 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | - | 0.02 | 0.07 | 0.06 | 0.05 | NA | - | - | - | 0.03 | 0.07 | 0.06 | 0.05 |
| Fish < 2 g | $L_p$ | 150 | 3.13 | 4.77 | 5.79 | 6.79 | 7.94 | 9.42 | 12.13 | 11.66 | 3.28 | 4.99 | 6.06 | 7.29 | 8.80 | 11.30 | 13.73 | 11.50 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | - | - | 0.05 | 0.06 | 0.05 | NA | - | - | - | 0.02 | 0.05 | 0.06 | 0.05 |

Table 118. Typical jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 11.50 | 12.88 |
| Fish < 2 g | 183 | 15.78 | 18.84 |
| Fish without swim bladder | 216 | 0.39 | 0.40 |
| Fish with swim bladder | 203 | 2.54 | 2.61 |

Table 119. Typical jacket foundation with 4 pin piles (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | 0.06 | 0.06 | 0.06 | 0.07 | 0.05 | NA | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_p$ | 150 | 2.10 | 3.62 | 4.62 | 5.22 | 5.62 | 5.83 | 7.22 | 8.29 | 2.27 | 3.87 | 5.03 | 5.78 | 6.27 | 6.46 | 8.44 | 9.88 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | 0.06 | 0.06 | 0.06 | 0.07 | 0.05 | NA | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_p$ | 150 | 2.10 | 3.62 | 4.62 | 5.22 | 5.62 | 5.83 | 7.22 | 8.29 | 2.27 | 3.87 | 5.03 | 5.78 | 6.27 | 6.46 | 8.44 | 9.88 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | 0.05 | 0.06 | 0.06 | 0.06 | 0.05 | NA | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |

Table 120. Typical jacket foundation with 4 pin piles (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 8.59 | 10.55 |
| Fish < 2 g | 183 | 11.29 | 14.79 |
| Fish without swim bladder | 216 | 0.55 | 0.57 |
| Fish with swim bladder | 203 | 2.60 | 2.73 |

Table 121. Typical jacket foundation with 4 pin piles (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | - | 0.02 | 0.07 | 0.06 | 0.05 | NA | - | - | - | 0.03 | 0.07 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_p$ | 150 | 3.13 | 4.77 | 5.79 | 6.79 | 7.94 | 9.42 | 12.13 | 11.66 | 3.28 | 4.99 | 6.06 | 7.29 | 8.80 | 11.30 | 13.73 | 11.50 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | - | 0.02 | 0.07 | 0.06 | 0.05 | NA | - | - | - | 0.03 | 0.07 | 0.06 | 0.05 |
| Fish < 2 g | $L_p$ | 150 | 3.13 | 4.77 | 5.79 | 6.79 | 7.94 | 9.42 | 12.13 | 11.66 | 3.28 | 4.99 | 6.06 | 7.29 | 8.80 | 11.30 | 13.73 | 11.50 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | - | - | 0.05 | 0.06 | 0.05 | NA | - | - | - | 0.02 | 0.05 | 0.06 | 0.05 |

Table 122. Typical jacket foundation with 4 pin piles (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 13.50 | 15.59 |
| Fish < 2 g | 183 | 18.25 | 24.07 |
| Fish without swim bladder | 216 | 0.54 | 0.56 |
| Fish with swim bladder | 203 | 3.16 | 3.28 |

Table 123. Typical jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | 0.06 | 0.06 | 0.06 | 0.07 | 0.05 | NA | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_p$ | 150 | 2.10 | 3.62 | 4.62 | 5.22 | 5.62 | 5.83 | 7.22 | 8.29 | 2.27 | 3.87 | 5.03 | 5.78 | 6.27 | 6.46 | 8.44 | 9.88 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | 0.06 | 0.06 | 0.06 | 0.07 | 0.05 | NA | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_p$ | 150 | 2.10 | 3.62 | 4.62 | 5.22 | 5.62 | 5.83 | 7.22 | 8.29 | 2.27 | 3.87 | 5.03 | 5.78 | 6.27 | 6.46 | 8.44 | 9.88 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | 0.05 | 0.06 | 0.06 | 0.06 | 0.05 | NA | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |

Table 124. Typical jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 9.11 | 11.55 |
| Fish < 2 g | 183 | 12.05 | 16.11 |
| Fish without swim bladder | 216 | 0.64 | 0.66 |
| Fish with swim bladder | 203 | 2.81 | 3.01 |

Table 125. Typical jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | - | 0.02 | 0.07 | 0.06 | 0.05 | NA | - | - | - | 0.03 | 0.07 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_p$ | 150 | 3.13 | 4.77 | 5.79 | 6.79 | 7.94 | 9.42 | 12.13 | 11.66 | 3.28 | 4.99 | 6.06 | 7.29 | 8.80 | 11.30 | 13.73 | 11.50 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | - | 0.02 | 0.07 | 0.06 | 0.05 | NA | - | - | - | 0.03 | 0.07 | 0.06 | 0.05 |
| Fish < 2 g | $L_p$ | 150 | 3.13 | 4.77 | 5.79 | 6.79 | 7.94 | 9.42 | 12.13 | 11.66 | 3.28 | 4.99 | 6.06 | 7.29 | 8.80 | 11.30 | 13.73 | 11.50 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | - | - | 0.05 | 0.06 | 0.05 | NA | - | - | - | 0.02 | 0.05 | 0.06 | 0.05 |

Table 126. Typical jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 14.61 | 17.17 |
| Fish < 2 g | 183 | 20.09 | 27.04 |
| Fish without swim bladder | 216 | 0.64 | 0.65 |
| Fish with swim bladder | 203 | 3.56 | 3.70 |

Table 127. Typical jacket foundation with 8 pin piles (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | 0.06 | 0.06 | 0.06 | 0.07 | 0.05 | NA | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_{p}$ | 150 | 2.10 | 3.62 | 4.62 | 5.22 | 5.62 | 5.83 | 7.22 | 8.29 | 2.27 | 3.87 | 5.03 | 5.78 | 6.27 | 6.46 | 8.44 | 9.88 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | 0.06 | 0.06 | 0.06 | 0.07 | 0.05 | NA | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_{p}$ | 150 | 2.10 | 3.62 | 4.62 | 5.22 | 5.62 | 5.83 | 7.22 | 8.29 | 2.27 | 3.87 | 5.03 | 5.78 | 6.27 | 6.46 | 8.44 | 9.88 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | 0.05 | 0.06 | 0.06 | 0.06 | 0.05 | NA | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |

Table 128. Typical jacket foundation with 8 pin piles (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 10.54 | 13.62 |
| Fish < 2 g | 183 | 13.64 | 19.03 |
| Fish without swim bladder | 216 | 0.84 | 0.86 |
| Fish with swim bladder | 203 | 3.44 | 3.70 |

Table 129. Typical jacket foundation with 8 pin piles (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | - | 0.02 | 0.07 | 0.06 | 0.05 | NA | - | - | - | 0.03 | 0.07 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_p$ | 150 | 3.13 | 4.77 | 5.79 | 6.79 | 7.94 | 9.42 | 12.13 | 11.66 | 3.28 | 4.99 | 6.06 | 7.29 | 8.80 | 11.30 | 13.73 | 11.50 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | - | 0.02 | 0.07 | 0.06 | 0.05 | NA | - | - | - | 0.03 | 0.07 | 0.06 | 0.05 |
| Fish < 2 g | $L_p$ | 150 | 3.13 | 4.77 | 5.79 | 6.79 | 7.94 | 9.42 | 12.13 | 11.66 | 3.28 | 4.99 | 6.06 | 7.29 | 8.80 | 11.30 | 13.73 | 11.50 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | - | - | 0.05 | 0.06 | 0.05 | NA | - | - | - | 0.02 | 0.05 | 0.06 | 0.05 |

Table 130. Typical jacket foundation with 8 pin piles (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 17.05 | 21.45 |
| Fish < 2 g | 183 | 24.10 | 35.33 |
| Fish without swim bladder | 216 | 0.86 | 0.89 |
| Fish with swim bladder | 203 | 4.35 | 4.53 |

Table 131. Difficult-to-drive jacket foundation with 4 pin piles (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | 0.05 | 0.06 | 0.06 | 0.06 | - | NA | - | 0.02 | 0.06 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_p$ | 150 | 2.57 | 4.40 | 5.03 | 5.38 | 5.91 | 7.25 | 5.14 | 2.81 | 4.76 | 5.54 | 5.94 | 6.58 | 8.52 | 5.15 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | 0.05 | 0.06 | 0.06 | 0.06 | - | NA | - | 0.02 | 0.06 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_p$ | 150 | 2.57 | 4.40 | 5.03 | 5.38 | 5.91 | 7.25 | 5.14 | 2.81 | 4.76 | 5.54 | 5.94 | 6.58 | 8.52 | 5.15 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | 0.05 | 0.06 | 0.06 | - | NA | - | - | 0.02 | 0.06 | 0.06 | - |

Table 132. Difficult-to-drive jacket foundation with 4 pin piles (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 6.67 | 7.63 |
| Fish < 2 g | 183 | 8.71 | 10.46 |
| Fish without swim bladder | 216 | 0.35 | 0.35 |
| Fish with swim bladder | 203 | 1.83 | 1.90 |

Table 133. Difficult-to-drive jacket foundation with 4 pin piles (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | 0.02 | 0.07 | 0.06 | - | NA | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_p$ | 150 | 3.83 | 5.57 | 6.72 | 8.01 | 10.06 | 11.74 | 5.30 | 4.03 | 5.85 | 7.22 | 8.80 | 12.03 | 13.07 | 5.02 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | 0.02 | 0.07 | 0.06 | - | NA | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_p$ | 150 | 3.83 | 5.57 | 6.72 | 8.01 | 10.06 | 11.74 | 5.30 | 4.03 | 5.85 | 7.22 | 8.80 | 12.03 | 13.07 | 5.02 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | - | 0.06 | 0.06 | - | NA | - | - | - | 0.05 | 0.06 | - |

Table 134. Difficult-to-drive jacket foundation with 4 pin piles (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 10.08 | 11.49 |
| Fish < 2 g | 183 | 14.09 | 16.74 |
| Fish without swim bladder | 216 | 0.33 | 0.33 |
| Fish with swim bladder | 203 | 2.23 | 2.29 |

Table 135. Difficult-to-drive jacket foundation with 4 pin piles (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | 0.05 | 0.06 | 0.06 | 0.06 | - | NA | - | 0.02 | 0.06 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_p$ | 150 | 2.57 | 4.40 | 5.03 | 5.38 | 5.91 | 7.25 | 5.14 | 2.81 | 4.76 | 5.54 | 5.94 | 6.58 | 8.52 | 5.15 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | 0.05 | 0.06 | 0.06 | 0.06 | - | NA | - | 0.02 | 0.06 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_p$ | 150 | 2.57 | 4.40 | 5.03 | 5.38 | 5.91 | 7.25 | 5.14 | 2.81 | 4.76 | 5.54 | 5.94 | 6.58 | 8.52 | 5.15 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | 0.05 | 0.06 | 0.06 | - | NA | - | - | 0.02 | 0.06 | 0.06 | - |

Table 136. Difficult-to-drive jacket foundation with 4 pin piles (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 7.68 | 8.84 |
| Fish < 2 g | 183 | 9.92 | 12.41 |
| Fish without swim bladder | 216 | 0.47 | 0.48 |
| Fish with swim bladder | 203 | 2.28 | 2.40 |

Table 137. Difficult-to-drive jacket foundation with 4 pin piles (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | 0.02 | 0.07 | 0.06 | - | NA | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ | 150 | 3.83 | 5.57 | 6.72 | 8.01 | 10.06 | 11.74 | 5.30 | 4.03 | 5.85 | 7.22 | 8.80 | 12.03 | 13.07 | 5.02 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | 0.02 | 0.07 | 0.06 | - | NA | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_{p}$ | 150 | 3.83 | 5.57 | 6.72 | 8.01 | 10.06 | 11.74 | 5.30 | 4.03 | 5.85 | 7.22 | 8.80 | 12.03 | 13.07 | 5.02 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | - | 0.06 | 0.06 | - | NA | - | - | - | 0.05 | 0.06 | - |

Table 138. Difficult-to-drive jacket foundation with 4 pin piles (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 12.06 | 13.87 |
| Fish < 2 g | 183 | 16.40 | 20.60 |
| Fish without swim bladder | 216 | 0.47 | 0.48 |
| Fish with swim bladder | 203 | 2.78 | 2.84 |

Table 139. Difficult-to-drive jacket foundation with 8 pin piles (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | 0.05 | 0.06 | 0.06 | 0.06 | - | NA | - | 0.02 | 0.06 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_p$ | 150 | 2.57 | 4.40 | 5.03 | 5.38 | 5.91 | 7.25 | 5.14 | 2.81 | 4.76 | 5.54 | 5.94 | 6.58 | 8.52 | 5.15 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | 0.05 | 0.06 | 0.06 | 0.06 | - | NA | - | 0.02 | 0.06 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_p$ | 150 | 2.57 | 4.40 | 5.03 | 5.38 | 5.91 | 7.25 | 5.14 | 2.81 | 4.76 | 5.54 | 5.94 | 6.58 | 8.52 | 5.15 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | 0.05 | 0.06 | 0.06 | - | NA | - | - | 0.02 | 0.06 | 0.06 | - |

Table 140. Difficult-to-drive jacket foundation with 8 pin piles (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 8.20 | 9.52 |
| Fish < 2 g | 183 | 10.74 | 13.46 |
| Fish without swim bladder | 216 | 0.55 | 0.57 |
| Fish with swim bladder | 203 | 2.50 | 2.62 |

Table 141. Difficult-to-drive jacket foundation with 8 pin piles (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | 0.02 | 0.07 | 0.06 | - | NA | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ | 150 | 3.83 | 5.57 | 6.72 | 8.01 | 10.06 | 11.74 | 5.30 | 4.03 | 5.85 | 7.22 | 8.80 | 12.03 | 13.07 | 5.02 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | 0.02 | 0.07 | 0.06 | - | NA | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_{p}$ | 150 | 3.83 | 5.57 | 6.72 | 8.01 | 10.06 | 11.74 | 5.30 | 4.03 | 5.85 | 7.22 | 8.80 | 12.03 | 13.07 | 5.02 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | - | 0.06 | 0.06 | - | NA | - | - | - | 0.05 | 0.06 | - |

Table 142. Difficult-to-drive jacket foundation with 8 pin piles (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 13.05 | 15.26 |
| Fish < 2 g | 183 | 17.61 | 23.22 |
| Fish without swim bladder | 216 | 0.54 | 0.54 |
| Fish with swim bladder | 203 | 3.09 | 3.23 |

Table 143. Difficult-to-drive jacket foundation with 8 pin piles (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | 0.05 | 0.06 | 0.06 | 0.06 | - | NA | - | 0.02 | 0.06 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_p$ | 150 | 2.57 | 4.40 | 5.03 | 5.38 | 5.91 | 7.25 | 5.14 | 2.81 | 4.76 | 5.54 | 5.94 | 6.58 | 8.52 | 5.15 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | 0.05 | 0.06 | 0.06 | 0.06 | - | NA | - | 0.02 | 0.06 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_p$ | 150 | 2.57 | 4.40 | 5.03 | 5.38 | 5.91 | 7.25 | 5.14 | 2.81 | 4.76 | 5.54 | 5.94 | 6.58 | 8.52 | 5.15 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | 0.05 | 0.06 | 0.06 | - | NA | - | - | 0.02 | 0.06 | 0.06 | - |

Table 144. Difficult-to-drive jacket foundation with 8 pin piles (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 9.24 | 11.45 |
| Fish < 2 g | 183 | 12.30 | 15.85 |
| Fish without swim bladder | 216 | 0.73 | 0.74 |
| Fish with swim bladder | 203 | 2.93 | 3.15 |

Table 145. Difficult-to-drive jacket foundation with 8 pin piles (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | - | 0.02 | 0.07 | 0.06 | - | NA | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ | 150 | 3.83 | 5.57 | 6.72 | 8.01 | 10.06 | 11.74 | 5.30 | 4.03 | 5.85 | 7.22 | 8.80 | 12.03 | 13.07 | 5.02 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | - | 0.02 | 0.07 | 0.06 | - | NA | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_{p}$ | 150 | 3.83 | 5.57 | 6.72 | 8.01 | 10.06 | 11.74 | 5.30 | 4.03 | 5.85 | 7.22 | 8.80 | 12.03 | 13.07 | 5.02 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | - | 0.06 | 0.06 | - | NA | - | - | - | 0.05 | 0.06 | - |

Table 146. Difficult-to-drive jacket foundation with 8 pin piles (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 15.22 | 18.28 |
| Fish < 2 g | 183 | 20.93 | 29.14 |
| Fish without swim bladder | 216 | 0.74 | 0.75 |
| Fish with swim bladder | 203 | 3.92 | 4.04 |

Table 147. Difficult-to-drive jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 | NA | - | 0.05 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_{p}$ | 150 | 2.10 | 4.68 | 5.30 | 5.76 | 6.41 | 7.22 | 8.29 | 2.27 | 5.09 | 5.92 | 6.43 | 7.38 | 8.44 | 9.88 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 | NA | - | 0.05 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_{p}$ | 150 | 2.10 | 4.68 | 5.30 | 5.76 | 6.41 | 7.22 | 8.29 | 2.27 | 5.09 | 5.92 | 6.43 | 7.38 | 8.44 | 9.88 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | 0.04 | 0.06 | 0.06 | 0.06 | 0.05 | NA | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |

Table 148. Difficult-to-drive jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 8.02 | 9.49 |
| Fish < 2 g | 183 | 10.41 | 13.44 |
| Fish without swim bladder | 216 | 0.46 | 0.47 |
| Fish with swim bladder | 203 | 2.36 | 2.49 |

Table 149. Difficult-to-drive jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | 0.02 | 0.03 | 0.09 | 0.06 | 0.05 | NA | - | - | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_p$ | 150 | 3.13 | 5.98 | 6.46 | 7.43 | 9.15 | 12.13 | 11.66 | 3.28 | 6.28 | 6.87 | 8.00 | 10.38 | 13.73 | 11.51 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | 0.02 | 0.03 | 0.09 | 0.06 | 0.05 | NA | - | - | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish < 2 g | $L_p$ | 150 | 3.13 | 5.98 | 6.46 | 7.43 | 9.15 | 12.13 | 11.66 | 3.28 | 6.28 | 6.87 | 8.00 | 10.38 | 13.73 | 11.51 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | 0.02 | 0.06 | 0.06 | 0.05 | NA | - | - | 0.02 | 0.06 | 0.06 | 0.05 |

Table 150. Difficult-to-drive jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to SEL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 12.34 | 13.88 |
| Fish < 2 g | 183 | 16.82 | 20.80 |
| Fish without swim bladder | 216 | 0.46 | 0.47 |
| Fish with swim bladder | 203 | 2.79 | 2.86 |

Table 151. Difficult-to-drive jacket foundation with 4 pin piles (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 | NA | - | 0.05 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_p$ | 150 | 2.10 | 4.68 | 5.30 | 5.76 | 6.41 | 7.22 | 8.29 | 2.27 | 5.09 | 5.92 | 6.43 | 7.38 | 8.44 | 9.88 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 | NA | - | 0.05 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_p$ | 150 | 2.10 | 4.68 | 5.30 | 5.76 | 6.41 | 7.22 | 8.29 | 2.27 | 5.09 | 5.92 | 6.43 | 7.38 | 8.44 | 9.88 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | 0.04 | 0.06 | 0.06 | 0.06 | 0.05 | NA | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |

Table 152. Difficult-to-drive jacket foundation with 4 pin piles (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 9.03 | 11.41 |
| Fish < 2 g | 183 | 11.92 | 15.85 |
| Fish without swim bladder | 216 | 0.63 | 0.65 |
| Fish with swim bladder | 203 | 2.79 | 2.99 |

Table 153. Difficult-to-drive jacket foundation with 4 pin piles (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | 0.02 | 0.03 | 0.09 | 0.06 | 0.05 | NA | - | - | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_{p}$ | 150 | 3.13 | 5.98 | 6.46 | 7.43 | 9.15 | 12.13 | 11.66 | 3.28 | 6.28 | 6.87 | 8.00 | 10.38 | 13.73 | 11.51 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | 0.02 | 0.03 | 0.09 | 0.06 | 0.05 | NA | - | - | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish < 2 g | $L_{p}$ | 150 | 3.13 | 5.98 | 6.46 | 7.43 | 9.15 | 12.13 | 11.66 | 3.28 | 6.28 | 6.87 | 8.00 | 10.38 | 13.73 | 11.51 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | 0.02 | 0.06 | 0.06 | 0.05 | NA | - | - | 0.02 | 0.06 | 0.06 | 0.05 |

Table 154. Difficult-to-drive jacket foundation with 4 pin piles (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 14.42 | 16.80 |
| Fish < 2 g | 183 | 19.67 | 26.25 |
| Fish without swim bladder | 216 | 0.64 | 0.65 |
| Fish with swim bladder | 203 | 3.58 | 3.68 |

Table 155. Difficult-to-drive jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 | NA | - | 0.05 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_p$ | 150 | 2.10 | 4.68 | 5.30 | 5.76 | 6.41 | 7.22 | 8.29 | 2.27 | 5.09 | 5.92 | 6.43 | 7.38 | 8.44 | 9.88 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 | NA | - | 0.05 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_p$ | 150 | 2.10 | 4.68 | 5.30 | 5.76 | 6.41 | 7.22 | 8.29 | 2.27 | 5.09 | 5.92 | 6.43 | 7.38 | 8.44 | 9.88 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | 0.04 | 0.06 | 0.06 | 0.06 | 0.05 | NA | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |

Table 156. Difficult-to-drive jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 9.63 | 12.40 |
| Fish < 2 g | 183 | 12.70 | 17.23 |
| Fish without swim bladder | 216 | 0.72 | 0.74 |
| Fish with swim bladder | 203 | 3.10 | 3.35 |

Table 157. Difficult-to-drive jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | 0.02 | 0.03 | 0.09 | 0.06 | 0.05 | NA | - | - | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_p$ | 150 | 3.13 | 5.98 | 6.46 | 7.43 | 9.15 | 12.13 | 11.66 | 3.28 | 6.28 | 6.87 | 8.00 | 10.38 | 13.73 | 11.51 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | 0.02 | 0.03 | 0.09 | 0.06 | 0.05 | NA | - | - | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish < 2 g | $L_p$ | 150 | 3.13 | 5.98 | 6.46 | 7.43 | 9.15 | 12.13 | 11.66 | 3.28 | 6.28 | 6.87 | 8.00 | 10.38 | 13.73 | 11.51 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | 0.02 | 0.06 | 0.06 | 0.05 | NA | - | - | 0.02 | 0.06 | 0.06 | 0.05 |

Table 158. Difficult-to-drive jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 15.59 | 18.38 |
| Fish < 2 g | 183 | 21.73 | 29.70 |
| Fish without swim bladder | 216 | 0.73 | 0.73 |
| Fish with swim bladder | 203 | 3.97 | 4.07 |

Table 159. Difficult-to-drive foundation with 8 pin piles (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 | NA | - | 0.05 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_p$ | 150 | 2.10 | 4.68 | 5.30 | 5.76 | 6.41 | 7.22 | 8.29 | 2.27 | 5.09 | 5.92 | 6.43 | 7.38 | 8.44 | 9.88 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 | NA | - | 0.05 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_p$ | 150 | 2.10 | 4.68 | 5.30 | 5.76 | 6.41 | 7.22 | 8.29 | 2.27 | 5.09 | 5.92 | 6.43 | 7.38 | 8.44 | 9.88 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | 0.04 | 0.06 | 0.06 | 0.06 | 0.05 | NA | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |

Table 160. Difficult-to-drive foundation with 8 pin piles (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish SEL thresholds at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 11.18 | 14.60 |
| Fish < 2 g | 183 | 14.33 | 20.85 |
| Fish without swim bladder | 216 | 0.93 | 0.95 |
| Fish with swim bladder | 203 | 3.73 | 4.01 |

Table 161. Difficult-to-drive jacket foundation with 8 pin piles (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ | 206 | NA | - | 0.02 | 0.03 | 0.09 | 0.06 | 0.05 | NA | - | - | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_p$ | 150 | 3.13 | 5.98 | 6.46 | 7.43 | 9.15 | 12.13 | 11.66 | 3.28 | 6.28 | 6.87 | 8.00 | 10.38 | 13.73 | 11.51 |
| Fish < 2 g | $L_{pk}$ | 206 | NA | - | 0.02 | 0.03 | 0.09 | 0.06 | 0.05 | NA | - | - | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish < 2 g | $L_p$ | 150 | 3.13 | 5.98 | 6.46 | 7.43 | 9.15 | 12.13 | 11.66 | 3.28 | 6.28 | 6.87 | 8.00 | 10.38 | 13.73 | 11.51 |
| Fish without swim bladder | $L_{pk}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ | 207 | NA | - | - | 0.02 | 0.06 | 0.06 | 0.05 | NA | - | - | 0.02 | 0.06 | 0.06 | 0.05 |

Table 162. Difficult-to-drive jacket foundation with 8 pin piles (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish PK and SPL thresholds at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa2·s) | Summer | Winter |
|---|---|---|---|
| Fish ≥ 2g | 187 | 18.04 | 23.47 |
| Fish < 2 g | 183 | 25.71 | 40.03 |
| Fish without swim bladder | 216 | 1.00 | 1.04 |
| Fish with swim bladder | 203 | 4.80 | 4.94 |

# 5. Discussion

This study predicted underwater sound levels associated with installing piles during impact piling, and vibratory pile setting followed by impact pile driving. The piles installed will support WTGs, ESP(s), and the booster station (if used). The maximum monopile diameter of 14 m was considered for typical and difficult to drive scenarios. The jacket foundations use either 4 or 4.25 diameter typical and difficult to drive pin piles. Sounds fields produced during pile driving for installing the monopile and jacket foundations were found by a three-step process. First, the force applied by the hammer at the top of the pile was computed. Second, JASCO's PDSM was used to model the vibration of the pile and to obtain a point-source array representation of the sound radiating from the pile due to such vibrations. Third, JASCO's FWRAM model was used to propagate this sound field into the environment. Acoustic ranges to injury and behavioral thresholds were calculated for installing the monopile and jacket foundations (see Section 4.5 and Appendix F and G).

Sound fields were sampled by simulating animal movement within the sound fields and determining if simulated marine mammal and sea turtle animats (simulated animals) exceed regulatory thresholds. For those animats that exceeded thresholds, the closest point of approach to the source was found and the distance accounting for 95% of exceedances was reported as the exposure range, $ER_{95\%}$. The species-specific $ER_{95\%}$ (see tables in Section 4.4) were determined with different broadband attenuation levels (0, 10, 12, and 15 dB) to account for the use of noise reduction systems, such as bubble curtains. $ER_{95\%}$ can be used for mitigation purposes, like establishing monitoring areas or shutdown zones. Fish were considered as static receivers, so exposure ranges were not calculated. Instead, the acoustic distance to their regulatory thresholds were determined and reported, with the different broadband attenuation levels (see tables in Section 4.5).

Exposure estimates (Section 4.2.1) and exposure ranges (Section 4.4) for monopile and jacket foundation installation were calculated for the different construction schedules over various years of construction (see Section 1.2.1.1).

## 5.1. Exposure Estimates for Marine Mammals and Sea Turtles

The potential risk of exposure for marine mammals and sea turtles was estimated from the sound levels received by each animat over the course of the JASMINE simulation, comparing those levels with the relevant regulatory thresholds, scaling by the mean monthly densities for each marine mammal species (Roberts et al. 2016, 2022) and sea turtle species (DiMatteo et al. 2023) then summing over the construction period to get the total number of individual animals that may experience sound levels exceeding regulatory thresholds. These thresholds are described in detail in Section 2.4. The thresholds for injurious exposures are based on cumulative SEL and maximum PK pressure level (NMFS 2018). Thresholds for behavioral disruption are based on maximum SPL (NOAA 2005, Wood et al. 2012, Finneran et al. 2017). This discussion summarizes the modeled injury and behavior exposure estimates, exposure ranges, and fish acoustic ranges presented in the main body of this report.

The endangered NARW is predicted to experience up to 4.99 injurious exposures per year during Schedules A and B. This corresponds to approximately 1.48% of the total species abundance (abundances for all species are provided in

Table 36 and Table 37). However, it is important to note that the Proponent will implement several mitigation measures to prevent any injurious exposures to NARW. The predicted number of exposures above SEL injury threshold for all low-frequency cetaceans, assuming 10 dB attenuation, varies from approximately 1 individual per year (sei whale in Schedule A) to 48 individuals (minke whale in Schedule B). No injury-level acoustic exposures are predicted for mid-frequency cetacean species at 10 dB attenuation. Harbor porpoise, the only high frequency cetacean in the acoustic analysis, is predicted to experience up to 4.63 exposures above the SEL injury threshold, but this still only represents less than 0.01% of the population.

For NARW, up to 69.64 animals are predicted to experience sound levels exceeding the 160 dB behavioral threshold, which corresponds to 20.6% of the total population. Due to their relatively high local monthly densities, common dolphins have the highest predicted number of exposures above behavioral thresholds with up to ~31,119 animals (approximately 18% of the population). Using the Wood et al. (2012) criteria, behavioral exposure estimates for NARW are lower than for other low-frequency species, with a maximum annual prediction of 15.83 animals. Minke whales consistently have the highest predicted number of exposures for this metric, with a maximum of 736.46.

Fewer than 2 sea turtles per year during Schedules A and B are predicted to be exposed to sound levels exceeding injury or behavior thresholds.

Even within a hearing group, the exposure modeling results vary substantially between species due to differences in estimated local species density, modeled monthly construction schedule, and modeled swimming and diving behavior. The use of NAS and mitigation may reduce the number of marine mammal and sea turtle exposures.

## 5.2. Exposure Ranges for Marine Mammals and Sea Turtles

The maximum $ER_{95\%}$ NARW exposure range across all foundation types to injury thresholds for any source with 10 dB attenuation is 2.80 km. The maximum NARW exposure range for potential behavioral disruption is 26.93 km. For all low frequency cetaceans, the maximum $ER_{95\%}$ exposure range to injury thresholds is between 1.37- 4.80 km and 3.5-33.84 for behavioral thresholds. Exposure ranges ($ER_{95\%}$) are not expected to exceed injury thresholds for mid-frequency cetaceans. The maximum $ER_{95\%}$ exposure range to behavioral thresholds is 1.24 – 2.50 km for the Wood et al. (2012) criteria and 2.92-29.06 km for the NMFS (2018) criteria. For harbor porpoise, the exposure range to injury thresholds is up to 0.13 km. Exposure ranges to behavioral thresholds are between 24.56-82.11 for the Wood et al. (2012) criteria and 3.52-25.59 for the NMFS (2018) criteria. The maximum exposure range for sea turtle injury for any foundation type is 1.52 m. Sea turtle maximum exposure range for behavioral disruption is approximately 0.40–1.84 km.

## 5.3. Acoustic Ranges for Fish

Using exposure guidelines defined by Popper et al. (2014), acoustic results indicate that ranges to potential injury for fish without swim bladders are small, less than 1 km. Maximum range to the threshold defining potential injury across all foundation types is 40 km with 10 dB attenuation level, for fish of less than 2 g in winter and considering the post-piling installation of 8 pin-piles of 4.25 m diameter. GARFO (2020) defines a broad behavioral criterion for all fish, which corresponds to a maximum range to threshold of 15.74 km, considering the installation of 14 m monopiles at an approximate impact pile driving energy of 6,600 kJ.

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# Literature Cited

[ANSI] American National Standards Institute. S1.1-1994 (R2004). *American National Standard: Acoustical Terminology*. NY, USA. https://webstore.ansi.org/Standards/ASA/ANSIS11994R2004.

[ANSI] American National Standards Institute and [ASA] Acoustical Society of America. S1.1-2013. *American National Standard: Acoustical Terminology*. NY, USA. https://webstore.ansi.org/Standards/ASA/ANSIASAS12013.

[ANSI] American National Standards Institute and [ASA] Acoustical Society of America. S1.13-2005 (R2010). *American National Standard: Measurement of Sound Pressure Levels in Air*. NY, USA. https://webstore.ansi.org/Standards/ASA/ANSIASAS1132005R2010.

[ANSI] American National Standards Institute and [ASA] Acoustical Society of America. S3.20-1995 (R2008). *American National Standard: Bioacoustical Terminology*. NY, USA. https://webstore.ansi.org/Standards/ASA/ANSIASAS3201995R2008.

[ANSI] American National Standards Institute. S12.7-1986 (R2006). *American National Standard: Methods for Measurements of Impulsive Noise*. NY, USA. https://webstore.ansi.org/Standards/ASA/ANSIS121986R2006.

[BOEM] Bureau of Ocean Energy Management. 2014. *Atlantic OCS Proposed Geological and Geophysical Activities: Mid-Atlantic and South Atlantic Planning Area. Final Programmatic Environmental Impact Statement*. Volume I: Chapters 1-8, Figures, Tables, and Keyword Index. OCS EIS/EA BOEM 2014-001. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. https://www.boem.gov/sites/default/files/oil-and-gas-energy-program/GOMR/BOEM-2014-001-v1.pdf.

[CeTAP] Cetacean and Turtle Assessment Program, University of Rhode Island. 1982. *A Characterization of marine mammals and turtles in the mid- and North Atlantic aeas of the US Outer Continental Shelf, final report*. Contract AA551-CT8-48. Bureau of Land Management, Washington, DC.

[DoC] Department of Commerce (US) and [NOAA] National Oceanic and Atmospheric Administration (US). 2005. Endangered Fish and Wildlife; Notice of Intent to Prepare an Environmental Impact Statement. *Federal Register* 70(7): 1871-1875. https://www.govinfo.gov/content/pkg/FR-2005-01-11/pdf/05-525.pdf.

[DoC] Department of Commerce (US) and [NOAA] National Oceanic and Atmospheric Administration (US). 2020. 2019 Marine Mammal Stock Assessment Reports. *Federal Register* 85(149): 46589-46598. https://www.federalregister.gov/d/2020-16720.

[ESA] Endangered Species Act of 1973 as Amended through the 108th Congress. 2002. United States Pub. L. No. 93–205, 87 Stat. 884, 16 U.S.C. 1531 (Dec 28, 1973) as amended by Pub. L. No. 107–136 (Jan 24, 2002). http://www.fws.gov/endangered/esa-library/pdf/ESAall.pdf.

[DoN] Department of the Navy (US). 2012. *Commander Task Force 20, 4th, and 6th Fleet Navy marine species density database*. Technical report for Naval Facilities Engineering Command Atlantic, Norfolk, VA.

[DoN] Department of the Navy (US). 2017. *U.S. Navy marine species density database phase III for the Atlantic Fleet training and testing study area. NAVFAC Atlantic Final Technical Report*. Naval Facilities Engineering Command Atlantic, Norfolk, VA.

[FHWG] Fisheries Hydroacoustic Working Group. 2008. *Agreement in Principle for Interim Criteria for Injury to Fish from Pile Driving Activities*. 12 Jun 2008 edition. http://www.dot.ca.gov/hq/env/bio/files/fhwgcriteria_agree.pdf.

[GARFO] Greater Atlantic Regional Fisheries Office. 2020a. *Section 7: Consultation Technical Guidance in the Greater Atlantic Region* (webpage). National Marine Fisheries Service, 14 Sep 2020. https://www.greateratlantic.fisheries.noaa.gov/protected/section7/guidance/consultation/index.html.

[GARFO] Greater Atlantic Regional Fisheries Office. 2020b. *GARFO Acoustics Tool: Analyzing the effects of pile driving on ESA-listed species in the Greater Atlantic Region* https://s3.amazonaws.com/media.fisheries.noaa.gov/2020-09/GARFO-Sect7-PileDriving-AcousticsTool-09142020.xlsx?.Egxagq5Dh4dplwJQsmN1gV0nggnk5qX.

[HESS] High Energy Seismic Survey. 1999. *High Energy Seismic Survey Review Process and Interim Operational Guidelines for Marine Surveys Offshore Southern California*. Prepared for the California State Lands Commission and the United States Minerals Management Service Pacific Outer Continental Shelf Region by the High Energy Seismic Survey Team, Camarillo, CA, USA. 98 p. https://ntrl.ntis.gov/NTRL/dashboard/searchResults/titleDetail/PB2001100103.xhtml.

[ISO] International Organization for Standardization. 2006. *ISO 80000-3:2006 Quantities and units – Part 3: Space and time*. https://www.iso.org/standard/31888.html.

[ISO] International Organization for Standardization. 2017. *ISO 18405:2017. Underwater acoustics – Terminology*. Geneva. https://www.iso.org/standard/62406.html.

Marine Mammal Protection Act of 1972 as Amended. 2015. United States Pub. L. No. 92-522, 16 U.S.C. 1361 (21 Oct 1972). http://www.nmfs.noaa.gov/pr/laws/mmpa/text.htm.

[NAVO] Naval Oceanography Office (US). 2003. *Database description for the Generalized Digital Environmental Model (GDEM-V) (U)*. Document Number MS 39522-5003. Oceanographic Data Bases Division, Stennis Space Center.

[NIOSH] National Institute for Occupational Safety and Health. 1998. *Criteria for a recommended standard: Occupational noise exposure. Revised Criteria*. Document Number 98-126. US Department of Health and Human Services, NIOSH, Cincinnati, OH, USA. 122 p. https://www.cdc.gov/niosh/docs/98-126/pdfs/98-126.pdf.

[NMFS] National Marine Fisheries Service (US) and [NOAA] National Oceanic and Atmospheric Administration (US). 2005. Endangered fish and wildlife: Notice of intent to prepare an environmental impact statement. *Federal Register* 70(7): 1871-1875. http://www.nmfs.noaa.gov/pr/pdfs/fr/fr70-1871.pdf.

[NMFS] National Marine Fisheries Service (US). 2016. *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts*. US Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55. 178 p.

[NMFS] National Marine Fisheries Service (US). 2018. *2018 Revision to: 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*. US Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-59. 167 p. https://www.fisheries.noaa.gov/webdam/download/75962998.

[NOAA] National Oceanic and Atmospheric Administration (U.S.). 2019. *Interim Recommendation for Sound Source Level and Propagation Analysis for High Resolution Geophysical Sources*. National Oceanic and Atmospheric Administration, US Department of Commerce. 3 p.

[NOAA] National Oceanic and Atmospheric Administration (US). 2013. *Draft guidance for assessing the effects of anthropogenic sound on marine mammals: Acoustic threshold levels for onset of permanent and temporary threshold shifts*. National Oceanic and Atmospheric Administration, US Department of Commerce, and NMFS Office of Protected Resources, Silver Spring, MD, USA. 76 p.

[NOAA] National Oceanic and Atmospheric Administration (US). 2015. *Draft guidance for assessing the effects of anthropogenic sound on marine mammal hearing: Underwater acoustic threshold levels for onset of permanent and temporary threshold shifts*. NMFS Office of Protected Resources, Silver Spring, MD, USA. 180 p.

[USFWS] US Fish and Wildlife Service. 2014. *West Indian manatee (Trichechus manatus) Florida stock (Florida subspecies, Trichechus manatus latirostris)*. https://www.fws.gov/northflorida/manatee/SARS/20140123_FR00001606_Final_SAR_WIM_FL_Stock.pdf.

Aerts, L.A.M., M. Blees, S.B. Blackwell, C.R. Greene, Jr., K.H. Kim, D.E. Hannay, and M.E. Austin. 2008. *Marine mammal monitoring and mitigation during BP Liberty OBC seismic survey in Foggy Island Bay, Beaufort Sea, July-August 2008: 90-day report*. Document Number P1011-1. Report by LGL Alaska Research Associates Inc., LGL Ltd., Greeneridge Sciences Inc., and JASCO Applied Sciences for BP Exploration Alaska. 199 p. ftp://ftp.library.noaa.gov/noaa_documents.lib/NMFS/Auke%20Bay/AukeBayScans/Removable%20Disk/P1011-1.pdf.

Andersson, M.H., E. Dock-Åkerman, R. Ubral-Hedenberg, M.C. Öhman, and P. Sigray. 2007. Swimming behavior of roach (*Rutilus rutilus*) and three-spined stickleback (*Gasterosteus aculeatus*) in response to wind power noise and single-tone frequencies. *AMBIO* 36(8): 636-638. https://doi.org/10.1579/0044-7447(2007)36[636:SBORRR]2.0.CO;2.

Aoki, K., M. Amano, M. Yoshioka, K. Mori, D. Tokuda, and N. Miyazaki. 2007. Diel diving behavior of sperm whales off Japan. *Marine Ecology Progress Series* 349: 277-287. https://doi.org/10.3354/meps07068.

Au, W.W.L. and M.C. Hastings. 2008. *Principles of Marine Bioacoustics*. Modern Acoustics and Signal Processing. Springer, New York. 510 p. https://doi.org/10.1007/978-0-387-78365-9.

Austin, M.E. and G.A. Warner. 2012. *Sound Source Acoustic Measurements for Apache's 2012 Cook Inlet Seismic Survey*. Version 2.0. Technical report by JASCO Applied Sciences for Fairweather LLC and Apache Corporation.

Austin, M.E. and L. Bailey. 2013. *Sound Source Verification: TGS Chukchi Sea Seismic Survey Program 2013*. Document Number 00706, Version 1.0. Technical report by JASCO Applied Sciences for TGS-NOPEC Geophysical Company.

Austin, M.E., A. McCrodan, C. O'Neill, Z. Li, and A.O. MacGillivray. 2013. *Marine mammal monitoring and mitigation during exploratory drilling by Shell in the Alaskan Chukchi and Beaufort Seas, July–November 2012: 90-Day Report*. *In*: Funk, D.W., C.M. Reiser, and W.R. Koski (eds.). Underwater Sound Measurements. LGL Rep. P1272D–1. Report from LGL Alaska Research Associates Inc. and JASCO Applied Sciences, for Shell Offshore Inc., National Marine Fisheries Service (US), and US Fish and Wildlife Service. 266 pp plus appendices.

Austin, M.E. 2014. Underwater noise emissions from drillships in the Arctic. *In*: Papadakis, J.S. and L. Bjørnø (eds.). *UA2014 - 2nd International Conference and Exhibition on Underwater Acoustics*. 22-27 Jun 2014, Rhodes, Greece. pp. 257-263.

Austin, M.E., H. Yurk, and R. Mills. 2015. *Acoustic Measurements and Animal Exclusion Zone Distance Verification for Furie's 2015 Kitchen Light Pile Driving Operations in Cook Inlet*. Version 2.0. Technical report by JASCO Applied Sciences for Jacobs LLC and Furie Alaska.

Austin, M.E. and Z. Li. 2016. *Marine Mammal Monitoring and Mitigation During Exploratory Drilling by Shell in the Alaskan Chukchi Sea, July–October 2015: Draft 90-day report*. *In*: Ireland, D.S. and L.N. Bisson (eds.). Underwater Sound Measurements. LGL Rep. P1363D. Report from LGL Alaska Research Associates Inc., LGL Ltd., and JASCO Applied Sciences Ltd. For Shell Gulf of Mexico Inc, National Marine Fisheries Service, and US Fish and Wildlife Service. 188 pp + appendices.

Becker, J.J., D.T. Sandwell, W.H.F. Smith, J. Braud, B. Binder, J. Depner, D. Fabre, J. Factor, S. Ingalls, et al. 2009. Global Bathymetry and Elevation Data at 30 Arc Seconds Resolution: SRTM30_PLUS. *Marine Geodesy* 32(4): 355-371. https://doi.org/10.1080/01490410903297766.

Bellmann, M.A. 2014. Overview of existing noise mitigation systems for reducing pile-driving noise. *Inter-noise2014*. Melbourne, Australia. https://www.acoustics.asn.au/conference_proceedings/INTERNOISE2014/papers/p358.pdf.

Bellmann, M.A., A. May, T. Wendt, S. Gerlach, P. Remmers, and J. Brinkmann. 2020. *Underwater noise during percussive pile driving: Influencing factors on pile-driving noise and technical possibilities to comply with noise mitigation values*. Supported by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (BMU)), FKZ UM16 881500. Commissioned and managed by the Federal Maritime and Hydrographic Agency (Bundesamt für Seeschifffahrt und Hydrographie (BSH)), Order No. 10036866. Edited by the itap GmbH. https://www.itap.de/media/experience_report_underwater_era-report.pdf.

Betke, K. 2008. *Measurement of Wind Turbine Construction Noise at Horns Rev II*. Report Number 1256-08-a-KB. Technical report by Institut für technische und angewandte Physik GmbH (ITAP) for BioConsultSH, Husun, Germany. 30 p. https://tethys.pnnl.gov/sites/default/files/publications/Betke-2008.pdf.

Blackstock, S.A., J.O. Fayton, P.H. Hulton, T.E. Moll, K.K. Jenkins, S. Kotecki, E.E. Henderson, S. Rider, C. Martin, et al. 2018. *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing*. Naval Undersea Warfare Center Division, Newport United States.

Buckingham, M.J. 2005. Compressional and shear wave properties of marine sediments: Comparisons between theory and data. *Journal of the Acoustical Society of America* 117: 137-152. https://doi.org/10.1121/1.1810231.

Buehler, D., R. Oestman, J.A. Reyff, K. Pommerenck, and B. Mitchell. 2015. *Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish*. Report Number CTHWANP-RT-15-306.01.01. Report by California Department of Transportation (CALTRANS), Division of Environmental Analysis. 532 p. https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/bio-tech-guidance-hydroacoustic-effects-110215-a11y.pdf.

Collins, M.D. 1993. A split-step Padé solution for the parabolic equation method. *Journal of the Acoustical Society of America* 93(4): 1736-1742. https://doi.org/10.1121/1.406739.

Collins, M.D., R.J. Cederberg, D.B. King, and S. Chin-Bing. 1996. Comparison of algorithms for solving parabolic wave equations. *Journal of the Acoustical Society of America* 100(1): 178-182. https://doi.org/10.1121/1.415921.

Coppens, A.B. 1981. Simple equations for the speed of sound in Neptunian waters. *Journal of the Acoustical Society of America* 69(3): 862-863. https://doi.org/10.1121/1.382038.

Cranford, T.W. and P. Krysl. 2015. Fin whale sound reception mechanisms: Skull vibration enables low-frequency hearing. *PLOS ONE* 10(1). https://doi.org/10.1371/journal.pone.0116222.

Dadswell, M.J., B.D. Taubert, T.S. Squiers, D. Marchette, and J. Buckley. 1984. *Synopsis of biological data on shortnose sturgeon, Acipenser brevirostrum LeSueur 1818*. NOAA/National Marine Fisheries Service. NOAA Technical Report NMFS 14

Dahlheim, M.E. and D.K. Ljungblad. 1990. Preliminary hearing study on gray whales (*Eschrichtius robustus*) in the field. *In* Thomas, J.A. and R.A. Kastelein (eds.). *Sensory abilities of cetaceans*. Volume 196. Springer US. pp. 335-346.

DiMatteo A, J.J. Roberts, D. Jones, L. Garrison, K.M. Hart, R.D. Kenney, C. Khan, W.A. McLellan, K. Lomac-MacNair, D. Palka, M.E. Rickard, K. Roberts, A.M. Zoidis, and L. Sparks. 2023. *Sea turtle density surface models along the United States Atlantic coast*. Manuscript in prep.

Dunlop, R.A., M.J. Noad, R.D. McCauley, L. Scott-Hayward, E. Kniest, R. Slade, D. Paton, and D.H. Cato. 2017. Determining the behavioural dose–response relationship of marine mammals to air gun noise and source proximity. *Journal of Experimental Biology* 220(16): 2878-2886. https://doi.org/10.1242/jeb.160192.

Dunton, K.J., A. Jordaan, K.A. McKown, D.O. Conover, and M.G. Frisk. 2010. Abundance and distribution of Atlantic sturgeon (*Acipenser oxyrinchus*) within the Northwest Atlantic Ocean, determined from five fishery-independent surveys. *Fishery Bulletin* 108(4): 450-464. https://spo.nmfs.noaa.gov/sites/default/files/pdf-content/2010/1084/dunton.pdf.

Ellison, W.T., B.L. Southall, C.W. Clark, and A.S. Frankel. 2012. A New Context-Based Approach to Assess Marine Mammal Behavioral Responses to Anthropogenic Sounds. *Conservation Biology* 26(1): 21-28. https://doi.org/10.1111/j.1523-1739.2011.01803.x.

Erbe, C., R.D. McCauley, and A. Gavrilov. 2016. Characterizing marine soundscapes. *In* Popper, A.N. and A.D. Hawkins (eds.). *The Effects of Noise on Aquatic Life II*. Volume 875. Springer, New York. pp. 265-271. https://doi.org/10.1007/978-1-4939-2981-8_31.

Finneran, J.J. 2015. *Auditory weighting functions and TTS/PTS exposure functions for cetaceans and marine carnivores*. Technical report by SSC Pacific, San Diego, CA, USA.

Finneran, J.J. 2016. *Auditory weighting functions and TTS/PTS exposure functions for marine mammals exposed to underwater noise*. Technical Report for Space and Naval Warfare Systems Center Pacific, San Diego, CA, USA. 49 p. https://apps.dtic.mil/dtic/tr/fulltext/u2/1026445.pdf.

Finneran, J.J., E.E. Henderson, D.S. Houser, K. Jenkins, S. Kotecki, and J. Mulsow. 2017. *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)*. Technical report by Space and Naval Warfare Systems Center Pacific (SSC Pacific). 183 p. https://nwtteis.com/portals/nwtteis/files/technical_reports/Criteria_and_Thresholds_for_U.S._Navy_Acoustic_and_Explosive_Effects_Analysis_June2017.pdf.

Funk, D.W., D.E. Hannay, D.S. Ireland, R. Rodrigues, and W.R. Koski. 2008. *Marine mammal monitoring and mitigation during open water seismic exploration by Shell Offshore Inc. in the Chukchi and Beaufort Seas, July–November 2007: 90-day report*. LGL Report P969-1. Prepared by LGL Alaska Research Associates Inc., LGL Ltd., and JASCO Research Ltd. for Shell Offshore Inc., National Marine Fisheries Service (US), and US Fish and Wildlife Service. 218 p.

Hannay, D.E. and R. Racca. 2005. *Acoustic Model Validation*. Document Number 0000-S-90-04-T-7006-00-E, Revision 02, Version 1.3. Technical report by JASCO Research Ltd. for Sakhalin Energy Investment Company Ltd. 34 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2017. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2016 (second edition)*. US Department of Commerce. NOAA Technical Memorandum NMFS-NE-241. 274 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2018. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments—2017 (second edition)*. US Department of Commerce. NOAA Technical Memorandum NMFS-NE-245. 371 p. https://doi.org/10.25923/e764-9g81.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2019. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2018*. US Department of Commerce. NOAA Technical Memorandum NMFS-NE-258. 298 p. https://doi.org/10.25923/9rrd-tx13.

Hayes, S.A., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2020. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019*. US Department of Commerce. US Department of Commerce. NOAA Technical Memorandum NMFS-NE-264, Woods Hole, MA, USA. 479 p. https://media.fisheries.noaa.gov/dam-migration/2019_sars_atlantic_508.pdf.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2021. *US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments 2020*. US Department of Commerce. US Department of Commerce. NOAA Technical Memorandum NMFS-NE-271, Woods Hole, MA, USA. 394 p. https://media.fisheries.noaa.gov/2021-07/Atlantic%202020%20SARs%20Final.pdf.

Houser, D.S., D.A. Helweg, and P.W.B. Moore. 2001. A bandpass filter-bank model of auditory sensitivity in the humpback whale. *Aquatic Mammals* 27(2): 82-91.

https://www.aquaticmammalsjournal.org/share/AquaticMammalsIssueArchives/2001/AquaticMammals_27-02/27-02_Houser.PDF.

Houser, D.S. 2006. A method for modeling marine mammal movement and behavior for environmental impact assessment. *IEEE Journal of Oceanic Engineering* 31(1): 76-81. https://doi.org/10.1109/JOE.2006.872204.

Ireland, D.S., R. Rodrigues, D.W. Funk, W.R. Koski, and D.E. Hannay. 2009. *Marine mammal monitoring and mitigation during open water seismic exploration by Shell Offshore Inc. in the Chukchi and Beaufort Seas, July–October 2008: 90-Day Report*. Document Number P1049-1. 277 p.

Kenney, R.D. and K.J. Vigness-Raposa. 2009. *Marine Mammals and Sea Turtles of Narragansett Bay, Block Island Sound, Rhode Island Sound, and Nearby Waters: An Analysis of Existing Data for the Rhode Island Ocean Special Area Management Plan: Draft Technical Report*. University of Rhode Island. 361 p. https://seagrant.gso.uri.edu/oceansamp/pdf/documents/research_marine_mammals.pdf.

Koschinski, S. and K. Lüdemann. 2013. *Development of Noise Mitigation Measures in Offshore Wind Farm Construction*. Commissioned by the Federal Agency for Nature Conservation (Bundesamt für Naturschutz, BfN). Original report (in German) published Jul 2011, updated Feb 2013, Nehmten and Hamburg, Germany. 97 p. https://www.bfn.de/fileadmin/MDB/documents/themen/meeresundkuestenschutz/downloads/Berichte-und-Positionspapiere/Mitigation-Measures-Underwater-Noise_2013-08-27_final.pdf.

Kraus, S.D., S. Leiter, K. Stone, B. Wikgren, C.A. Mayo, P. Hughes, R.D. Kenney, C.W. Clark, A.N. Rice, et al. 2016. *Northeast Large Pelagic Survey Collaborative Aerial and Acoustic Surveys for Large Whales and Sea Turtles*. US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2016-054, Sterling, Virginia. 117 + appendices p. https://www.boem.gov/RI-MA-Whales-Turtles/.

MacGillivray, A.O. and N.R. Chapman. 2012. Modeling underwater sound propagation from an airgun array using the parabolic equation method. *Canadian Acoustics* 40(1): 19-25. https://jcaa.caa-aca.ca/index.php/jcaa/article/view/2502/2251.

MacGillivray, A.O. 2014. A model for underwater sound levels generated by marine impact pile driving. *Proceedings of Meetings on Acoustics* 20(1). https://doi.org/10.1121/2.0000030

MacGillivray, A.O. 2018. Underwater noise from pile driving of conductor casing at a deep-water oil platform. *Journal of the Acoustical Society of America* 143(1): 450-459. https://doi.org/10.1121/1.5021554.

Malme, C.I., P.R. Miles, C.W. Clark, P.L. Tyack, and J.E. Bird. 1983. *Investigations of the Potential Effects of Underwater Noise from Petroleum Industry Activities on Migrating Gray Whale Behavior. Final Report for the Period of 7 June 1982 - 31 July 1983*. Report Number 5366. Report by Bolt Beranek and Newman Inc. for US Department of the Interior, Minerals Management Service, Alaska OCS Office, Cambridge, MA, USA. https://www.boem.gov/sites/default/files/boem-newsroom/Library/Publications/1983/rpt5366.pdf.

Malme, C.I., P.R. Miles, C.W. Clark, P.L. Tyack, and J.E. Bird. 1984. *Investigations of the Potential Effects of Underwater Noise from Petroleum Industry Activities on Migrating Gray Whale Behavior. Phase II: January 1984 Migration*. Report Number 5586. Report by Bolt Beranek and Newman Inc. for the US Department of the Interior, Minerals Management Service, Cambridge, MA, USA. https://www.boem.gov/sites/default/files/boem-newsroom/Library/Publications/1983/rpt5586.pdf.

Martin, B., K. Bröker, M.-N.R. Matthews, J.T. MacDonnell, and L. Bailey. 2015. Comparison of measured and modeled air-gun array sound levels in Baffin Bay, West Greenland. *OceanNoise 2015*. 11-15 May 2015, Barcelona, Spain.

Martin, B., J.T. MacDonnell, and K. Bröker. 2017a. Cumulative sound exposure levels—Insights from seismic survey measurements. *Journal of the Acoustical Society of America* 141(5): 3603-3603. https://doi.org/10.1121/1.4987709.

Martin, S.B. and A.N. Popper. 2016. Short- and long-term monitoring of underwater sound levels in the Hudson River (New York, USA). *Journal of the Acoustical Society of America* 139(4): 1886-1897. https://doi.org/10.1121/1.4944876.

Martin, S.B., M.-N.R. Matthews, J.T. MacDonnell, and K. Bröker. 2017b. Characteristics of seismic survey pulses and the ambient soundscape in Baffin Bay and Melville Bay, West Greenland. *Journal of the Acoustical Society of America* 142(6): 3331-3346. https://doi.org/10.1121/1.5014049.

Matthews, M.-N.R. and A.O. MacGillivray. 2013. Comparing modeled and measured sound levels from a seismic survey in the Canadian Beaufort Sea. *Proceedings of Meetings on Acoustics* 19(1): 1-8. https://doi.org/10.1121/1.4800553.

McCauley, R.D., J. Fewtrell, A.J. Duncan, C. Jenner, M.-N. Jenner, J.D. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch, et al. 2000a. Marine seismic surveys: A study of environmental implications. *Australian Petroleum Production Exploration Association (APPEA) Journal* 40(1): 692-708. https://doi.org/10.1071/AJ99048.

McCauley, R.D., J. Fewtrell, A.J. Duncan, C. Jenner, M.-N. Jenner, J.D. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch, et al. 2000b. *Marine seismic surveys: Analysis and propagation of air-gun signals; and effects of air-gun exposure on humpback whales, sea turtles, fishes and squid*. Report Number R99-15. Prepared for Australian Petroleum Production Exploration Association by Centre for Maine Science and Technology, Western Australia. 198 p. https://cmst.curtin.edu.au/wp-content/uploads/sites/4/2016/05/McCauley-et-al-Seismic-effects-2000.pdf.

McCrodan, A., C.R. McPherson, and D.E. Hannay. 2011. *Sound Source Characterization (SSC) Measurements for Apache's 2011 Cook Inlet 2D Technology Test*. Version 3.0. Technical report by JASCO Applied Sciences for Fairweather LLC and Apache Corporation. 51 p.

McPherson, C.R. and G.A. Warner. 2012. *Sound Sources Characterization for the 2012 Simpson Lagoon OBC Seismic Survey 90-Day Report*. Document Number 00443, Version 2.0. Technical report by JASCO Applied Sciences for BP Exploration (Alaska) Inc. http://www.nmfs.noaa.gov/pr/pdfs/permits/bp_openwater_90dayreport_appendices.pdf.

McPherson, C.R., K. Lucke, B.J. Gaudet, S.B. Martin, and C.J. Whitt. 2018. *Pelican 3-D Seismic Survey Sound Source Characterisation*. Document Number 001583. Version 1.0. Technical report by JASCO Applied Sciences for RPS Energy Services Pty Ltd.

McPherson, C.R. and B. Martin. 2018. *Characterisation of Polarcus 2380 in$^3$ Airgun Array*. Document Number 001599, Version 1.0. Technical report by JASCO Applied Sciences for Polarcus Asia Pacific Pte Ltd.

Mueller-Blenkle, C., P.K. McGregor, A.B. Gill, M.H. Andersson, J. Metcalfe, V. Bendall, P. Sigray, D.T. Wood, and F. Thomsen. 2010. *Effects of Pile-driving Noise on the Behaviour of Marine Fish*. COWRIE Ref: Fish 06-08; Cefas Ref: C3371. 62 p. https://dspace.lib.cranfield.ac.uk/handle/1826/8235.

Nedwell, J.R. and A.W. Turnpenny. 1998. The use of a generic frequency weighting scale in estimating environmental effect. *Workshop on Seismics and Marine Mammals*. 23–25 Jun 1998, London, UK.

Nedwell, J.R., A.W. Turnpenny, J. Lovell, S.J. Parvin, R. Workman, J.A.L. Spinks, and D. Howell. 2007. *A validation of the dB$_{ht}$ as a measure of the behavioural and auditory effects of underwater noise*. Document Number 534R1231 Report prepared by Subacoustech Ltd. for Chevron Ltd, TotalFinaElf Exploration UK PLC, Department of Business, Enterprise and Regulatory Reform, Shell UK Exploration and Production Ltd, The Industry Technology Facilitator, Joint Nature Conservation Committee, and The UK Ministry of Defence. 74 p. https://tethys.pnnl.gov/sites/default/files/publications/Nedwell-et-al-2007.pdf.

Nehls, G., A. Rose, A. Diederichs, M.A. Bellmann, and H. Pehlke. 2016. Noise Mitigation During Pile Driving Efficiently Reduces Disturbance of Marine Mammals. (Chapter 92) *In* Popper, A.N. and A.D. Hawkins (eds.). *The Effects of Noise on Aquatic Life II*. Volume 875. Springer, NY, USA. pp. 755-762. https://doi.org/10.1007/978-1-4939-2981-8_92.

NOAA Fisheries. 2019. *Glossary: Marine Mammal Protection Act* (webpage), 30 Jul 2019. (Accessed 21 Apr 2020).

NOAA Fisheries. 2021a. *Draft U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments: 2021*. 314 p. https://media.fisheries.noaa.gov/2021-10/Draft%202021%20NE%26SE%20SARs.pdf.

NOAA Fisheries. 2021b. *Atlantic Salmon (Protected) (Salmo salar)* (webpage). https://www.fisheries.noaa.gov/species/atlantic-salmon-protected. (Accessed D Mon YYYY).

NOAA Fisheries. 2021c. *Giant Manta Ray (Manta birostris)* (webpage). https://www.fisheries.noaa.gov/species/giant-manta-ray. (Accessed D Mon YYYY).

O'Neill, C., D. Leary, and A. McCrodan. 2010. Sound Source Verification. (Chapter 3) *In* Blees, M.K., K.G. Hartin, D.S. Ireland, and D.E. Hannay (eds.). *Marine mammal monitoring and mitigation during open water seismic exploration by Statoil USA E&P Inc. in the Chukchi Sea, August-October 2010: 90-day report*. LGL Report P1119. Prepared by LGL Alaska Research Associates Inc., LGL Ltd., and JASCO Applied Sciences Ltd. for Statoil USA E&P Inc., National Marine Fisheries Service (US), and US Fish and Wildlife Service. pp. 1-34.

Pace, R.M., III, P.J. Corkeron, and S.D. Kraus. 2017. State-space mark-recapture estimates reveal a recent decline in abundance of North Atlantic right whales. *Ecology and Evolution* 7(21): 8730-8741. https://doi.org/10.1002/ece3.3406.

Pace, R.M., III, R. Williams, S.D. Kraus, A.R. Knowlton, and H.M. Pettis. 2021. Cryptic mortality of North Atlantic right whales. *Conservation Science and Practice* 3(2): e346. https://doi.org/10.1111/csp2.346.

Parks, S.E., C.W. Clark, and P.L. Tyack. 2007. Short-and long-term changes in right whale calling behavior: The potential effects of noise on acoustic communication. *Journal of the Acoustical Society of America* 122(6): 3725-3731. https://doi.org/10.1121/1.2799904.

Pettis, H.M., R.M. Pace, III, and P.K. Hamilton. 2022. *North Atlantic Right Whale Consortium 2021 Annual Report Card*. Report to the North Atlantic Right Whale Consortium.

Pile Dynamics, Inc. 2010. GRLWEAP. https://www.pile.com/.

Popper, A.N., A.D. Hawkins, R.R. Fay, D.A. Mann, S. Bartol, T.J. Carlson, S. Coombs, W.T. Ellison, R.L. Gentry, et al. 2014. *Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI*. ASA S3/SC1.4 TR-2014. SpringerBriefs in Oceanography. ASA Press and Springer. https://doi.org/10.1007/978-3-319-06659-2.

Purser, J. and A.N. Radford. 2011. Acoustic noise induces attention shifts and reduces foraging performance in three-spined sticklebacks (*Gasterosteus aculeatus*). *PLOS ONE* 6(2): e17478. https://doi.org/10.1371/journal.pone.0017478.

Racca, R., A.N. Rutenko, K. Bröker, and M.E. Austin. 2012a. A line in the water - design and enactment of a closed loop, model based sound level boundary estimation strategy for mitigation of behavioural impacts from a seismic survey. *11th European Conference on Underwater Acoustics*. Volume 34(3), Edinburgh, UK.

Racca, R., A.N. Rutenko, K. Bröker, and G. Gailey. 2012b. Model based sound level estimation and in-field adjustment for real-time mitigation of behavioural impacts from a seismic survey and post-event evaluation of sound exposure for individual whales. *In*: McMinn, T. (ed.). *Acoustics 2012*. Fremantle, Australia. http://www.acoustics.asn.au/conference_proceedings/AAS2012/papers/p92.pdf.

Racca, R., M.E. Austin, A.N. Rutenko, and K. Bröker. 2015. Monitoring the gray whale sound exposure mitigation zone and estimating acoustic transmission during a 4-D seismic survey, Sakhalin Island, Russia. *Endangered Species Research* 29(2): 131-146. https://doi.org/10.3354/esr00703.

Reichmuth, C., J. Mulsow, J.J. Finneran, D.S. Houser, and A.Y. Supin. 2007. Measurement and Response Characteristics of Auditory Brainstem Responses in Pinnipeds. *Aquatic Mammals* 33(1): 132-150. https://doi.org/10.1578/AM.33.1.2007.132.

Rhode Island Ocean Special Area Management Plan. 2011. *OCEANSAMP*. Volume 1. Adopted by the Rhode Island Coastal Resources Management Council, 19 Oct 2010. https://tethys.pnnl.gov/sites/default/files/publications/RI-Ocean-SAMP-Volume1.pdf

Richardson, W.J., B. Würsig, and C.R. Greene, Jr. 1986. Reactions of bowhead whales, *Balaena mysticetus*, to seismic exploration in the Canadian Beaufort Sea. *Journal of the Acoustical Society of America* 79(4): 1117-1128. https://doi.org/10.1121/1.393384.

Richardson, W.J., B. Würsig, and C.R. Greene, Jr. 1990. Reactions of bowhead whales, *Balaena mysticetus*, to drilling and dredging noise in the Canadian Beaufort Sea. *Marine Environmental Research* 29(2): 135-160. https://doi.org/10.1016/0141-1136(90)90032-J.

Richardson, W.J., C.R. Greene, Jr., C.I. Malme, and D.H. Thomson. 1995. *Marine Mammals and Noise*. Academic Press, San Diego, CA, USA. 576 p. https://doi.org/10.1016/C2009-0-02253-3.

[ANSI] American National Standards Institute and [ASA] Acoustical Society of America. S1.1-2013. *American National Standard: Acoustical Terminology*. NY, USA. https://webstore.ansi.org/Standards/ASA/ANSIASAS12013.

[BOEM] Bureau of Ocean Energy Management. 2014. *Atlantic OCS Proposed Geological and Geophysical Activities: Mid-Atlantic and South Atlantic Planning Area. Final Programmatic Environmental Impact Statement*. Volume I: Chapters 1-8, Figures, Tables, and Keyword Index. OCS EIS/EA BOEM 2014-001. US Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. https://www.boem.gov/sites/default/files/oil-and-gas-energy-program/GOMR/BOEM-2014-001-v1.pdf.

[CeTAP] Cetacean and Turtle Assessment Program, University of Rhode Island. 1982. *A Characterization of Marine Mammals and Turtles in the Mid- and North Atlantic Areas of the US Outer Continental Shelf, final report*. Report for US Department of the Interior, Bureau of Land Management. Contract AA551-CT8-48, Washington, DC.

[DoC] Department of Commerce (US) and [NOAA] National Oceanic and Atmospheric Administration (US). 2005. 70 FR 1871: Endangered Fish and Wildlife; Notice of Intent to Prepare an Environmental Impact Statement. *Federal Register* 70(7): 1871-1875. https://www.federalregister.gov/d/05-525.

[ESA] Endangered Species Act of 1973 as Amended through the 108th Congress. 2002. United States Pub. L. No. 93–205, 87 Stat. 884, 16 U.S.C. 1531 (Dec 28, 1973) as amended by Pub. L. No. 107–136 (24 Jan 2002). http://www.fws.gov/endangered/esa-library/pdf/ESAall.pdf.

[FHWG] Fisheries Hydroacoustic Working Group. 2008. *Agreement in Principle for Interim Criteria for Injury to Fish from Pile Driving Activities*. 12 Jun 2008 edition. https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/ser/bio-fhwg-criteria-agree-a11y.pdf.

[GARFO] Greater Atlantic Regional Fisheries Office. 2019. *GARFO Acoustics Tool: Analyzing the effects of pile driving on ESA-listed species in the Greater Atlantic Region National Marine Fisheries Service* (web page), 8 Aug 2019. http://www.greateratlantic.fisheries.noaa.gov/protected/section7/guidance/consultation/index.html.

[GARFO] Greater Atlantic Regional Fisheries Office. 2020a. *Section 7: Consultation Technical Guidance in the Greater Atlantic Region* (web page). National Marine Fisheries Service, 14 Sep 2020. https://www.greateratlantic.fisheries.noaa.gov/protected/section7/guidance/consultation/index.html.

[GARFO] Greater Atlantic Regional Fisheries Office. 2020b. *GARFO Acoustics Tool: Analyzing the effects of pile driving on ESA-listed species in the Greater Atlantic Region* https://s3.amazonaws.com/media.fisheries.noaa.gov/2020-09/GARFO-Sect7-PileDriving-AcousticsTool-09142020.xlsx?.Egxagq5Dh4dplwJQsmN1gV0nggnk5qX.

[HESS] High Energy Seismic Survey. 1999. *High Energy Seismic Survey Review Process and Interim Operational Guidelines for Marine Surveys Offshore Southern California*. Prepared for the California State Lands Commission and the United States Minerals Management Service Pacific Outer Continental Shelf Region by the High Energy Seismic Survey Team, Camarillo, CA, USA. 98 p. https://ntrl.ntis.gov/NTRL/dashboard/searchResults/titleDetail/PB2001100103.xhtml.

[ISO] International Organization for Standardization. 2006. *ISO 80000-3:2006. Quantities and units — Part 3: Space and time*. https://www.iso.org/standard/31888.html.

[ISO] International Organization for Standardization. 2017. *ISO 18405:2017. Underwater acoustics — Terminology*. Geneva. https://www.iso.org/obp/ui/en/#!iso:std:62406:en.

Marine Mammal Protection Act of 1972 as Amended. 2015. United States Pub. L. No. 92-522, 16 U.S.C. 1361 (21 Oct 1972). http://www.nmfs.noaa.gov/pr/laws/mmpa/text.htm.

[NAVO] Naval Oceanography Office (US). 2003. *Database description for the Generalized Digital Environmental Model (GDEM-V) (U)*. Document MS 39522-5003. Oceanographic Data Bases Division, Stennis Space Center.

[NMFS] National Marine Fisheries Service (US) and [NOAA] National Oceanic and Atmospheric Administration (US). 2005. Endangered fish and wildlife: Notice of intent to prepare an environmental impact statement. *Federal Register* 70(7): 1871-1875. http://www.nmfs.noaa.gov/pr/pdfs/fr/fr70-1871.pdf.

[NMFS] National Marine Fisheries Service (US). 2016. *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts*. US Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55. 178 p.

[NMFS] National Marine Fisheries Service (US). 2018. *2018 Revision to: 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*. US Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-59. 167 p. https://media.fisheries.noaa.gov/dam-migration/tech_memo_acoustic_guidance_(20)_(pdf)_508.pdf.

[NMFS] National Marine Fisheries Service (US). 2022. *Summary of Marine Mammal Protection Act Acoustic Thresholds*. 7 p. https://media.fisheries.noaa.gov/2022-05/MM%20Acoustic%20Thresholds%20%28508%29_secure%20%28May%202022%29.pdf.

[USFWS] US Fish and Wildlife Service. 2014. *West Indian manatee (Trichechus manatus) Florida stock (Florida subspecies, Trichechus manatus latirostris)*. https://www.fws.gov/northflorida/manatee/SARS/20140123_FR00001606_Final_SAR_WIM_FL_Stock.pdf.

Aerts, L.A.M., M. Blees, S.B. Blackwell, C.R. Greene, Jr., K.H. Kim, D.E. Hannay, and M.E. Austin. 2008. *Marine mammal monitoring and mitigation during BP Liberty OBC seismic survey in Foggy Island Bay, Beaufort Sea, July-August 2008: 90-day report*. Document P1011-1. Report by LGL Alaska Research Associates Inc., LGL Ltd., Greeneridge Sciences Inc., and JASCO Applied Sciences for BP Exploration Alaska. 199 p. ftp://ftp.library.noaa.gov/noaa_documents.lib/NMFS/Auke%20Bay/AukeBayScans/Removable%20Disk/P1011-1.pdf.

Amoser, S. and F. Ladich. 2003. Diversity in noise-induced temporary hearing loss in otophysine fishes. *Journal of the Acoustical Society of America* 113(4): 2170–2179. https://doi.org/10.1121/1.1557212.

Andersson, M.H., E. Dock-Åkerman, R. Ubral-Hedenberg, M.C. Öhman, and P. Sigray. 2007. Swimming behavior of roach (*Rutilus rutilus*) and three-spined stickleback (*Gasterosteus aculeatus*) in response to wind power noise and single-tone frequencies. *AMBIO* 36(8): 636–638. https://doi.org/10.1579/0044-7447(2007)36[636:SBORRR]2.0.CO;2.

Au, W.W.L. and M.C. Hastings. 2008. *Principles of Marine Bioacoustics*. Modern Acoustics and Signal Processing. Springer, New York. 510 p. https://doi.org/10.1007/978-0-387-78365-9.

Austin, M.E. and G.A. Warner. 2012. *Sound Source Acoustic Measurements for Apache's 2012 Cook Inlet Seismic Survey*. Version 2.0. Technical report by JASCO Applied Sciences for Fairweather LLC and Apache Corporation.

Austin, M.E. and L. Bailey. 2013. *Sound Source Verification: TGS Chukchi Sea Seismic Survey Program 2013*. Document 00706, Version 1.0. Technical report by JASCO Applied Sciences for TGS-NOPEC Geophysical Company.

Austin, M.E., A. McCrodan, C. O'Neill, Z. Li, and A.O. MacGillivray. 2013. *Marine mammal monitoring and mitigation during exploratory drilling by Shell in the Alaskan Chukchi and Beaufort Seas, July–November 2012: 90-Day Report*. *In*: Funk, D.W., C.M. Reiser, and W.R. Koski (eds.). Underwater Sound Measurements. LGL Rep. P1272D–1. Report from LGL Alaska Research Associates Inc. and JASCO Applied Sciences, for Shell Offshore Inc., National Marine Fisheries Service (US), and US Fish and Wildlife Service. 266 pp plus appendices.

Austin, M.E. 2014. Underwater noise emissions from drillships in the Arctic. *In*: Papadakis, J.S. and L. Bjørnø (eds.). *UA2014 - 2nd International Conference and Exhibition on Underwater Acoustics*. 22–27 Jun 2014, Rhodes, Greece. pp. 257–263.

Austin, M.E., H. Yurk, and R. Mills. 2015. *Acoustic Measurements and Animal Exclusion Zone Distance Verification for Furie's 2015 Kitchen Light Pile Driving Operations in Cook Inlet*. Version 2.0. Technical report by JASCO Applied Sciences for Jacobs LLC and Furie Alaska.

Austin, M.E. and Z. Li. 2016. *Marine Mammal Monitoring and Mitigation During Exploratory Drilling by Shell in the Alaskan Chukchi Sea, July–October 2015: Draft 90-day report*. *In*: Ireland, D.S. and L.N. Bisson (eds.). Underwater Sound Measurements. LGL Rep. P1363D. Report from LGL Alaska Research Associates Inc., LGL Ltd., and JASCO Applied Sciences Ltd. For Shell Gulf of Mexico Inc, National Marine Fisheries Service, and US Fish and Wildlife Service. 188 pp + appendices.

Austin, M.E., D.E. Hannay, and K.C. Bröker. 2018. Acoustic characterization of exploration drilling in the Chukchi and Beaufort seas. *Journal of the Acoustical Society of America* 144: 115–123. https://doi.org/10.1121/1.5044417

Becker, J.J., D.T. Sandwell, W.H.F. Smith, J. Braud, B.A. Binder, J. Depner, D. Fabre, J. Factor, S. Ingalls, et al. 2009. Global Bathymetry and Elevation Data at 30 Arc Seconds Resolution: SRTM30_PLUS. *Marine Geodesy* 32(4): 355-371. https://doi.org/10.1080/01490410903297766.

Bellmann, M.A. 2014. Overview of existing noise mitigation systems for reducing pile-driving noise. *Inter-noise2014*. Melbourne, Australia. https://www.acoustics.asn.au/conference_proceedings/INTERNOISE2014/papers/p358.pdf.

Bellmann, M.A., A. May, T. Wendt, S. Gerlach, P. Remmers, and J. Brinkmann. 2020. *Underwater noise during percussive pile driving: Influencing factors on pile-driving noise and technical possibilities to comply with noise mitigation values*. Supported by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (BMU)), FKZ UM16 881500. Commissioned and managed by the Federal Maritime and Hydrographic Agency (Bundesamt für Seeschifffahrt und Hydrographie (BSH)), Order No. 10036866. Edited by the itap GmbH. https://www.itap.de/media/experience_report_underwater_era-report.pdf.

Bellmann, M.A. 2021. *Expert opinion report regarding underwater noise emissions during UXO-clearance activity and possible options for noise mitigation*. Document 3960. Institut für Technische und angewandte Physik (ITAP) GmbH for Orsted Wind Power A/S.

Betke, K. 2008. *Measurement of Wind Turbine Construction Noise at Horns Rev II*. Report 1256-08-a-KB. Technical report by Institut für technische und angewandte Physik GmbH ( ITAP) for BioConsultSH, Husun, Germany. 30 p. https://tethys.pnnl.gov/sites/default/files/publications/Betke-2008.pdf.

Blackstock, S.A., J.O. Fayton, P.H. Hulton, T.E. Moll, K.K. Jenkins, S. Kotecki, E.E. Henderson, S. Rider, C. Martin, and V. Bowman. 2018. *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing*. Naval Undersea Warfare Center Division, Newport United States.

Buckingham, M.J. 2005. Compressional and shear wave properties of marine sediments: Comparisons between theory and data. *Journal of the Acoustical Society of America* 117: 137–152. https://doi.org/10.1121/1.1810231.

Buehler, D., R. Oestman, J.A. Reyff, K. Pommerenck, and B. Mitchell. 2015. *Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish*. Report CTHWANP-RT-15-306.01.01. Report by California Department of Transportation (CALTRANS), Division of Environmental Analysis. 532 p. https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/bio-tech-guidance-hydroacoustic-effects-110215-a11y.pdf.

Coppens, A.B. 1981. Simple equations for the speed of sound in Neptunian waters. *Journal of the Acoustical Society of America* 69(3): 862–863. https://doi.org/10.1121/1.382038.

Cranford, T.W. and P. Krysl. 2015. Fin whale sound reception mechanisms: Skull vibration enables low-frequency hearing. *PLOS ONE* 10(1). https://doi.org/10.1371/journal.pone.0116222.

Dadswell, M.J., B.D. Taubert, T.S. Squiers, D. Marchette, and J. Buckley. 1984. *Synopsis of biological data on shortnose sturgeon, Acipenser brevirostrum LeSueur 1818*. NOAA/National Marine Fisheries Service. NOAA Technical Report NMFS 14

Dahlheim, M.E. and D.K. Ljungblad. 1990. Preliminary Hearing Study on Gray Whales (*Eschrichtius Robustus*) in the Field. *In* Thomas, J.A. and R.A. Kastelein (eds.). *Sensory abilities of Cetaceans*. Volume 196. Springer Science+Business Media, Boston. pp. 335-346. https://doi.org/10.1007/978-1-4899-0858-2_22.

DiMatteo, A.D., J.J. Roberts, D. Jones, L. Garrison, K.M. Hart, R.D. Kenney, C.B. Khan, W.A. McLellan, K. Lomac-MacNair, et al. 2023. Sea turtle density surface models along the United States Atlantic coast. *Endangered Species Research* Prepress abstract. https://doi.org/10.3354/esr01298.

Dunlop, R.A., M.J. Noad, R.D. McCauley, L. Scott-Hayward, E. Kniest, R. Slade, D. Paton, and D.H. Cato. 2017. Determining the behavioural dose–response relationship of marine mammals to air gun noise and source proximity. *Journal of Experimental Biology* 220(16): 2878-2886. https://doi.org/10.1242/jeb.160192.

Dunton, K.J., A. Jordaan, K.A. McKown, D.O. Conover, and M.G. Frisk. 2010. Abundance and distribution of Atlantic sturgeon (*Acipenser oxyrinchus*) within the Northwest Atlantic Ocean, determined from five fishery-independent surveys. *Fishery Bulletin* 108(4): 450-464. https://spo.nmfs.noaa.gov/sites/default/files/pdf-content/2010/1084/dunton.pdf.

Ellison, W.T., B.L. Southall, C.W. Clark, and A.S. Frankel. 2012. A New Context-Based Approach to Assess Marine Mammal Behavioral Responses to Anthropogenic Sounds. *Conservation Biology* 26(1): 21-28. https://doi.org/10.1111/j.1523-1739.2011.01803.x.

Erbe, C., R.D. McCauley, and A. Gavrilov. 2016. Characterizing marine soundscapes. *In* Popper, A.N. and A.D. Hawkins (eds.). *The Effects of Noise on Aquatic Life II*. Volume 875. Springer, New York. pp. 265-271. https://doi.org/10.1007/978-1-4939-2981-8_31.

Finneran, J.J. 2015. *Auditory weighting functions and TTS/PTS exposure functions for cetaceans and marine carnivores*. Technical report by SSC Pacific, San Diego, CA, USA.

Finneran, J.J. 2016. *Auditory weighting functions and TTS/PTS exposure functions for marine mammals exposed to underwater noise*. Technical Report for Space and Naval Warfare Systems Center Pacific, San Diego, CA, USA. 49 p. https://apps.dtic.mil/dtic/tr/fulltext/u2/1026445.pdf.

Finneran, J.J., E.E. Henderson, D.S. Houser, K. Jenkins, S. Kotecki, and J.L. Mulsow. 2017. *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)*. Technical report by Space and Naval Warfare Systems Center Pacific (SSC Pacific). 183 p. https://nwtteis.com/portals/nwtteis/files/technical_reports/Criteria_and_Thresholds_for_U.S._Navy_Acoustic_and_Explosive_Effects_Analysis_June2017.pdf.

Funk, D.W., D.E. Hannay, D.S. Ireland, R. Rodrigues, and W.R. Koski. 2008. *Marine mammal monitoring and mitigation during open water seismic exploration by Shell Offshore Inc. in the Chukchi and Beaufort Seas, July–November 2007: 90-day report*. LGL Report P969-1. Prepared by LGL Alaska Research Associates Inc., LGL Ltd., and JASCO Research Ltd. for Shell Offshore Inc., National Marine Fisheries Service (US), and US Fish and Wildlife Service. 218 p. http://www-static.shell.com/static/usa/downloads/alaska/shell2007_90-d_final.pdf.

Hannay, D.E. and R. Racca. 2005. *Acoustic Model Validation*. Document 0000-S-90-04-T-7006-00-E, Revision 02, Version 1.3. Technical report by JASCO Research Ltd. for Sakhalin Energy Investment Company Ltd. 34 p.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Turek. 2022. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments 2021*. US Department of Commerce. NOAA Technical Memorandum NMFS-NE-288, Woods Hole, MA, USA. 380 p. https://doi.org/10.25923/6tt7-kc16.

Houser, D.S., D.A. Helweg, and P.W.B. Moore. 2001. A bandpass filter-bank model of auditory sensitivity in the humpback whale. *Aquatic Mammals* 27(2): 82–91. https://www.aquaticmammalsjournal.org/share/AquaticMammalsIssueArchives/2001/AquaticMammals_27-02/27-02_Houser.PDF.

Illingworth & Rodkin, Inc. 2007. Appendix I. Compendium of pile driving sound data. *In Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish*. Illingworth & Rodkin, Inc. for the California Department of Transportation, Sacramento, CA. p. 129. www.dot.ca.gov/hq/env/bio/files/pile_driving_snd_comp9_27_07.pdf.

Ireland, D.S., R. Rodrigues, D.W. Funk, W.R. Koski, and D.E. Hannay. 2009. *Marine mammal monitoring and mitigation during open water seismic exploration by Shell Offshore Inc. in the Chukchi and Beaufort Seas, July–October 2008: 90-Day Report*. Document P1049-1. 277 p.

Koschinski, S. and K. Lüdemann. 2013. *Development of Noise Mitigation Measures in Offshore Wind Farm Construction*. Commissioned by the Federal Agency for Nature Conservation (Bundesamt für Naturschutz, BfN). Original report (in German) published Jul 2011, updated Feb 2013, Nehmten and Hamburg, Germany. 97 p. https://www.bfn.de/fileadmin/MDB/documents/themen/meeresundkuestenschutz/downloads/Berichte-und-Positionspapiere/Mitigation-Measures-Underwater-Noise_2013-08-27_final.pdf.

MacGillivray, A.O. and N.R. Chapman. 2012. Modeling underwater sound propagation from an airgun array using the parabolic equation method. *Canadian Acoustics* 40(1): 19–25. https://jcaa.caa-aca.ca/index.php/jcaa/article/view/2502/2251.

MacGillivray, A.O. 2014. A model for underwater sound levels generated by marine impact pile driving. *Proceedings of Meetings on Acoustics* 20(1). https://doi.org/10.1121/2.0000030

MacGillivray, A.O. 2018. Underwater noise from pile driving of conductor casing at a deep-water oil platform. *Journal of the Acoustical Society of America* 143(1): 450–459. https://doi.org/10.1121/1.5021554.

Malme, C.I., P.R. Miles, C.W. Clark, P.L. Tyack, and J.E. Bird. 1983. *Investigations of the Potential Effects of Underwater Noise from Petroleum Industry Activities on Migrating Gray Whale Behavior. Final Report for the Period of 7 June 1982 - 31 July 1983*. Report 5366. Report by Bolt Beranek and Newman Inc. for US Department of the Interior, Minerals Management Service, Alaska OCS Office, Cambridge, MA, USA. https://www.boem.gov/sites/default/files/boem-newsroom/Library/Publications/1983/rpt5366.pdf.

Malme, C.I., P.R. Miles, C.W. Clark, P.L. Tyack, and J.E. Bird. 1984. *Investigations of the Potential Effects of Underwater Noise from Petroleum Industry Activities on Migrating Gray Whale Behavior. Phase II: January 1984 Migration*. Report 5586. Report by Bolt Beranek and Newman Inc. for the US Department of the

Interior, Minerals Management Service, Cambridge, MA, USA. https://www.boem.gov/sites/default/files/boem-newsroom/Library/Publications/1983/rpt5586.pdf.

Martin, S.B., K.C. Bröker, M.-N.R. Matthews, J.T. MacDonnell, and L. Bailey. 2015. Comparison of measured and modeled air-gun array sound levels in Baffin Bay, West Greenland. *OceanNoise 2015*. 11–15 May 2015, Barcelona, Spain.

Martin, S.B. and A.N. Popper. 2016. Short- and long-term monitoring of underwater sound levels in the Hudson River (New York, USA). *Journal of the Acoustical Society of America* 139(4): 1886–1897. https://doi.org/10.1121/1.4944876.

Martin, S.B., J.T. MacDonnell, and K.C. Bröker. 2017a. Cumulative sound exposure levels—Insights from seismic survey measurements. *Journal of the Acoustical Society of America* 141(5): 3603–3603. https://doi.org/10.1121/1.4987709.

Martin, S.B., M.-N.R. Matthews, J.T. MacDonnell, and K.C. Bröker. 2017b. Characteristics of seismic survey pulses and the ambient soundscape in Baffin Bay and Melville Bay, West Greenland. *Journal of the Acoustical Society of America* 142(6): 3331–3346. https://doi.org/10.1121/1.5014049.

Matthews, M.-N.R. and A.O. MacGillivray. 2013. Comparing modeled and measured sound levels from a seismic survey in the Canadian Beaufort Sea. *Proceedings of Meetings on Acoustics* 19(1): 1–8. https://doi.org/10.1121/1.4800553.

Matuschek, R. and K. Betke. 2009. Measurements of construction noise during pile driving of offshore research platforms and wind farms. *NAG-DAGA 2009 International Conference on Acoustics*. 23–26 Mar 2009, Rotterdam, Netherlands. pp. 262–265.

McCauley, R.D. 1994. *The Environmental Implications of Offshore Oil and Gas Development in Australia - Seismic Surveys*. *In*: Neff, J.M. and P.C. Young (eds.). Environmental Implications of Offshore Oil and Gas Develpment in Australia - The Findings of an Independent Scientific Review Swan. Australian Petroleum Exploration Association, Sydney. 19-122 p.

McCauley, R.D. 1998. *Radiated underwater noise measured from the drilling rig Ocean General, rig tenders Pacific Ariki and Pacific Frontier, fishing vessel Reef Venture and natural sources in the Timor Sea, northern Australia*. Report C98-20. Report by Centre for Marine Science and Technology (CMST) for Shell Australia. https://cmst.curtin.edu.au/wp-content/uploads/sites/4/2016/05/1998-19.pdf.

McCauley, R.D., J. Fewtrell, A.J. Duncan, C. Jenner, M.-N. Jenner, J.D. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch, and K.A. McCabe. 2000a. *Marine seismic surveys: Analysis and propagation of air-gun signals; and effects of air-gun exposure on humpback whales, sea turtles, fishes and squid*. Report R99-15. Prepared for Australian Petroleum Production Exploration Association by Centre for Maine Science and Technology, Western Australia. 198 p. https://cmst.curtin.edu.au/wp-content/uploads/sites/4/2016/05/McCauley-et-al-Seismic-effects-2000.pdf.

McCauley, R.D., J. Fewtrell, A.J. Duncan, C. Jenner, M.-N. Jenner, J.D. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch, and K.A. McCabe. 2000b. Marine seismic surveys: A study of environmental implications. *Australian Petroleum Production Exploration Association (APPEA) Journal* 40(1): 692–708. https://doi.org/10.1071/AJ99048.

McCrodan, A., C.R. McPherson, and D.E. Hannay. 2011. *Sound Source Characterization (SSC) Measurements for Apache's 2011 Cook Inlet 2D Technology Test*. Version 3.0. Technical report by JASCO Applied Sciences for Fairweather LLC and Apache Corporation. 51 p.

McPherson, C.R. and G.A. Warner. 2012. *Sound Sources Characterization for the 2012 Simpson Lagoon OBC Seismic Survey 90-Day Report*. Document 00443, Version 2.0. Technical report by JASCO Applied Sciences for BP Exploration (Alaska) Inc.

McPherson, C.R., K. Lucke, B.J. Gaudet, S.B. Martin, and C.J. Whitt. 2018. *Pelican 3-D Seismic Survey Sound Source Characterisation*. Document 001583. Version 1.0. Technical report by JASCO Applied Sciences for RPS Energy Services Pty Ltd.

McPherson, C.R. and S.B. Martin. 2018. *Characterisation of Polarcus 2380 in³ Airgun Array*. Document 001599, Version 1.0. Technical report by JASCO Applied Sciences for Polarcus Asia Pacific Pte Ltd.

Mueller-Blenkle, C., P.K. McGregor, A.B. Gill, M.H. Andersson, J. Metcalfe, V. Bendall, P. Sigray, D.T. Wood, and F. Thomsen. 2010. *Effects of Pile-driving Noise on the Behaviour of Marine Fish*. COWRIE Ref: Fish 06-08; Cefas Ref: C3371. 62 p. https://dspace.lib.cranfield.ac.uk/handle/1826/8235.

Nedwell, J.R. and A.W. Turnpenny. 1998. The use of a generic frequency weighting scale in estimating environmental effect. *Workshop on Seismics and Marine Mammals*. 23–25 Jun 1998, London, UK.

Nedwell, J.R., A.W. Turnpenny, J. Lovell, S.J. Parvin, R. Workman, J.A.L. Spinks, and D. Howell. 2007. *A validation of the* $dB_{ht}$ *as a measure of the behavioural and auditory effects of underwater noise*. Document 534R1231 Report by Subacoustech Ltd. for Chevron Ltd, TotalFinaElf Exploration UK PLC, Department of Business, Enterprise and Regulatory Reform, Shell UK Exploration and Production Ltd, The Industry Technology Facilitator, Joint Nature Conservation Committee, and The UK Ministry of Defence. 74 p. https://tethys.pnnl.gov/sites/default/files/publications/Nedwell-et-al-2007.pdf.

Nehls, G., A. Rose, A. Diederichs, M.A. Bellmann, and H. Pehlke. 2016. Noise Mitigation During Pile Driving Efficiently Reduces Disturbance of Marine Mammals. (Chapter 92) *In* Popper, A.N. and A.D. Hawkins (eds.). *The Effects of Noise on Aquatic Life II*. Volume 875. Springer, NY, USA. pp. 755-762. https://doi.org/10.1007/978-1-4939-2981-8_92.

NOAA Fisheries. 2021. *Giant Manta Ray (Manta birostris)* (web page), 29 Dec 2021. https://www.fisheries.noaa.gov/species/giant-manta-ray.

NOAA Fisheries. 2022. *Atlantic Salmon (Protected) (Salmo salar)* (web page), 25 Feb 2022. https://www.fisheries.noaa.gov/species/atlantic-salmon-protected.

O'Neill, C., D. Leary, and A. McCrodan. 2010. Sound Source Verification. (Chapter 3) *In* Blees, M.K., K.G. Hartin, D.S. Ireland, and D.E. Hannay (eds.). *Marine mammal monitoring and mitigation during open water seismic exploration by Statoil USA E&P Inc. in the Chukchi Sea, August-October 2010: 90-day report*. LGL Report P1119. Technical report by LGL Alaska Research Associates Inc., LGL Ltd., and JASCO Applied Sciences Ltd. for Statoil USA E&P Inc., National Marine Fisheries Service (US), and US Fish and Wildlife Service. pp. 1–34.

Parks, S.E., C.W. Clark, and P.L. Tyack. 2007. Short-and long-term changes in right whale calling behavior: The potential effects of noise on acoustic communication. *Journal of the Acoustical Society of America* 122(6): 3725–3731. https://doi.org/10.1121/1.2799904.

Pile Dynamics, Inc. 2010. GRLWEAP. https://www.pile.com/.

Popper, A.N., A.D. Hawkins, R.R. Fay, D.A. Mann, S. Bartol, T.J. Carlson, S. Coombs, W.T. Ellison, R.L. Gentry, et al. 2014. *Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI*. ASA S3/SC1.4 TR-2014. SpringerBriefs in Oceanography. ASA Press and Springer. https://doi.org/10.1007/978-3-319-06659-2.

Popper, A.N. and A.D. Hawkins. 2019. An overview of fish bioacoustics and the impacts of anthropogenic sounds on fishes [Review paper]. *Journal of Fish Biology* 94(5): 692-713. https://doi.org/10.1111/jfb.13948.

Purser, J. and A.N. Radford. 2011. Acoustic noise induces attention shifts and reduces foraging performance in three-spined sticklebacks (*Gasterosteus aculeatus*). *PLOS ONE* 6(2): e17478. https://doi.org/10.1371/journal.pone.0017478.

Quijano, J.E., M.E. Austin, and G.A. Warner. 2017. *Acoustic Modeling Study: Underwater Sound Levels from Marine Pile Driving in Southeast Alaska*. Document 01429, Version 1.0 Report 4000(135)B. Technical report by JASCO Applied Sciences for Alaska Department of Transportation & Public Facilities and Federal Highway Administration. http://www.dot.alaska.gov/stwddes/research/assets/pdf/4000-135b.pdf.

Racca, R., A.N. Rutenko, K.C. Bröker, and M.E. Austin. 2012a. A line in the water - design and enactment of a closed loop, model based sound level boundary estimation strategy for mitigation of behavioural impacts from a seismic survey. *11th European Conference on Underwater Acoustics*. Volume 34(3), Edinburgh, UK.

Racca, R., A.N. Rutenko, K.C. Bröker, and G. Gailey. 2012b. Model based sound level estimation and in-field adjustment for real-time mitigation of behavioural impacts from a seismic survey and post-event evaluation of sound exposure for individual whales. *In*: McMinn, T. (ed.). *Acoustics 2012*. Fremantle, Australia. http://www.acoustics.asn.au/conference_proceedings/AAS2012/papers/p92.pdf.

Racca, R., M.E. Austin, A.N. Rutenko, and K.C. Bröker. 2015. Monitoring the gray whale sound exposure mitigation zone and estimating acoustic transmission during a 4-D seismic survey, Sakhalin Island, Russia. *Endangered Species Research* 29(2): 131–146. https://doi.org/10.3354/esr00703.

Reichmuth, C.J., J.L. Mulsow, J.J. Finneran, D.S. Houser, and A.Y. Supin. 2007. Measurement and Response Characteristics of Auditory Brainstem Responses in Pinnipeds. *Aquatic Mammals* 33(1): 132–150. https://doi.org/10.1578/AM.33.1.2007.132.

Richardson, W.J., B. Würsig, and C.R. Greene, Jr. 1986. Reactions of bowhead whales, *Balaena mysticetus*, to seismic exploration in the Canadian Beaufort Sea. *Journal of the Acoustical Society of America* 79(4): 1117–1128. https://doi.org/10.1121/1.393384.

Richardson, W.J., B. Würsig, and C.R. Greene, Jr. 1990. Reactions of bowhead whales, *Balaena mysticetus*, to drilling and dredging noise in the Canadian Beaufort Sea. *Marine Environmental Research* 29(2): 135–160. https://doi.org/10.1016/0141-1136(90)90032-J.

Richardson, W.J., C.R. Greene, Jr., C.I. Malme, and D.H. Thomson. 1995. *Marine Mammals and Noise*. Academic Press, San Diego, CA, USA. 576 p. https://doi.org/10.1016/C2009-0-02253-3.

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, et al. 2016. Habitat-based cetacean density models for the U.S. Atlantic and Gulf of Mexico. *Scientific Reports* 6. https://doi.org/10.1038/srep22615.

Roberts, J.J., T.M. Yack, and P.N. Halpin. 2022. *Habitat-based marine mammal density models for the U.S. Atlantic. Version June 20, 2022. Downloaded July 19, 2022 from https://seamap.env.duke.edu/models/Duke/EC/.*

Sills, J.M., B.L. Southall, and C.J. Reichmuth. 2014. Amphibious hearing in spotted seals (*Phoca largha*): Underwater audiograms, aerial audiograms and critical ratio measurements. *Journal of Experimental Biology* 217(5): 726–734. https://doi.org/10.1242/jeb.097469.

Smith, M.E., A.B. Coffin, D.L. Miller, and A.N. Popper. 2006. Anatomical and functional recovery of the goldfish (*Carassius auratus*) ear following noise exposure. *Journal of Experimental Biology* 209(21): 4193-4202. https://doi.org/10.1242/jeb.02490.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, et al. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals* 33(4): 411–521. https://doi.org/10.1578/AM.33.4.2007.411.

Southall, B.L., J.J. Finneran, C.J. Reichmuth, P.E. Nachtigall, D.R. Ketten, A.E. Bowles, W.T. Ellison, D.P. Nowacek, and P.L. Tyack. 2019. Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. *Aquatic Mammals* 45(2): 125–232. https://doi.org/10.1578/AM.45.2.2019.125.

Stadler, J.H. and D.P. Woodbury. 2009. Assessing the effects to fishes from pile driving: Application of new hydroacoustic criteria. *Inter-Noise 2009: Innovations in Practical Noise Control*. 23–29 Aug 2009, Ottawa, Canada.

Tubelli, A.A., A. Zosuls, D.R. Ketten, and D.C. Mountain. 2012. Prediction of a mysticete audiogram via finite element analysis of the middle ear. *In* Popper, A.N. and A.D. Hawkins (eds.). *The Effects of Noise on Aquatic Life*. Volume 730. Springer, New York. pp. 57-59. https://doi.org/10.1007/978-1-4419-7311-5_12.

Warner, G.A., C. Erbe, and D.E. Hannay. 2010. Underwater Sound Measurements. (Chapter 3) *In* Reiser, C.M., D.W. Funk, R. Rodrigues, and D.E. Hannay (eds.). *Marine Mammal Monitoring and Mitigation during Open Water Shallow Hazards and Site Clearance Surveys by Shell Offshore Inc. in the Alaskan Chukchi Sea, July-October 2009: 90-Day Report*. LGL Report P1112-1. Report by LGL Alaska Research Associates Inc. and JASCO Applied Sciences for Shell Offshore Inc., National Marine Fisheries Service (US), and Fish and Wildlife Service (US). pp. 1–54.

Warner, G.A., M.E. Austin, and A.O. MacGillivray. 2017. Hydroacoustic measurements and modeling of pile driving operations in Ketchikan, Alaska [Abstract]. *Journal of the Acoustical Society of America* 141(5): 3992. https://doi.org/10.1121/1.4989141.

Wartzok, D. and D.R. Ketten. 1999. Marine Mammal Sensory Systems. (Chapter 4) *In* Reynolds, J. and S. Rommel (eds.). *Biology of Marine Mammals*. Smithsonian Institution Press, Washington, DC. pp. 117-175.

Wood, J.D., B.L. Southall, and D.J. Tollit. 2012. *PG&E offshore 3-D Seismic Survey Project Environmental Impact Report–Marine Mammal Technical Draft Report*. Report by SMRU Ltd. 121 p. https://www.coastal.ca.gov/energy/seismic/mm-technical-report-EIR.pdf.

Wysocki, L.E., S. Amoser, and F. Ladich. 2007. Diversity in ambient noise in European freshwater habitats: Noise levels, spectral profiles, and impact on fishes. *Journal of the Acoustical Society of America* 121(5): 2559–2566. https://doi.org/10.1121/1.2713661.

Zykov, M.M. and J.T. MacDonnell. 2013. *Sound Source Characterizations for the Collaborative Baseline Survey Offshore Massachusetts Final Report: Side Scan Sonar, Sub-Bottom Profiler, and the R/V Small Research Vessel experimental*. Document 00413, Version 2.0. Technical report by JASCO Applied Sciences for Fugro GeoServices, Inc. and US Bureau of Ocean Energy Management.

Sills, J.M., B.L. Southall, and C. Reichmuth. 2014. Amphibious hearing in spotted seals (*Phoca largha*): Underwater audiograms, aerial audiograms and critical ratio measurements. *Journal of Experimental Biology* 217(5): 726-734. https://doi.org/10.1242/jeb.097469.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, et al. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals* 33(4): 411-521. https://doi.org/10.1578/AM.33.4.2007.411.

Southall, B.L., J.J. Finneran, C.J. Reichmuth, P.E. Nachtigall, D.R. Ketten, A.E. Bowles, W.T. Ellison, D.P. Nowacek, and P.L. Tyack. 2019. Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. *Aquatic Mammals* 45(2): 125-232. https://doi.org/10.1578/AM.45.2.2019.125.

Stadler, J.H. and D.P. Woodbury. 2009. Assessing the effects to fishes from pile driving: Application of new hydroacoustic criteria. *Inter-Noise 2009: Innovations in Practical Noise Control*. 23-29 Aug 2009, Ottawa, Canada.

Tubelli, A.A., A. Zosuls, D.R. Ketten, and D.C. Mountain. 2012. Prediction of a mysticete audiogram via finite element analysis of the middle ear. *In* Popper, A.N. and A.D. Hawkins (eds.). *The Effects of Noise on Aquatic Life*. Volume 730. Springer, New York. pp. 57-59. https://doi.org/10.1007/978-1-4419-7311-5_12.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2011. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2010*. US Department of Commerce. NOAA Technical Memorandum NMFS-NE-219. 598 p. https://repository.library.noaa.gov/view/noaa/3831.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2013. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2012. Volume 1*. Volume 1. US Department of Commerce. NOAA Technical Memorandum NMFS-NE-223. 419 p. https://repository.library.noaa.gov/view/noaa/4375.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2015. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2014*. US Department of Commerce. NOAA Technical Memorandum NMFS-NE-232. 361 p. https://doi.org/10.7289/V5TQ5ZH0.

Warner, G.A., C. Erbe, and D.E. Hannay. 2010. Underwater Sound Measurements. (Chapter 3) *In* Reiser, C.M., D. Funk, R. Rodrigues, and D.E. Hannay (eds.). *Marine Mammal Monitoring and Mitigation during Open Water Shallow Hazards and Site Clearance Surveys by Shell Offshore Inc. in the Alaskan Chukchi Sea, July-October 2009: 90-Day Report*. LGL Report P1112-1. Report by LGL Alaska Research Associates Inc. and JASCO Applied Sciences for Shell Offshore Inc., National Marine Fisheries Service (US), and Fish and Wildlife Service (US). pp. 1-54.

Warner, G.A., M.E. Austin, and A.O. MacGillivray. 2017. Hydroacoustic measurements and modeling of pile driving operations in Ketchikan, Alaska [Abstract]. *Journal of the Acoustical Society of America* 141(5): 3992. https://doi.org/10.1121/1.4989141.

Wartzok, D. and D.R. Ketten. 1999. Marine Mammal Sensory Systems. (Chapter 4) *In* Reynolds, J. and S. Rommel (eds.). *Biology of Marine Mammals*. Smithsonian Institution Press, Washington, DC. pp. 117-175.

Wood, J.D., B.L. Southall, and D.J. Tollit. 2012. *PG&E offshore 3-D Seismic Survey Project Environmental Impact Report–Marine Mammal Technical Draft Report*. Report by SMRU Ltd. 121 p. https://www.coastal.ca.gov/energy/seismic/mm-technical-report-EIR.pdf.

Wysocki, L.E., S. Amoser, and F. Ladich. 2007. Diversity in ambient noise in European freshwater habitats: Noise levels, spectral profiles, and impact on fishes. *Journal of the Acoustical Society of America* 121(5): 2559-2566. https://doi.org/10.1121/1.2713661.

Zhang, Z.Y. and C.T. Tindle. 1995. Improved equivalent fluid approximations for a low shear speed ocean bottom. *Journal of the Acoustical Society of America* 98(6): 3391-3396. https://doi.org/10.1121/1.413789.

Zykov, M.M. and J.T. MacDonnell. 2013. *Sound Source Characterizations for the Collaborative Baseline Survey Offshore Massachusetts Final Report: Side Scan Sonar, Sub-Bottom Profiler, and the R/V Small Research Vessel experimental*. Document Number 00413, Version 2.0. Technical report by JASCO Applied Sciences for Fugro GeoServices, Inc. and the (US) Bureau of Ocean Energy Management.

# Glossary of Acoustics Terms

### 1/3-octave

One third of an octave. *Note*: A one-third octave is approximately equal to one decidecade (1/3 oct ≈1.003 ddec).

### 1/3-octave-band

Frequency band whose bandwidth is one 1/3-octave. *Note*: The bandwidth of a 1/3-octave-band increases with increasing center frequency.

### absorption

The reduction of sound amplitude due to sound pressure energy converting to heat in the propagation medium.

### acoustic noise

Sound that interferes with an acoustic process.

### agent-based modeling

A computer simulation of autonomous agents (sometimes called animats) acting in an environment, used to assess the agents' experience of the environment and/or their effect on the environment. See also animal movement modeling.

### ambient sound

Sound that would be present in the absence of a specified activity, usually a composite of sound from many sources near and far, e.g., shipping vessels, seismic activity, precipitation, sea ice movement, wave action, and biological activity.

### animal movement modeling

Simulation of animal movement based on behavioral rules for the purpose of predicting an animal's experience of an environment. A type of agent-based modeling.

### attenuation

The gradual loss of acoustic energy from absorption and scattering as sound propagates through a medium.

### auditory frequency weighting

The process of applying an auditory frequency-weighting function. In human audiometry, C-weighting is the most used function. An example for marine mammals are the auditory frequency-weighting functions published by Southall et al. (2007).

### auditory frequency-weighting function

Frequency-weighting function describing a compensatory approach accounting for a species' (or functional hearing group's) frequency-specific hearing sensitivity.

**A-weighting**

Frequency-selective weighting for human hearing in air that is derived from the inverse of the idealized 40-phon equal loudness hearing function across frequencies.

**azimuth**

A horizontal angle relative to a reference direction, which is often magnetic north or the direction of travel. In navigation it is also called bearing.

**bandwidth**

A range within a continuous band of frequencies. Unit: hertz (Hz).

**boxcar averaging**

A signal smoothing technique that returns the averages of consecutive segments of a specified width.

**broadband level**

The total level measured over a specified frequency range.

**cetacean**

An animal in the order Cetacea. Cetaceans are aquatic species and include whales, dolphins, and porpoises.

**compressional wave**

A mechanical vibration wave in which the direction of particle motion is parallel to the direction of propagation. Also called primary wave or P-wave. Shear waves in the seabed can be converted to compressional waves in water at the water-seabed interface.

**continuous sound**

A sound whose sound pressure level remains above the background noise during the observation period. A sound that gradually varies in intensity with time, e.g., sound from a marine vessel.

**decade**

Logarithmic frequency interval whose upper bound is ten times larger than its lower bound (ISO 80000-3:2006).

**decibel (dB)**

Unit of level used to express the ratio of one value of a power quantity to another on a logarithmic scale.

**decidecade**

One tenth of a decade. Approximately equal to one third of an octave (1 ddec ≈ 0.3322 oct), and for this reason is sometimes referred to as a 1/3-octave.

**decidecade band**

Frequency band whose bandwidth is one decidecade. *Note*: The bandwidth of a decidecade band increases with increasing center frequency.

**delphinid**

Member of the family of oceanic dolphins, or Delphinidae, composed of approximately 30 extant species, including dolphins, porpoises, and killer whales.

**energy source level**

A property of a sound source equal to the sound exposure level measured in the far field plus the propagation loss from the acoustic center of the source to the receiver position. Unit: decibel (dB). reference value: 1 μPa$^2$ m$^2$ s.

**ensonified**

Exposed to sound.

**far field**

The zone where, to an observer, sound originating from an array of sources (or a spatially distributed source) appears to radiate from a single point.

**frequency**

The rate of oscillation of a periodic function measured in cycles-per-unit-time. The reciprocal of the period. Unit: hertz (Hz). Symbol: $f$. 1 Hz is equal to 1 cycle per second.

**frequency weighting**

The process of applying a frequency-weighting function.

**frequency-weighting function**

The squared magnitude of the **sound pressure** transfer function. For sound of a given frequency, the frequency-weighting function is the ratio of output power to input power of a specified filter, sometimes expressed in decibels. Examples include the following:

- *Auditory frequency-weighting function*: compensatory frequency-weighting function accounting for a species' (or functional hearing group's) frequency-specific hearing sensitivity.
- *System frequency-weighting function*: frequency-weighting function describing the sensitivity of an acoustic recording system, typically consisting of a hydrophone, one or more amplifiers, and an analog-to-digital converter.

**geoacoustic**

Relating to the acoustic properties of the seabed.

**hearing group**

Category of animal species when classified according to their hearing sensitivity and their susceptibility to sound. Examples for marine mammals include very low-frequency (VLF) cetaceans, low-frequency (LF) cetaceans, mid-frequency (MF) cetaceans, high-frequency (HF) cetaceans, very high-frequency (VHF) cetaceans, otariid pinnipeds in water (OPW), phocid pinnipeds in water (PPW), sirenians (SI), other marine carnivores in air (OCA), and other marine carnivores in water (OCW) (NMFS 2018, Southall et al. 2019). See auditory frequency-weighting functions, which are often applied to these groups. Examples for fish include species for which the swim bladder is involved in hearing, species for which the swim bladder is not involved in hearing, and species without a swim bladder (Popper et al. 2014).

**hearing threshold**

For a given species or hearing group, the sound pressure level for a given frequency that is barely audible (i.e., that would be barely audible for a given individual for specified background noise during a specific percentage of experimental trials).

**hertz (Hz)**

A unit of frequency defined as one cycle per second.

**high-frequency (HF) cetaceans**

See hearing group.

**intermittent sound**

A sound whose level abruptly drops below the background noise level several times during an observation period.

**impulsive sound**

Qualitative term meaning sounds that are typically transient, brief (less than 1 s), broadband, with rapid rise time and rapid decay. They can occur in repetition or as a single event. Examples of impulsive sound sources include explosives, seismic airguns, and impact pile drivers.

**isopleth**

A line drawn on a map through all points having the same value of some quantity.

**level**

A measure of a quantity expressed as the logarithm of the ratio of the quantity to a specified reference value of that quantity. For example, a value of sound pressure level with reference to 1 $\mu Pa^2$ can be written in the form *x* dB re 1 $\mu Pa^2$.

**low-frequency (LF) cetaceans**

See hearing group.

**mid-frequency (MF) cetacean**

See hearing group.

**Monte Carlo simulation**

A method of investigating the distribution of a non-linear multi-variate function by random sampling of all of its input variable distributions.

**multiple linear regression**

A statistical method that seeks to explain the response of a dependent variable using multiple explanatory variables.

**M-weighting**

A set of auditory frequency-weighting functions proposed by Southall et al. (2007).

### mysticete

A suborder of cetaceans that use baleen plates to filter food from water. Members of this group include rorquals (Balaenopteridae), right whales (Balaenidae), and grey whales (*Eschrichtius robustus*).

### non-impulsive sound

Sound that is not an impulsive sound. A non-impulsive sound is not necessarily a continuous sound.

### octave

The interval between a sound and another sound with double or half the frequency. For example, one octave above 200 Hz is 400 Hz, and one octave below 200 Hz is 100 Hz.

### odontocete

Whales that have teeth rather than baleen. Members of the Odontoceti are a suborder of cetaceans, a group comprised of whales, dolphins, and porpoises. The skulls of toothed whales are mostly asymmetric, an adaptation for their echolocation. This group includes sperm whales, killer whales, belugas, narwhals, dolphins, and porpoises.

### otariid

A common term used to describe members of the Otariidae, eared seals, commonly called sea lions and fur seals. Otariids are adapted to a semi-aquatic life; they use their large fore flippers for propulsion. Their ears distinguish them from phocids. Otariids are one of the three main groups in the superfamily Pinnipedia; the other two groups are phocids and walrus.

### parabolic equation method

A computationally efficient solution to the acoustic wave equation that is used to model propagation loss. The parabolic equation approximation omits effects of back-scattered sound, simplifying the computation of propagation loss. The effect of back-scattered sound is negligible for most ocean-acoustic propagation problems.

### particle acceleration

See sound particle acceleration.

### particle velocity

See sound particle velocity.

### peak sound pressure level (PK), zero-to-peak sound pressure level

The level ($L_{\rm pk}$) of the squared maximum magnitude of the sound pressure ($p_{\rm pk}^2$) in a stated frequency band and time window. Defined as $L_{\rm pk} = 10log_{10}(p_{\rm pk}^2/p_0^2) = 20log_{10}(p_{pk}/p_0)$. Unit: decibel (dB). Reference value ($p_0^2$) for sound in water: 1 µPa$^2$.

### permanent threshold shift (PTS)

An irreversible loss of hearing sensitivity caused by excessive noise exposure. Considered auditory injury. Compare to temporary threshold shift.

### phocid

A common term used to describe all members of the family Phocidae. These true/earless seals are more adapted to in-water life than are otariids, which have more terrestrial adaptations. Phocids use their hind flippers to propel themselves. Phocids are one of the three main groups in the superfamily Pinnipedia; the other two groups are otariids and walrus.

### pinniped

A common term used to describe all three groups that form the superfamily Pinnipedia: phocids (true seals or earless seals), otariids (eared seals or fur seals and sea lions), and walrus.

### point source

A source that radiates sound as if from a single point.

### power spectral density

Generic term, formally defined as power in a unit frequency band. Unit: watt per hertz (W/Hz). The term is sometimes loosely used to refer to the spectral density of other parameters such as squared sound pressure. Ratio of energy spectral density, $E_f$, to time duration, $\Delta t$, in a specified temporal observation window. In equation form, the power spectral density $P_f$ is given by $P_f = E_f/\Delta t$. Power spectral density can be expressed in terms of various field variables (e.g., **sound pressure**).

### pressure, acoustic

The deviation from the ambient pressure caused by a sound wave. Also called **sound pressure**.
Unit: pascal (Pa).

### pressure, hydrostatic

The pressure at any given depth in a static liquid that is the result of the weight of the liquid acting on a unit area at that depth, plus any pressure acting on the surface of the liquid. Unit: pascal (Pa).

### propagation loss (PL)

Difference between a source level (SL) and the level at a specified location, $\mathrm{PL}(x) = \mathrm{SL} - \mathrm{L}(x)$.
Unit: decibel (dB). See also transmission loss.

### received level

The level of a given field variable measured (or that would be measured) at a defined location.

### reference value

Standard value of a quantity used for calculating underwater sound level. The reference value depends on the quantity for which the level is being calculated:

| Quantity | Reference value |
|---|---|
| Sound pressure | $p_0^2$ = 1 μPa$^2$ or $p_0$ = 1 μPa |
| Sound exposure | $E_0$ = 1 μPa$^2$ s |
| Sound particle displacement | $\delta_0^2$ = 1 pm$^2$ |
| Sound particle velocity | $u_0^2$ = 1 nm$^2$/s$^2$ |
| Sound particle acceleration | $a_0^2$ = 1 μm$^2$/s$^4$ |

### shear wave

A mechanical vibration wave in which the direction of particle motion is perpendicular to the direction of propagation. Also called a secondary wave or S-wave. Shear waves propagate only in solid media, such as sediments or rock. Shear waves in the seabed can be converted to compressional waves in water at the water-seabed interface.

### sound

A time-varying disturbance in the pressure, stress, or material displacement of a medium propagated by local compression and expansion of the medium.

### sound exposure

Time integral of squared **sound pressure** over a stated time interval. The time interval can be a specified time duration (e.g., 24 h) or from start to end of a specified event (e.g., a pile strike, an airgun pulse, a construction operation). Unit: pascal squared second (Pa$^2$ s). Symbol: $E$.

### sound exposure level (SEL)

The level ($L_E$) of the sound exposure ($E$) in a stated frequency band and time window: $L_E = 10\log_{10}(E/E_0)$. Unit: decibel (dB). **Reference value** ($E_0$) for sound in water: 1 µPa$^2$ s.

### sound field

Region containing sound waves.

### sound particle acceleration

The rate of change of sound particle velocity. Unit: meter per second squared (m/s$^2$). Symbol: $a$.

### sound particle velocity

The velocity of a particle in a material moving back and forth in the direction of the pressure wave. Unit: meter per second (m/s). Symbol: $u$.

### sound pressure

The contribution to total pressure caused by the action of sound (ISO 18405:2017). Unit: pascal (Pa). Symbol: $p$.

### sound pressure level (SPL), rms sound pressure level

The level ($L_p$) of the time-mean-square **sound pressure** ($p_{\mathrm{rms}}^2$) in a stated frequency band and time window: $L_p = 10\log_{10}(p_{\mathrm{rms}}^2/p_0^2) = 20\log_{10}(p_{rms}/p_0)$, where rms is the abbreviation for root-mean-square. Unit: decibel (dB). **Reference value** ($p_0^2$) for sound in water: 1 µPa$^2$.

### sound speed profile

The speed of sound in the water column as a function of depth below the water surface.

### source level (SL)

A property of a sound source equal to the sound pressure level measured in the far field plus the propagation loss from the acoustic center of the source to the receiver position. Unit: decibel (dB). **Reference value**: 1 μPa$^2$ m$^2$.

### spectrum

An acoustic signal represented in terms of its power, energy, mean-square **sound pressure**, or sound exposure distribution with frequency.

### temporary threshold shift (TTS)

Reversible loss of hearing sensitivity caused by noise exposure. Compare with permanent threshold shift.

### transmission loss (TL)

The difference between a specified level at one location and that at a different location: $\mathrm{TL}(x_1,x_2) = L(x_1) - L(x_2)$. Unit: decibel (dB). See also propagation loss.

### unweighted

Term indicating that no frequency-weighting function is applied.

# Appendix A. Summary of Acoustic Assessment Assumptions

The amount of sound generated during pile installation varies with the energy required to drive the piles to the desired depth, which depends on the sediment resistance encountered. Sediment types with greater resistance require pile drivers that deliver higher energy strikes and driving pressure. Maximum sound levels from pile installation usually occur during the last stage of driving (Betke 2008). The representative make and model of impact and vibratory hammers, and the hammering energy schedule, were provided by the client.

Vineyard Northeast is expected to install different WTG monopile foundations consisting of single, uniform piles. For monopile foundation models, piles are assumed to be vertical and driven to penetration depths of 148 ft (45 m) for uniform 14 m piles. OSS jacket foundations are also expected to be installed in the Lease Area. For such installations, uniform pin piles were also assumed to be vertical and driven to penetration depths of 263 ft (80 m) at all locations. While monopile and pin pile penetrations across the Lease Area will vary, these values were chosen as maximum penetration depths. The estimated number of strikes required to install piles to completion were obtained from the Proponent in consultation with potential hammer suppliers. All acoustic evaluation was performed assuming that only one pile is driven at a time. Modeling input, assumptions, and methods are listed in Table A-1. For each pile, a difficult-to-drive scenario containing higher hammer energies was additionally modeled. In cases where pile driving source model assumptions differ between typical and difficult-to-drive scenarios, the difficult-to-drive assumptions are provided in parentheses following the typical scenario values. Sound from the piling barge was not included in the model.

Table A-1. Details of model inputs and assumptions, for the expected installation of 14m monopile

| Parameter | Description |
|---|---|
| Modeling method | Finite-difference structural model of pile vibration based on thin-shell theory; Hammer forcing functions computed using GRLWEAP |
| Vibratory hammer frequency | 23.3 Hz |
| Number of clamps | 20 |
| Weight of individual clamps | 65.7 kN |
| Time of vibratory installation | 30 min |
| Impact hammer energy | 5500 kJ (6600 kJ) |
| Ram weight | 2726 kN |
| Helmet weight | 2351 kN |
| Strike rate ($min^{-1}$) | 30 |
| Estimated number of strikes to drive pile | 7900 |
| Expected maximum penetration | 45 m |
| Modeled seabed penetration per energy level | 10, 10, 15 m |
| Pile length | 144 m |
| Pile diameter | 14 m |
| Pile wall thickness | 20 cm (uniform) |
| Shaft resistance | 32, 43, 53% (for each energy level in increasing order of soil penetration) |

Table A-2. Details of model inputs and assumptions, for the expected installation of 4m jacket foundation

| Parameter | Description |
|---|---|
| Modeling method | Finite-difference structural model of pile vibration based on thin-shell theory; Hammer forcing functions computed using GRLWEAP |
| Vibratory hammer frequency | 23.3 Hz |
| Number of clamps | 6 |
| Weight of individual clamps | 65.7 kN |
| Time of vibratory installation | 30 min |
| Impact hammer energy | 3500 kJ (3500 kJ) |
| Ram weight | 1719 kN |
| Helmet weight | 2351 kN |
| Strike rate ($min^{-1}$) | 48/ 4 pin piles; 113/ 8 pin piles |
| Estimated number of strikes to drive pile | 15200 (14800) |
| Expected maximum penetration | 80 m |
| Modeled seabed penetration per energy level | 10, 10, 10, 10, 10, 20 m (10, 10, 10, 10, 10, 20 m) |
| Pile length | 87 m |
| Pile diameter | 4 m |
| Pile wall thickness | 10 cm (uniform) |
| Shaft resistance | 49, 61, 67, 72, 75, 80% (49, 61, 67, 72, 75, 80%) (for each energy level in increasing order of soil penetration) |

Table A-3. Details of model inputs and assumptions, for the expected installation of 4.25m jacket foundation

| Parameter | Description |
|---|---|
| Modeling method | Finite-difference structural model of pile vibration based on thin-shell theory; Hammer forcing functions computed using GRLWEAP |
| Vibratory hammer frequency | 23.3 Hz |
| Number of clamps | 8 |
| Weight of individual clamps | 65.7 kN |
| Time of vibratory installation | 30 min |
| Impact hammer energy | 3500 kJ (3500 kJ) |
| Ram weight | 1719 kN |
| Helmet weight | 2351 kN |
| Strike rate ($min^{-1}$) | 48/ 4 pin piles; 113/ 8 pin piles |
| Estimated number of strikes to drive pile | 15,200 |
| Expected maximum penetration | 80 m |
| Modeled seabed penetration per energy level | 10, 10, 10, 10, 10, 10, 10 m (10, 10, 10, 10, 20, 10 m) |
| Pile length | 99 m |
| Pile diameter | 4.25 m |
| Pile wall thickness | 10 cm (uniform) |
| Shaft resistance | 49, 61, 67, 72, 75, 78, 80% (33, 49, 61, 67, 72%)<br>(for each energy level in increasing order of soil penetration) |

Table A-4. Details of the environmental parameter model inputs and assumptions, for the expected installation of all pile types.

| Parameter | Description |
|---|---|
| Sound speed profile | GDEM data averaged over region |
| Bathymetry | SRTM 15 data |
| Geoacoustics | Elastic seabed properties based on client-supplied description of seabed layering |
| Quake (shaft and toe) | 2.54 mm |
| Shaft damping | 0.164 s/m |
| Toe damping | 0.49 s/m |

Table A-5. Details of the sound propagation model inputs and assumptions, for the expected installation of all pile types.

| Parameter | Description |
|---|---|
| Modeling method | FWRAM full-waveform parabolic equation propagation model with 22.5° azimuthal resolution and 10 m range resolution |
| Source representation | Vertical line array |
| Frequency range | 10–25,000 Hz |
| Synthetic trace length | Monopiles: 400 ms (14 m pile)<br>Jacket: 750 ms |
| Maximum modeled range | 90 km |

# Appendix B. Underwater Acoustics

This section provides a detailed description of the acoustic metrics and decidecade frequency bands relevant to the modeling study and the modeling methodology.

## B.1. Acoustic Metrics

Underwater sound pressure amplitude is measured in decibels (dB) relative to a fixed reference pressure of $p_0$ = 1 μPa in water and $p_0$ = 20 μPa in air. Because the perceived loudness of sound, especially impulsive noise such as from seismic airguns, pile driving, and sonar, is not generally proportional to the instantaneous acoustic pressure, several sound level metrics are commonly used to evaluate noise and its effects on marine life. Here we provide specific definitions of relevant metrics used in the accompanying report. Where possible, we follow ISO standard definitions and symbols for sound metrics (e.g., ISO 2017).

The zero-to-peak sound pressure level, or peak sound pressure level (PK or $L_{\text{pk}}$; dB re 1 μPa), is the decibel level of the maximum instantaneous acoustic pressure in a stated frequency band attained by an acoustic pressure signal, $p(t)$:

$$L_{p,\text{pk}} = 10\log_{10}\frac{\max|p^2(t)|}{p_0^2} = 20\log_{10}\frac{\max|p(t)|}{p_0} \tag{B-1}$$

PK is often included as a criterion for assessing whether a sound is potentially injurious; however, because it does not account for the duration of a noise event, it is generally a poor indicator of perceived loudness.

The sound pressure level (SPL or $L_p$; dB re 1 μPa) is the root-mean-square (rms) pressure level in a stated frequency band over a specified time window ($T$; s). It is important to note that SPL always refers to a rms pressure level and therefore not instantaneous pressure:

$$L_{p,\text{pk-pk}} = 10\log_{10}\frac{[\max(p(t)) - \min(p(t))]^2}{p_0^2} \tag{B-2}$$

where $g(t)$ is an optional time weighting function. In many cases, the start time of the integration is marched forward in small time steps to produce a time-varying $L_p$ function. For short acoustic events, such as sonar pulses and marine mammal vocalizations, it is important to choose an appropriate time window that matches the duration of the signal. For in-air studies, when evaluating the perceived loudness of sounds with rapid amplitude variations in time, the time weighting function $g(t)$ is often set to a decaying exponential function that emphasizes more recent pressure signals. This function mimics the leaky integration nature of mammalian hearing. For example, human-based fast time-weighted $L_p$ ($L_{p,\text{fast}}$) applies an exponential function with time constant 125 ms. A related simpler approach used in underwater acoustics sets $g(t)$ to a boxcar (unity amplitude) function of width 125 ms; the results can be referred to as $L_{p,\text{boxcar 125ms}}$. Another approach, historically used to evaluate $L_p$ of impulsive signals underwater, defines $g(t)$ as a boxcar function with edges set to the times corresponding to 5% and 95% of the cumulative square pressure function encompassing the duration of an impulsive acoustic event. This calculation is applied individually to each impulse signal, and the results have been referred to as 90% SPL ($L_{p,90\%}$).

The sound exposure level (SEL or $L_E$; dB re 1 µPa²·s) is the time-integral of the squared acoustic pressure over a duration ($T$):

$$L_E = 10 \log_{10}\left( \int_T p^2(t)\, dt \Big/ T_0 p_0^2 \right) \text{dB} \tag{B-3}$$

where $T_0$ is a reference time interval of 1 s. $L_E$ continues to increase with time when non-zero pressure signals are present. It is a dose-type measurement, so the integration time applied must be carefully considered in terms of relevance for impact to the exposed recipients.

SEL can be calculated over a fixed duration, such as the time of a single event or a period with multiple acoustic events. When applied to impulsive sounds, SEL can be calculated by summing the SEL of the *N* individual pulses. For a fixed duration, the square pressure is integrated over the duration of interest. For multiple events, the SEL can be computed by summing (in linear units) the SEL of the *N* individual events:

$$L_{E,N} = 10 \log_{10}\left( \sum_{i=1}^{N} 10^{\frac{L_{E,i}}{10}} \right) \text{dB} \tag{B-4}$$

## B.2. Decidecade Band Analysis

The distribution of a sound's power with frequency is described by the sound's spectrum. The sound spectrum can be split into a series of adjacent frequency bands. Splitting a spectrum into 1 Hz wide bands, called passbands, yields the power spectral density of the sound. This splitting of the spectrum into passbands of a constant width of 1 Hz, however, does not represent how animals perceive sound.

Because animals perceive exponential increases in frequency rather than linear increases, analyzing a sound spectrum with passbands that increase exponentially in size better approximates real-world scenarios. In underwater acoustics, a spectrum is commonly split into decidecade bands, which are approximately one-tenth of a decade wide and often referred to as 1/3-octave-bands. Each octave represents a doubling in sound frequency. The center frequency of the *i*th band, $fc(i)$, is defined as:

$$f_c(i) = 10^{\frac{i}{10}}\ \text{kHz} \tag{B-5}$$

and the low ($f_{lo}$) and high ($f_{hi}$) frequency limits of the *i*th decade band are defined as:

$$f_{\text{lo},i} = 10^{\frac{-1}{20}} f_c(i) \quad \text{and} \quad f_{\text{hi},i} = 10^{\frac{1}{20}} f_c(i) \tag{B-6}$$

The decidecade bands become wider with increasing frequency, and on a logarithmic scale the bands appear equally spaced (Figure B-1). The acoustic modeling spans from band −20 ($f_c$ (−20) = 0.010 kHz) to band 14 ($f_c$ (14) = 25 kHz).

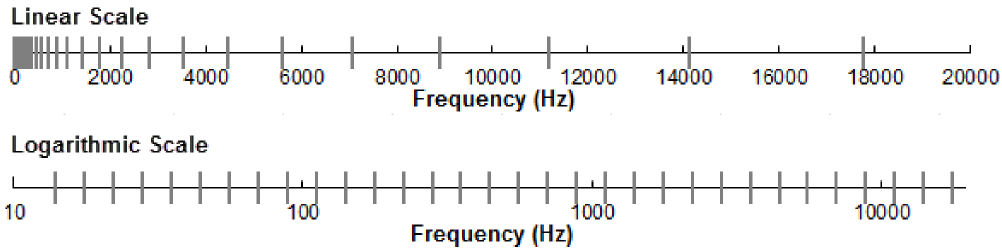



Figure B-1. Decidecade frequency bands (vertical lines) shown on a linear frequency scale and on a logarithmic scale.

The sound pressure level in the *i*th band ($L_{p,i}$) is computed from the spectrum $S(f)$ between $f_{10,i}$ and $f_{hl,i}$:

$$L_{p,i} = 10\log_{10}\int_{f_{lo,i}}^{f_{hi,i}} S(f)\,df \tag{B-7}$$

Summing the sound pressure level of all the bands yields the broadband sound pressure level:

$$\text{Broadband SPL} = 10\log_{10}\sum_{i} 10^{\frac{L_{p,i}}{10}} \tag{B-8}$$

Figure B-2 shows an example of how the decidecade band sound pressure levels compare to the sound pressure spectral density levels of an ambient noise signal. Because the decidecade bands are wider with increasing frequency, the decidecade band SPL is higher than the spectral levels, especially at higher frequencies. Acoustic modeling of decidecade bands require less computation time than 1 Hz bands and still resolves the frequency-dependence of the sound source and the propagation environment.

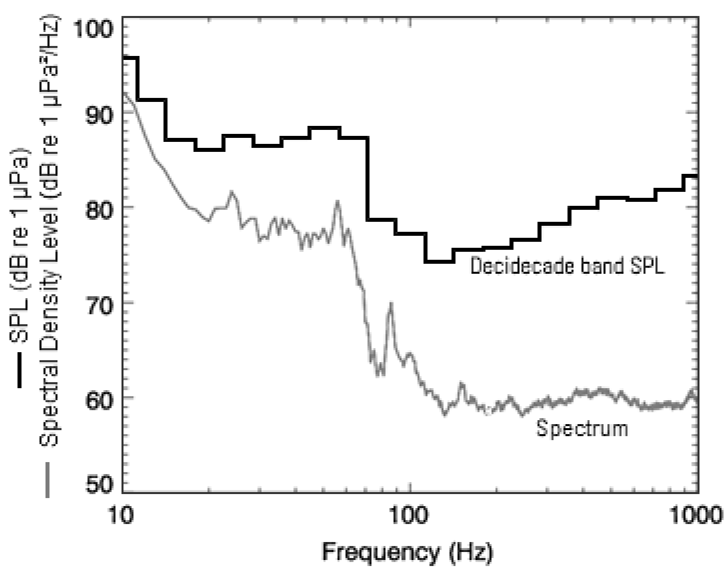



Figure B-2. Sound pressure spectral density levels and the corresponding decidecade band sound pressure levels of example ambient noise shown on a logarithmic frequency scale.

# Appendix C. Auditory (Frequency) Weighting Functions

Weighting functions are applied to the sound spectra under consideration to weight the importance of received sound levels at particular frequencies in a manner reflective of an animal's sensitivity to those frequencies (Nedwell and Turnpenny 1998, Nedwell et al. 2007). Southall et al. (2007) were first to suggest weighting functions and functional hearing groups for marine mammals. The Technical Guidance issued by NOAA (NMFS, 2018) includes weighting functions and associated thresholds, and is used here for determining the ranges for potential Level A harassment to marine mammals.

## C.1. Frequency Weighting Functions – Technical Guidance (NMFS 2018)

In 2015, a US Navy technical report by Finneran (2015) recommended new auditory weighting functions. The overall shape of the auditory weighting functions is similar to human A-weighting functions, which follows the sensitivity of the human ear at low sound levels. This frequency-weighting function is expressed as:

$$G(f) = K + 10\log_{10}\left[\left(\frac{(f/f_{lo})^{2a}}{\left[1+(f/f_{lo})^2\right]^a\left[1+(f/f_{hi})^2\right]^b}\right)\right] . \qquad \text{(C-1)}$$

Finneran (2015) proposed five functional hearing groups for marine mammals in water: low-, mid-, and high-frequency cetaceans, phocid pinnipeds, and otariid pinnipeds. The parameters for these frequency-weighting functions were further modified the following year (Finneran 2016) and were adopted in NOAA's technical guidance that assesses noise impacts on marine mammals (NMFS, 2018). Table C-1 lists the frequency-weighting parameters for each hearing group; Figure C-1 shows the resulting frequency-weighting curves.

Table C-1. Parameters for the auditory weighting functions recommended by NMFS (2018).

| Hearing group | a | b | $f_{lo}$ (Hz) | $f_{hi}$ (kHz) | $K$ (dB) |
|---|---|---|---|---|---|
| Low-frequency cetaceans | 1.0 | 2 | 200 | 19,000 | 0.13 |
| Mid-frequency cetaceans | 1.6 | 2 | 8,800 | 110,000 | 1.20 |
| High-frequency cetaceans | 1.8 | 2 | 12,000 | 140,000 | 1.36 |
| Phocid pinnipeds in water | 1.0 | 2 | 1,900 | 30,000 | 0.75 |
| Otariid pinnipeds in water | 2.0 | 2 | 940 | 25,000 | 0.64 |

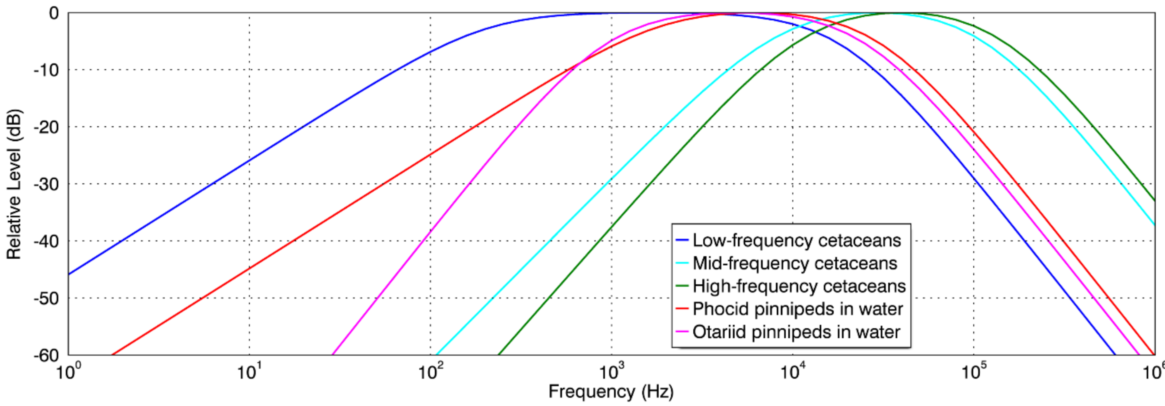



Figure C-1. Auditory weighting functions for functional marine mammal hearing groups included in NMFS (2018).

## C.2. Frequency Weighting Functions – Southall et al. (2007)

Auditory weighting functions for marine mammals were proposed by Southall et al. (2007). These so-called M-weighting functions are applied in a similar way as A-weighting for noise level assessments for humans. Functions were defined for five hearing groups of marine mammals:

- Low-frequency (LF) cetaceans—mysticetes (baleen whales)
- Mid-frequency (MF) cetaceans—some odontocetes (toothed whales)
- High-frequency (HF) cetaceans—odontocetes specialized for using high-frequencies
- Pinnipeds in water (Pw)—seals, sea lions, and walrus
- Pinnipeds in air (not addressed here)

The M-weighting functions have unity gain (0 dB) through the passband and their high- and low-frequency roll-offs are approximately –12 dB per octave. The amplitude response in the frequency domain of each M-weighting function is defined by:

$$G(f) = -20\log_{10}\left[\left(1+\frac{a^2}{f^2}\right)\left(1+\frac{f^2}{b^2}\right)\right] \quad \text{(C-2)}$$

where $G(f)$ is the weighting function amplitude (in dB) at the frequency $f$ (in Hz), and $a$ and $b$ are the estimated lower and upper hearing limits, respectively, which control the roll-off and passband of the weighting function. The parameters $a$ and $b$ are defined uniquely for each hearing group (Table C-2). Figure C-1 shows the auditory weighting functions.

Table C-2. Parameters for the auditory weighting functions recommended by Southall et al. (2007).

| Functional hearing group | $a$ (Hz) | $b$ (Hz) |
|---|---|---|
| Low-frequency cetaceans | 7 | 22,000 |
| Mid-frequency cetaceans | 150 | 160,000 |
| High-frequency cetaceans | 200 | 180,000 |
| Pinnipeds in water | 75 | 75,000 |

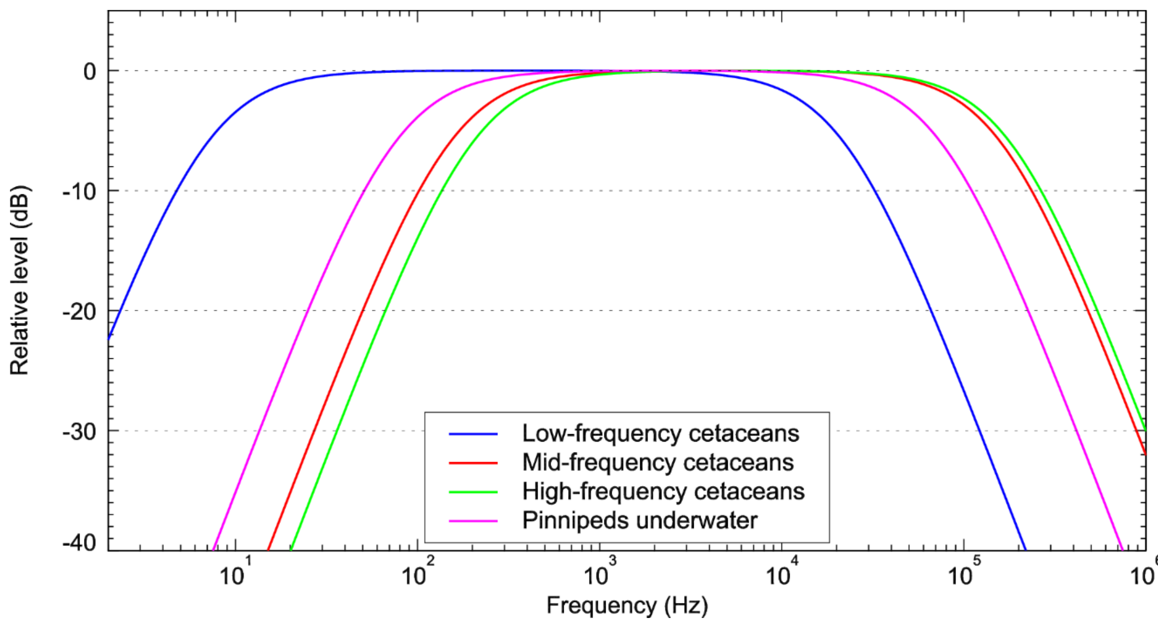



Figure C-2. Auditory weighting functions for the functional marine mammal hearing groups as recommended by Southall et al. (2007).

# Appendix D. Source Models

## D.1. Pile Driving Source Model (PDSM)

A physical model of pile vibration and near-field sound radiation is used to calculate source levels of piles. The physical model employed in this study computes the underwater vibration and sound radiation of a pile by solving the theoretical equations of motion for axial and radial vibrations of a cylindrical shell. These equations of motion are solved subject to boundary conditions, which describe the forcing function of the hammer at the top of the pile and the soil resistance at the base of the pile (Figure D-1). Damping of the pile vibration due to radiation loading is computed for Mach waves emanating from the pile wall. The equations of motion are discretised using the finite difference (FD) method and are solved on a discrete time and depth mesh.

To model the sound emissions from the piles, the force of the pile driving hammers also had to be modeled. The force at the top of each pile was computed using the GRLWEAP 2010 wave equation model (GRLWEAP, Pile Dynamics 2010), which includes a large database of simulated hammers—both impact and vibratory—based on the manufacturer's specifications. The forcing functions from GRLWEAP were used as inputs to the FD model to compute the resulting pile vibrations.

The sound radiating from the pile itself is simulated using a vertical array of discrete point sources. The point sources are centered on the pile axis. Their amplitudes are derived using an inverse technique, such that their collective particle velocity, calculated using a near-field wave-number integration model, matches the particle velocity in the water at the pile wall. The sound field propagating away from the vertical source array is then calculated using a time-domain acoustic propagation model (see Appendix E.3). MacGillivray (2014) describes the theory behind the physical model in more detail.

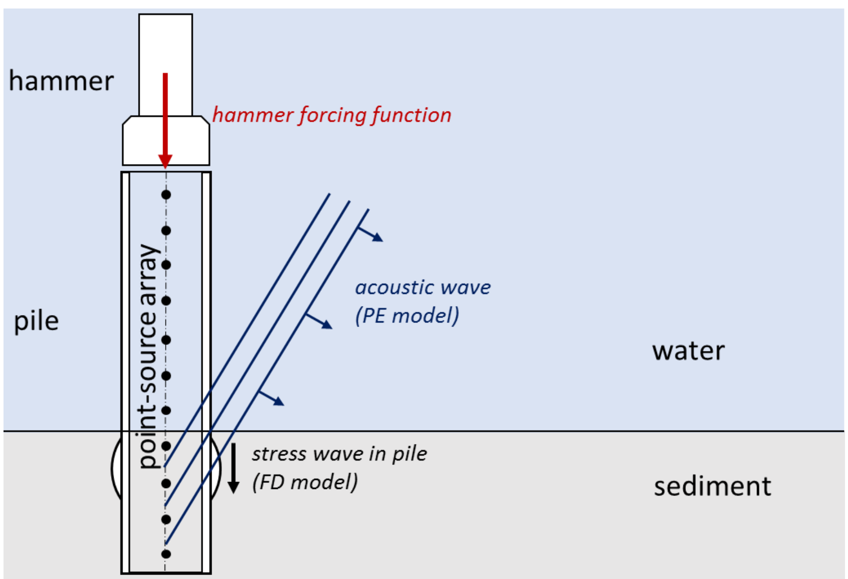



Figure D-1. Physical model geometry for impact driving of a cylindrical pile (vertical cross-section). The hammer forcing function is used with the finite difference (FD) model to compute the stress wave vibration in the pile. A vertical array of point sources is used with the parabolic equation (PE) model to compute the acoustic waves that the pile wall radiates.

# Appendix E. Sound Propagation Modeling Methodology

# E.1. Environmental Parameters

## E.1.1. Bathymetry

A bathymetry grid for the acoustic propagation model was compiled based on the Shuttle Radar Topography Mission (SRTM) data, which is referred to as SRTM-TOPO15+ (Becker et al. 2009).

## E.1.2. Geoacoustics

In shallow water environments where there is increased interaction with the seafloor, the properties of the substrate have a large influence over the sound propagation. Composition of the surficial sediments is expected to be predominantly sand, based on samples from nearby study sites. A geoacoustic profile for the area has been developed from geotechnical studies of surficial sediments commissioned by Vineyard Northeast for their project area, and from regional studies for deeper sediments. The Vineyard Northeast geotechnical studies used a vibra-coring system to extract cores through the top 5 meters of seabed sediments. Surficial sediments here are primarily silty sand to dense sand. The core samples provided density, grain size and porosity versus depth below seafloor. Table E-1 shows the sediment layer geoacoustic property profile based on the sediment type and generic porosity-depth profile using a sediment grain-shearing model (Buckingham 2005).

Over the course of several projects in the area JASCO has developed a generalized geoacoustic profile based on the available data in the area. According to the vibracore samples taken as part of the project planning the dominant surficial sediments are dense sand and silty sand. The same geoacoustics profile has been used at all five modeling sites.

Table E-1. Estimated geoacoustic properties used for modeling, as a function of depth. Within an indicated depth range, the parameter varies linearly within the stated range.

| Depth below seafloor (m) | Material | Density (g/cm$^3$) | Compressional wave Speed (m/s) | Compressional wave Attenuation (dB/λ) | Shear wave Speed (m/s) | Shear wave Attenuation (dB/λ) |
|---|---|---|---|---|---|---|
| 0–3.3 | Sand | 2.090–2.090 | 1,770–1,774 | 0.88–0.879 | 300 | 3.65 |
| 3.3–6.7 | Sand | 2.090–2.095 | 1,774–1,779 | 0.879–0.878 | 300 | 3.65 |
| 6.7–10 | Sand | 2.095–2.099 | 1,779–1,783 | 0.878–0.877 | 300 | 3.65 |
| 10–50 | Sand | 2.099–2.152 | 1,783–1,833 | 0.877–0.865 | 300 | 3.65 |
| 50–100 | Sand | 2.152–2.216 | 1,833–1,893 | 0.865–0.848 | 300 | 3.65 |
| 100–200 | Sand | 2.216–2.337 | 1,893–2,003 | 0.848–0.807 | 300 | 3.65 |
| 200–500 | Sand | 2.337–2.634 | 2,003–2,269 | 0.807–0.664 | 300 | 3.65 |
| >500 | Sand | 2.634 | 2,269 | 0.664 | 300 | 3.65 |

### E.1.3. Sound Speed Profile

The speed of sound in sea water is a function of temperature, salinity, and pressure (depth) (Coppens 1981). Sound speed profiles were obtained from the US Navy's Generalized Digital Environmental Model (GDEM; NAVO 2003). Considering the greater area around the proposed construction area and deep waters, the sound speed profiles in summer months and winter months assumed to be representative of typical propagation conditions annually (Figure E-1). An average profile, obtained by calculating the mean of June, July, and August for the summer profile and January, February, and March for winter, are shown in Figure E-1. The profiles are shown to 100 m, which encompasses all depths within the sound impact area (<90 km).These profiles were assumed to be representative of the entire area for modeling purposes.

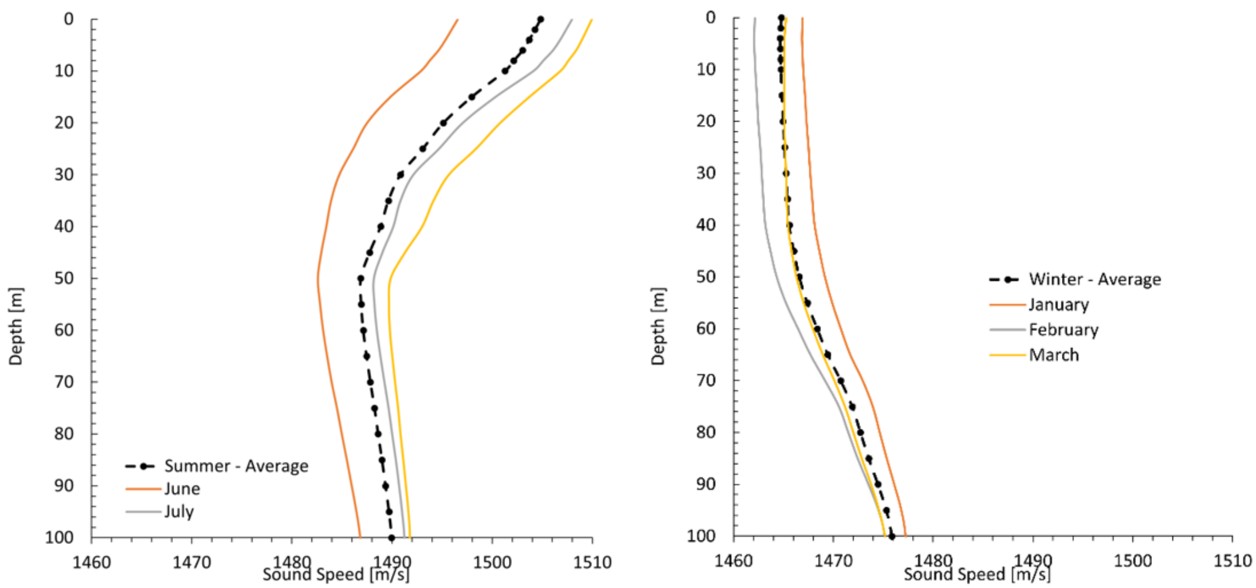



Figure E-1. Sound speed profiles up to 100 m for (left) the summer months of June through August and (right) the winter months of January through March for Vineyard Northeast. The mean profile used in the modeling was obtained by taking the average of all profiles for each season.

## E.2. Propagation Loss

The propagation of sound through the environment can be modeled by predicting the acoustic propagation loss—a measure, in decibels, of the decrease in sound level between a source and a receiver some distance away. Geometric spreading of acoustic waves is the predominant way by which propagation loss occurs. Propagation loss also happens when the sound is absorbed and scattered by the seawater, and absorbed scattered, and reflected at the water surface and within the seabed. Propagation loss depends on the acoustic properties of the ocean and seabed; its value changes with frequency.

If the acoustic energy source level $(L_{S,E})$ expressed in dB re 1 µPa²m²s, and energy propagation loss $(N_{PL,E})$ in units of dB, at a given frequency are known, then the received level $(L_{E,p})$ at a receiver location can be calculated in dB re 1 µPa²s by:

$$L_{E,p}(\theta, r) = L_{S,E}(\theta) - N_{PL,E}(\theta, r), \tag{E-1}$$

where $\theta$ defines the specific direction, and $r$ is the range of the receiver from the source.

## E.3. Sound Propagation with FWRAM

For impulsive sounds from impact pile driving, as well as non-impulsive sounds from vibratory piling, time-domain representations of the pressure waves generated in the water are required for calculating SPL and peak pressure level. Furthermore, the pile must be represented as a distributed source to accurately characterize vertical directivity effects in the near-field zone. For this study, synthetic pressure waveforms were computed using FWRAM, which is a time-domain acoustic model based on a wide-angle parabolic equation (PE). FWRAM computes synthetic pressure waveforms versus range and depth for range-varying marine acoustic environments and takes environmental inputs (bathymetry, water sound speed profile, and seabed geoacoustic profile). computes pressure waveforms via Fourier synthesis of the modeled acoustic transfer function in closely spaced frequency bands. FWRAM employs the array starter method to accurately model sound propagation from a spatially distributed source (MacGillivray and Chapman 2012).

Synthetic pressure waveforms were modeled over the frequency range 10–2048 Hz, inside a 1 s window (e.g., Figure E-2). The synthetic pressure waveforms were post-processed, after applying a travel time correction, to calculate standard SPL and $L_{pk}$ metrics versus range and depth from the source.

The acoustic field is extended to higher frequencies (up to 25,000 Hz) by applying a 20 dB/decade decay rate to match acoustic measurements of impact pile driving (Illingworth & Rodkin 2007, Matuschek and Betke 2009). The same decay rate is used for vibratory pile driving due to the lack of publicly available data from acoustic measurements made from vibratory piling of large piles.

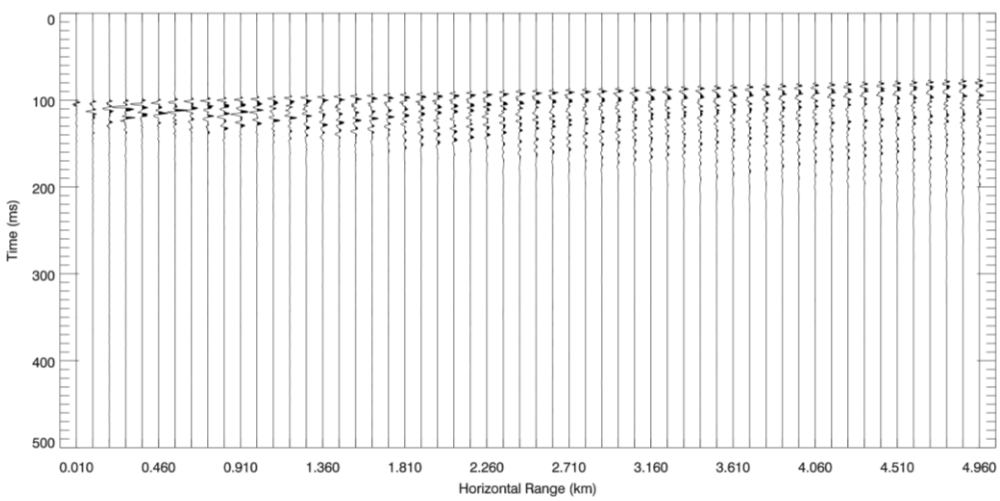



Figure E-2. Example of synthetic pressure waveforms computed by FWRAM at multiple range offsets. Receiver depth is 35 m, and the amplitudes of the pressure traces have been normalized for display purposes.

Acoustic fields in three dimensions are generated by modeling propagation loss within two-dimensional (2-D) vertical planes aligned along radials covering a 360° swath from the source, an approach commonly referred to as N×2-D (Figure E-3). These vertical radial planes are separated by an angular step size of $\Delta\theta$, yielding N = 360°/$\Delta\theta$ planes.

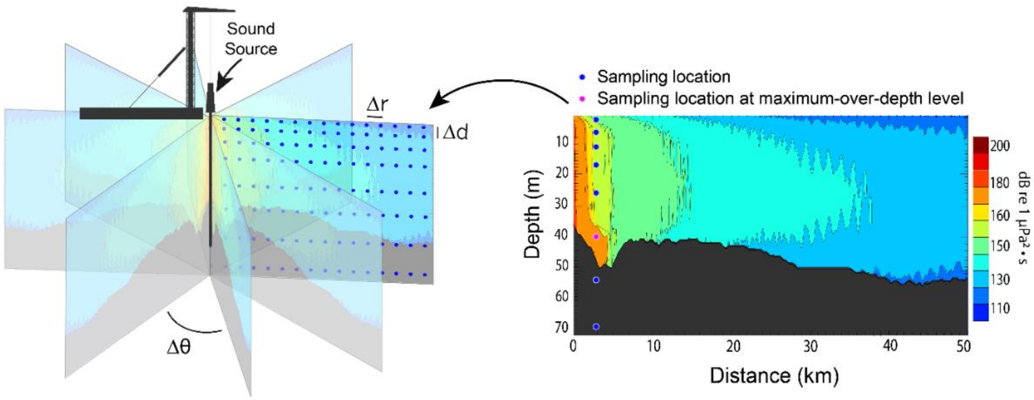
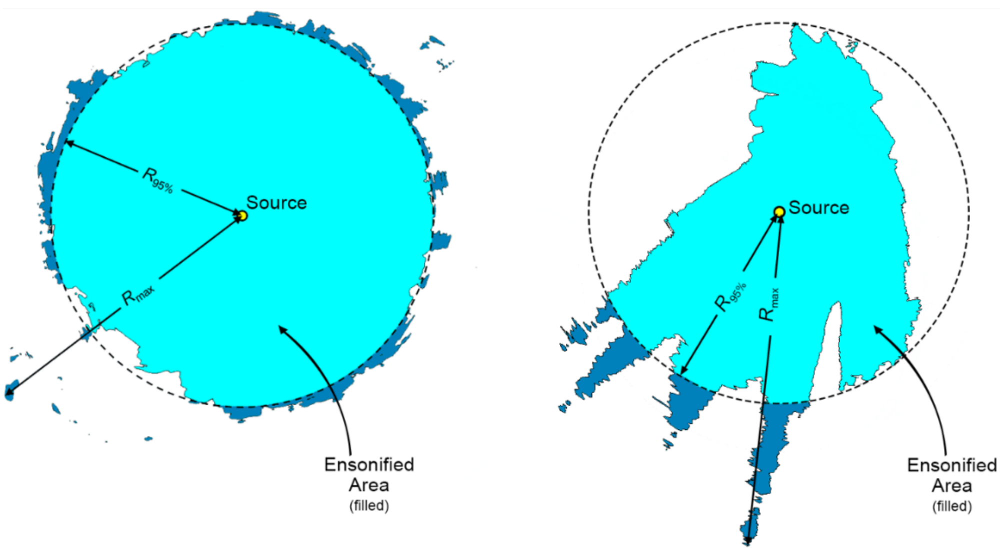



Figure E-3. Modeled three-dimensional sound field (N×2-D method) and maximum-over-depth modeling approach. Sampling locations are shown as blue dots on both figures. On the right panel, the pink dot represents the sampling location where the sound level is maximum over the water column. This maximum-over-depth level is used in calculating distances to sound level thresholds for some marine animals.

## E.4. Estimating Acoustic Range to Threshold Levels

A maximum-over depth approach is used to determine acoustic ranges to the defined thresholds (ranges to isopleths). That is, at each horizontal sampling range, the maximum received level that occurs within the water column is used as the value at that range. The ranges to a threshold typically differ along different radii and may not be continuous because sound levels may drop below threshold at some ranges and then exceed threshold at farther ranges. Figure E-4 shows an example of an area with sound levels above threshold and two methods of reporting the injury or behavioral disruption range: (1) $R_{max}$, the maximum range at which the sound level was encountered in the modeled maximum-over-depth sound field, and (2) $R_{95\%}$, the maximum range at which the sound level was encountered after the 5% farthest such points were excluded. $R_{95\%}$ is used because, regardless of the shape of the maximum-over-depth footprint, the predicted range encompasses at least 95% of the horizontal area that would be exposed to sound at or above the specified level. The difference between $R_{max}$ and $R_{95\%}$ depends on the source directivity and the heterogeneity of the acoustic environment. $R_{95\%}$ excludes ends of protruding areas or small isolated acoustic foci not representative of the nominal ensonification zone.




(a) (b)

Figure E-4. Sample areas ensonified to an arbitrary sound level with $R_{max}$ and $R_{95\%}$ ranges shown for two different scenarios. (a) Largely symmetric sound level contour with small protrusions. (b) Strongly asymmetric sound level contour with long protrusions. Light blue indicates the ensonified areas bounded by $R_{95\%}$; darker blue indicates the areas outside this boundary which determine $R_{max}$.

## E.5. Model Validation Information

Predictions from JASCO's propagation models (MONM and FWRAM) have been validated against experimental data from a number of underwater acoustic measurement programs conducted by JASCO globally, including the United States and Canadian Arctic, Canadian and southern United States waters, Greenland, Russia and Australia (Hannay and Racca 2005, Aerts et al. 2008, Funk et al. 2008, Ireland et al. 2009, O'Neill et al. 2010, Warner et al. 2010, Racca et al. 2012a, Racca et al. 2012b, Matthews and MacGillivray 2013, Martin et al. 2015, Racca et al. 2015, Martin et al. 2017a, Martin et al. 2017b, Warner et al. 2017, MacGillivray 2018, McPherson et al. 2018, McPherson and Martin 2018).

In addition, JASCO has conducted measurement programs associated with a significant number of anthropogenic activities which have included internal validation of the modeling (including McCrodan et al. 2011, Austin and Warner 2012, McPherson and Warner 2012, Austin and Bailey 2013, Austin et al. 2013, Zykov and MacDonnell 2013, Austin 2014, Austin et al. 2015, Austin and Li 2016, Martin and Popper 2016).

# Appendix F. Acoustic Range Results - Impact Pile Driving

The following subsections contain tables of acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) to marine mammal (NMFS 2018), sea turtle (Finneran et al. 2017), and fish (FHWG 2008, Stadler and Woodbury 2009, Popper et al. 2014) injury thresholds. The acoustic ranges to behavioral thresholds for marine mammals (NOAA 2005, Wood et al. 2012), sea turtles (McCauley et al. 2000a), and fish (Andersson et al. 2007, Wysocki et al. 2007, Mueller-Blenkle et al. 2010, Purser and Radford 2011) are also included. The acoustic ranges are shown for the following categories: Flat is unweighted, LF is low-frequency cetaceans, MF is mid-frequency cetaceans, HF is high-frequency cetaceans, PW is phocid pinnipeds in water, and TUW is turtles in water. TUW weighting functions are from the US Navy (Finneran et al. 2017), the rest are from the Technical Guidance (NMFS 2018). $R_{max}$ is the maximum distance at which the sound level was encountered in the modeled maximum-over-depth sound field and $R_{95\%}$ is the maximum distance at which the sound level was encountered after the 5% farthest such points were excluded (Appendix E.5).

# F.1. Impact Pile Driving Single-Strike PK Acoustic Ranges

## F.1.1. Monopile Foundation (Typical)

### F.1.1.1. 14 m Typical Monopile with and MHU 5500 Hammer

Table F-1. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | 0.02 | 0.03 | 0.04 |
| PPW | 218 | - | 0.03 | 0.04 | 0.05 |
| HF | 202 | 0.17 | 0.35 | 0.44 | 0.51 |

Table F-2. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | 0.04 | 0.08 | 0.09 | 0.11 |

Table F-3. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | 0.03 | 0.06 | 0.07 | 0.08 |

Table F-4. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | - | 0.03 | 0.05 | 0.06 |

Table F-5. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | 0.02 | 0.03 | 0.04 |
| PPW | 218 | - | 0.03 | 0.04 | 0.05 |
| HF | 202 | 0.17 | 0.34 | 0.45 | 0.52 |

Table F-6. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | 0.05 | 0.09 | 0.09 | 0.11 |

Table F-7. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | 0.03 | 0.06 | 0.08 | 0.09 |

Table F-8. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | - | 0.03 | 0.05 | 0.06 |

Table F-9. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | 0.02 | 0.06 |
| PPW | 218 | - | 0.02 | 0.06 | 0.08 |
| HF | 202 | 0.22 | 0.54 | 0.60 | 0.76 |

Table F-10. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | 0.03 | 0.12 | 0.14 | 0.16 |

Table F-11. Monopile foundation (14 m typical monopile with an MHU 5500 hammer ) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | - | 0.09 | 0.12 | 0.13 |

Table F-12. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | - | 0.02 | 0.08 | 0.09 |

Table F-13. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | 0.02 | 0.05 |
| PPW | 218 | - | 0.02 | 0.04 | 0.08 |
| HF | 202 | 0.20 | 0.53 | 0.60 | 0.73 |

Table F-14. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | 0.03 | 0.12 | 0.14 | 0.17 |

Table F-15. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | - | 0.09 | 0.12 | 0.13 |

Table F-16. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | - | 0.02 | 0.08 | 0.09 |

## F.1.2. Monopile Foundation (Difficult to Drive)

### F.1.2.1. 14 m Difficult to Drive Monopile with an MHU 5500 Hammer Scaled to 6600 kJ

Table F-17. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 2500 kJ | Hammer energy 4500 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | 0.03 | 0.04 | 0.06 | 0.06 |
| PPW | 218 | 0.03 | 0.05 | 0.06 | 0.06 |
| HF | 202 | 0.34 | 0.48 | 0.60 | 0.64 |

Table F-18. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 2500 kJ | Hammer energy 4500 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | 0.08 | 0.11 | 0.14 | 0.13 |

Table F-19. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 2500 kJ | Hammer energy 4500 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | 0.06 | 0.09 | 0.10 | 0.11 |

Table F-20. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 2500 kJ | Hammer energy 4500 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | 0.04 | 0.06 | 0.07 | 0.07 |

Table F-21. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 2500 kJ | Hammer energy 4500 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | 0.02 | 0.03 | 0.06 | 0.06 |
| PPW | 218 | 0.03 | 0.05 | 0.06 | 0.06 |
| HF | 202 | 0.34 | 0.53 | 0.65 | 0.65 |

Table F-22. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 2500 kJ | Hammer energy 4500 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | 0.09 | 0.11 | 0.13 | 0.13 |

Table F-23. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 2500 kJ | Hammer energy 4500 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | 0.06 | 0.09 | 0.10 | 0.11 |

Table F-24. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 2500 kJ | Hammer energy 4500 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | 0.03 | 0.06 | 0.07 | 0.07 |

Table F-25. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 2500 kJ | Hammer energy 4500 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | 0.03 | 0.09 | 0.09 |
| PPW | 218 | 0.02 | 0.08 | 0.10 | 0.10 |
| HF | 202 | 0.53 | 0.72 | 0.81 | 0.88 |

Table F-26. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 2500 kJ | Hammer energy 4500 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | 0.12 | 0.15 | 0.18 | 0.19 |

Table F-27. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 2500 kJ | Hammer energy 4500 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | 0.09 | 0.13 | 0.15 | 0.15 |

Table F-28. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 2500 kJ | Hammer energy 4500 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | 0.03 | 0.09 | 0.11 | 0.11 |

Table F-29. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 2500 kJ | Hammer energy 4500 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | 0.03 | 0.09 | 0.09 |
| PPW | 218 | 0.02 | 0.08 | 0.09 | 0.10 |
| HF | 202 | 0.51 | 0.63 | 0.80 | 0.93 |

Table F-30. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 2500 kJ | Hammer energy 4500 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | 0.12 | 0.15 | 0.19 | 0.20 |

Table F-31. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 2500 kJ | Hammer energy 4500 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | 0.09 | 0.13 | 0.15 | 0.16 |

Table F-32. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 2500 kJ | Hammer energy 4500 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - |
| MF | 230 | - | - | - | - |
| LF | 219 | - | - | - | - |
| PPW | 218 | - | - | - | - |
| HF | 202 | 0.03 | 0.09 | 0.11 | 0.11 |

## F.1.3. Jacket Foundation (Typical)

### F.1.3.1. 4.25 m Typical Jacket Foundation with an MHU-3500S Hammer

Table F-33. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | 0.05 | 0.03 |
| PPW | 218 | - | - | - | - | 0.04 | 0.05 | 0.06 | 0.04 |
| HF | 202 | 0.09 | 0.12 | 0.21 | 0.29 | 0.32 | 0.36 | 0.41 | 0.34 |

Table F-34. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | 0.02 | 0.07 | 0.09 | 0.09 | 0.10 | 0.11 | 0.09 |

Table F-35. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.06 | 0.07 | 0.07 | 0.08 | 0.09 | 0.06 |

Table F-36. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | 0.05 | 0.06 | 0.06 | 0.06 | 0.05 |

Table F-37. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | 0.05 | 0.03 |
| PPW | 218 | - | - | - | - | 0.02 | 0.04 | 0.06 | 0.04 |
| HF | 202 | 0.09 | 0.13 | 0.21 | 0.28 | 0.32 | 0.35 | 0.38 | 0.33 |

Table F-38. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | 0.02 | 0.07 | 0.09 | 0.09 | 0.11 | 0.11 | 0.09 |

Table F-39. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.06 |

Table F-40. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |

Table F-41. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | 0.05 | 0.03 |
| PPW | 218 | - | - | - | - | - | 0.02 | 0.06 | 0.04 |
| HF | 202 | 0.12 | 0.18 | 0.33 | 0.48 | 0.48 | 0.48 | 0.47 | 0.38 |

Table F-42. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.09 | 0.11 | 0.11 | 0.11 | 0.11 | 0.08 |

Table F-43. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.02 | 0.05 | 0.09 | 0.09 | 0.09 | 0.06 |

Table F-44. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | - | - | 0.05 | 0.06 | 0.05 |

Table F-45. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | 0.05 | 0.03 |
| PPW | 218 | - | - | - | - | - | 0.02 | 0.06 | 0.04 |
| HF | 202 | 0.12 | 0.19 | 0.33 | 0.38 | 0.48 | 0.47 | 0.46 | 0.37 |

Table F-46. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.06 | 0.10 | 0.11 | 0.11 | 0.11 | 0.09 |

Table F-47. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.02 | 0.05 | 0.09 | 0.09 | 0.09 | 0.06 |

Table F-48. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | - | 0.02 | 0.05 | 0.06 | 0.05 |

Table F-49. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | 0.05 | 0.06 | 0.06 | 0.06 | 0.05 |
| PPW | 218 | - | - | - | 0.06 | 0.06 | 0.06 | 0.07 | 0.05 |
| HF | 202 | 0.11 | 0.18 | 0.29 | 0.33 | 0.41 | 0.43 | 0.47 | 0.39 |

Table F-50. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | 0.06 | 0.09 | 0.11 | 0.11 | 0.12 | 0.13 | 0.10 |

Table F-51. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | 0.02 | 0.07 | 0.09 | 0.09 | 0.10 | 0.11 | 0.09 |

Table F-52. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.05 | 0.06 | 0.06 | 0.07 | 0.08 | 0.06 |

Table F-53. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |
| PPW | 218 | - | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| HF | 202 | 0.11 | 0.18 | 0.29 | 0.34 | 0.39 | 0.47 | 0.53 | 0.38 |

Table F-54. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | 0.06 | 0.09 | 0.11 | 0.12 | 0.12 | 0.13 | 0.10 |

Table F-55. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | 0.02 | 0.07 | 0.09 | 0.09 | 0.11 | 0.11 | 0.09 |

Table F-56. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.02 | 0.06 | 0.07 | 0.08 | 0.09 | 0.06 |

Table F-57. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | 0.05 | 0.06 | 0.05 |
| PPW | 218 | - | - | - | - | 0.02 | 0.07 | 0.06 | 0.05 |
| HF | 202 | 0.15 | 0.20 | 0.47 | 0.56 | 0.54 | 0.55 | 0.54 | 0.44 |

Table F-58. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | 0.03 | 0.12 | 0.13 | 0.13 | 0.13 | 0.13 | 0.09 |

Table F-59. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.09 | 0.11 | 0.11 | 0.11 | 0.11 | 0.08 |

Table F-60. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 15 dB.

| Hearing group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | 0.02 | 0.06 | 0.08 | 0.08 | 0.06 |

Table F-61. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | 0.02 | 0.05 | 0.06 | 0.05 |
| PPW | 218 | - | - | - | - | 0.03 | 0.07 | 0.06 | 0.05 |
| HF | 202 | 0.15 | 0.20 | 0.37 | 0.54 | 0.55 | 0.54 | 0.53 | 0.44 |

Table F-62. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | 0.03 | 0.12 | 0.14 | 0.13 | 0.13 | 0.13 | 0.10 |

Table F-63. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.06 | 0.10 | 0.11 | 0.11 | 0.11 | 0.09 |

Table F-64. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | 0.03 | 0.07 | 0.09 | 0.08 | 0.06 |

## F.1.3.2. 4 m Typical Jacket Foundation with an MHU 3500S Hammer

Table F-65. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | 0.03 | - |
| PPW | 218 | - | - | - | - | - | 0.05 | - |
| HF | 202 | 0.07 | 0.13 | 0.18 | 0.29 | 0.33 | 0.36 | 0.22 |

Table F-66. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.04 | 0.06 | 0.07 | 0.09 | 0.09 | 0.03 |

Table F-67. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.05 | 0.06 | 0.07 | 0.08 | 0.02 |

Table F-68. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | - | - | 0.05 | - |

Table F-69. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | 0.03 | - |
| PPW | 218 | - | - | - | - | - | 0.05 | - |
| HF | 202 | 0.08 | 0.13 | 0.19 | 0.28 | 0.32 | 0.35 | 0.22 |

Table F-70. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.02 | 0.06 | 0.08 | 0.09 | 0.09 | 0.03 |

Table F-71. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.04 | 0.06 | 0.07 | 0.08 | 0.02 |

Table F-72. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | - | - | 0.05 | - |

Table F-73. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | 0.02 | - |
| PPW | 218 | - | - | - | - | - | 0.05 | - |
| HF | 202 | 0.10 | 0.17 | 0.29 | 0.32 | 0.32 | 0.42 | 0.17 |

Table F-74. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.03 | 0.09 | 0.09 | 0.09 | 0.03 |

Table F-75. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | 0.06 | 0.07 | 0.07 | 0.02 |

Table F-76. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | - | 0.02 | 0.06 | - |

Table F-77. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | 0.02 | - |
| PPW | 218 | - | - | - | - | - | 0.05 | - |
| HF | 202 | 0.10 | 0.18 | 0.20 | 0.31 | 0.31 | 0.41 | 0.16 |

Table F-78. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.03 | 0.09 | 0.09 | 0.09 | 0.03 |

Table F-79. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | 0.04 | 0.07 | 0.08 | 0.02 |

Table F-80. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | - | - | 0.06 | - |

Table F-81. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | 0.05 | - |
| PPW | 218 | - | - | - | 0.02 | 0.04 | 0.06 | - |
| HF | 202 | 0.09 | 0.18 | 0.28 | 0.33 | 0.36 | 0.42 | 0.27 |

Table F-82. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.06 | 0.08 | 0.09 | 0.11 | 0.12 | 0.04 |

Table F-83. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.04 | 0.06 | 0.07 | 0.09 | 0.09 | 0.03 |

Table F-84. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | 0.06 | 0.06 | 0.06 | 0.02 |

Table F-85. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | 0.05 | - |
| PPW | 218 | - | - | - | 0.02 | 0.04 | 0.06 | - |
| HF | 202 | 0.09 | 0.18 | 0.27 | 0.32 | 0.36 | 0.39 | 0.26 |

Table F-86. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.06 | 0.08 | 0.09 | 0.11 | 0.12 | 0.04 |

Table F-87. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.02 | 0.06 | 0.08 | 0.09 | 0.09 | 0.03 |

Table F-88. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | 0.06 | 0.06 | 0.06 | 0.02 |

Table F-89. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | 0.02 | 0.06 | - |
| PPW | 218 | - | - | - | - | 0.04 | 0.06 | - |
| HF | 202 | 0.13 | 0.20 | 0.36 | 0.48 | 0.47 | 0.48 | 0.20 |

Table F-90. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.02 | 0.10 | 0.11 | 0.11 | 0.11 | 0.04 |

Table F-91. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.03 | 0.09 | 0.09 | 0.09 | 0.03 |

Table F-92. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | 0.02 | 0.06 | 0.06 | 0.02 |

Table F-93. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | 0.06 | - |
| PPW | 218 | - | - | - | - | 0.04 | 0.06 | - |
| HF | 202 | 0.13 | 0.20 | 0.36 | 0.47 | 0.46 | 0.47 | 0.19 |

Table F-94. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.02 | 0.09 | 0.11 | 0.11 | 0.11 | 0.04 |

Table F-95. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.03 | 0.09 | 0.09 | 0.09 | 0.03 |

Table F-96. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | 0.02 | 0.06 | 0.06 | 0.02 |

## F.1.4. Jacket Foundation (Difficult-to-drive)

### F.1.4.1. 4 m Difficult to Drive Jacket Foundation with an MHU 3500S Hammer

Table F-97. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | 0.03 | - |
| PPW | 218 | - | - | - | - | 0.02 | 0.05 | - |
| HF | 202 | 0.12 | 0.19 | 0.28 | 0.31 | 0.36 | 0.37 | 0.22 |

Table F-98. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.06 | 0.08 | 0.09 | 0.11 | 0.09 | 0.03 |

Table F-99. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.05 | 0.06 | 0.07 | 0.08 | 0.08 | 0.02 |

Table F-100. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | 0.05 | 0.06 | 0.06 | - |

Table F-101. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | 0.03 | - |
| PPW | 218 | - | - | - | - | 0.02 | 0.05 | - |
| HF | 202 | 0.12 | 0.19 | 0.27 | 0.31 | 0.36 | 0.36 | 0.22 |

Table F-102. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.06 | 0.08 | 0.09 | 0.11 | 0.10 | 0.03 |

Table F-103. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.04 | 0.06 | 0.07 | 0.09 | 0.08 | 0.02 |

Table F-104. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | 0.02 | 0.06 | 0.06 | - |

Table F-105. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | 0.03 | - |
| PPW | 218 | - | - | - | - | 0.02 | 0.05 | - |
| HF | 202 | 0.17 | 0.31 | 0.36 | 0.46 | 0.47 | 0.42 | 0.17 |

Table F-106. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.03 | 0.09 | 0.10 | 0.11 | 0.09 | 0.03 |

Table F-107. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.03 | 0.08 | 0.09 | 0.07 | 0.02 |

Table F-108. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | - | 0.06 | 0.06 | - |

Table F-109. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | 0.03 | - |
| PPW | 218 | - | - | - | - | 0.02 | 0.05 | - |
| HF | 202 | 0.18 | 0.21 | 0.35 | 0.43 | 0.46 | 0.42 | 0.16 |

Table F-110. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.03 | 0.09 | 0.10 | 0.11 | 0.09 | 0.03 |

Table F-111. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.03 | 0.07 | 0.09 | 0.08 | 0.02 |

Table F-112. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | - | 0.05 | 0.06 | - |

Table F-113. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | 0.05 | 0.06 | 0.06 | - |
| PPW | 218 | - | - | 0.05 | 0.06 | 0.06 | 0.06 | - |
| HF | 202 | 0.15 | 0.28 | 0.32 | 0.36 | 0.42 | 0.43 | 0.27 |

Table F-114. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | 0.06 | 0.08 | 0.09 | 0.11 | 0.12 | 0.12 | 0.04 |

Table F-115. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.06 | 0.08 | 0.09 | 0.11 | 0.09 | 0.03 |

Table F-116. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.06 | 0.06 | 0.07 | 0.06 | 0.02 |

Table F-117. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | 0.02 | 0.06 | 0.06 | - |
| PPW | 218 | - | - | 0.02 | 0.06 | 0.07 | 0.06 | - |
| HF | 202 | 0.14 | 0.27 | 0.31 | 0.34 | 0.45 | 0.39 | 0.26 |

Table F-118. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | 0.06 | 0.09 | 0.09 | 0.11 | 0.13 | 0.12 | 0.04 |

Table F-119. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.06 | 0.08 | 0.09 | 0.11 | 0.09 | 0.03 |

Table F-120. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.06 | 0.06 | 0.08 | 0.06 | 0.02 |

Table F-121. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | 0.06 | 0.06 | - |
| PPW | 218 | - | - | - | 0.02 | 0.07 | 0.06 | - |
| HF | 202 | 0.19 | 0.37 | 0.53 | 0.53 | 0.54 | 0.49 | 0.20 |

Table F-122. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | 0.02 | 0.10 | 0.13 | 0.13 | 0.13 | 0.11 | 0.04 |

Table F-123. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.03 | 0.09 | 0.10 | 0.11 | 0.09 | 0.03 |

Table F-124. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.02 | 0.06 | 0.08 | 0.06 | 0.02 |

Table F-125. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | 0.05 | 0.06 | - |
| PPW | 218 | - | - | - | 0.02 | 0.07 | 0.06 | - |
| HF | 202 | 0.20 | 0.36 | 0.51 | 0.52 | 0.53 | 0.48 | 0.19 |

Table F-126. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | 0.02 | 0.10 | 0.13 | 0.13 | 0.13 | 0.12 | 0.04 |

Table F-127. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.03 | 0.09 | 0.10 | 0.11 | 0.09 | 0.03 |

Table F-128. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.02 | 0.06 | 0.08 | 0.06 | 0.02 |

### F.1.4.2. 4.25 m Difficult to Drive Jacket Foundation with an MHU 3500S

Table F-129. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | 0.05 | 0.05 | 0.03 |
| PPW | 218 | - | - | - | 0.05 | 0.06 | 0.06 | 0.04 |
| HF | 202 | 0.12 | 0.21 | 0.28 | 0.31 | 0.40 | 0.41 | 0.34 |

Table F-130. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | 0.04 | 0.07 | 0.08 | 0.09 | 0.11 | 0.11 | 0.09 |

Table F-131. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.06 |

Table F-132. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.04 | 0.06 | 0.06 | 0.06 | 0.05 |

Table F-133. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | 0.05 | 0.05 | 0.03 |
| PPW | 218 | - | - | - | 0.04 | 0.06 | 0.06 | 0.04 |
| HF | 202 | 0.13 | 0.21 | 0.28 | 0.32 | 0.37 | 0.38 | 0.33 |

Table F-134. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.07 | 0.09 | 0.09 | 0.11 | 0.11 | 0.09 |

Table F-135. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.06 |

Table F-136. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |

Table F-137. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | 0.02 | 0.05 | 0.03 |
| PPW | 218 | - | - | - | - | 0.03 | 0.06 | 0.04 |
| HF | 202 | 0.18 | 0.33 | 0.47 | 0.54 | 0.56 | 0.47 | 0.38 |

Table F-138. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.09 | 0.12 | 0.13 | 0.13 | 0.11 | 0.08 |

Table F-139. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.02 | 0.06 | 0.09 | 0.11 | 0.09 | 0.06 |

Table F-140. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |

Table F-141. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | 0.02 | 0.05 | 0.03 |
| PPW | 218 | - | - | - | - | 0.03 | 0.06 | 0.04 |
| HF | 202 | 0.19 | 0.32 | 0.37 | 0.52 | 0.55 | 0.46 | 0.37 |

Table F-142. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.09 | 0.12 | 0.13 | 0.13 | 0.11 | 0.09 |

Table F-143. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.02 | 0.05 | 0.09 | 0.11 | 0.09 | 0.06 |

Table F-144. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |

Table F-145. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | 0.04 | 0.06 | 0.06 | 0.06 | 0.05 |
| PPW | 218 | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| HF | 202 | 0.18 | 0.28 | 0.32 | 0.40 | 0.52 | 0.47 | 0.39 |

Table F-146. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | 0.06 | 0.09 | 0.11 | 0.11 | 0.13 | 0.13 | 0.10 |

Table F-147. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | 0.04 | 0.07 | 0.08 | 0.09 | 0.11 | 0.11 | 0.09 |

Table F-148. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.02 | 0.06 | 0.07 | 0.08 | 0.08 | 0.06 |

Table F-149. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |
| PPW | 218 | - | - | 0.05 | 0.06 | 0.07 | 0.07 | 0.05 |
| HF | 202 | 0.18 | 0.28 | 0.34 | 0.43 | 0.54 | 0.53 | 0.38 |

Table F-150. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | 0.06 | 0.09 | 0.11 | 0.12 | 0.13 | 0.13 | 0.10 |

Table F-151. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.07 | 0.09 | 0.09 | 0.11 | 0.11 | 0.09 |

Table F-152. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L01 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.02 | 0.06 | 0.07 | 0.09 | 0.09 | 0.06 |

Table F-153. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |
| PPW | 218 | - | - | 0.02 | 0.03 | 0.09 | 0.06 | 0.05 |
| HF | 202 | 0.20 | 0.38 | 0.55 | 0.60 | 0.62 | 0.54 | 0.44 |

Table F-154. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | 0.04 | 0.13 | 0.15 | 0.15 | 0.16 | 0.13 | 0.10 |

Table F-155. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.09 | 0.12 | 0.13 | 0.13 | 0.11 | 0.08 |

Table F-156. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during summer at location L02 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.03 | 0.07 | 0.10 | 0.08 | 0.06 |

Table F-157. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 0 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |
| PPW | 218 | - | - | - | 0.03 | 0.09 | 0.06 | 0.05 |
| HF | 202 | 0.20 | 0.36 | 0.54 | 0.59 | 0.62 | 0.53 | 0.44 |

Table F-158. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 10 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | 0.04 | 0.13 | 0.15 | 0.16 | 0.16 | 0.13 | 0.10 |

Table F-159. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 12 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | 0.09 | 0.12 | 0.13 | 0.13 | 0.11 | 0.09 |

Table F-160. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer) acoustic ranges to marine mammal and sea turtle injury thresholds ($R_{95\%}$ in km) during winter at location L02 with different energy levels at 15 dB.

| Faunal group | Level ($L_{pk}$) | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|
| TUW | 232 | - | - | - | - | - | - | - |
| MF | 230 | - | - | - | - | - | - | - |
| LF | 219 | - | - | - | - | - | - | - |
| PPW | 218 | - | - | - | - | - | - | - |
| HF | 202 | - | - | 0.03 | 0.05 | 0.10 | 0.08 | 0.06 |

# F.2. Impact Pile Driving Single-Strike SPL Ranges

## F.2.1. Monopile Foundation (Typical)

### F.2.1.1. 14 m Typical Monopile with an MHU 5500 Hammer

Table F-161. Monopile foundation (14 m typical monopile with an MHU 5500 hammer, 4400 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 for 0 dB.

| Level (dB re 1µPa$^2$) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.12 | 0.12 | 0.12 | 0.12 | - | - | - | - | 0.06 | 0.06 |
| 190 | 0.67 | 0.64 | 0.66 | 0.63 | 0.11 | 0.11 | 0.09 | 0.08 | 0.32 | 0.31 |
| 180 | 2.13 | 1.94 | 2.10 | 1.92 | 0.58 | 0.55 | 0.38 | 0.36 | 1.15 | 1.08 |
| 175 | 3.43 | 3.13 | 3.38 | 3.09 | 1.08 | 1.01 | 0.75 | 0.71 | 1.98 | 1.83 |
| 170 | 5.03 | 4.61 | 4.99 | 4.57 | 1.88 | 1.74 | 1.39 | 1.30 | 3.08 | 2.84 |
| 160 | 9.72 | 8.54 | 9.68 | 8.50 | 4.33 | 4.02 | 3.48 | 3.21 | 6.93 | 6.20 |
| 150 | 17.28 | 14.99 | 17.22 | 14.94 | 9.05 | 7.92 | 7.17 | 6.35 | 13.51 | 11.71 |
| 140 | 29.07 | 25.63 | 28.96 | 25.53 | 16.96 | 14.77 | 14.06 | 12.23 | 23.73 | 20.44 |
| 130 | 49.69 | 44.19 | 49.35 | 43.87 | 30.25 | 27.08 | 26.00 | 22.92 | 40.98 | 36.32 |
| 120 | >90.00 | 83.46 | >90.00 | 83.04 | 64.84 | 55.42 | 52.24 | 45.85 | >90.00 | 77.94 |

Table F-162. Monopile foundation (14 m typical monopile with an MHU 5500 hammer, 4400 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 for 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 190 | 0.12 | 0.12 | 0.12 | 0.12 | - | - | - | - | 0.06 | 0.06 |
| 180 | 0.67 | 0.64 | 0.66 | 0.63 | 0.11 | 0.11 | 0.09 | 0.08 | 0.32 | 0.31 |
| 175 | 1.22 | 1.16 | 1.20 | 1.14 | 0.27 | 0.26 | 0.13 | 0.13 | 0.64 | 0.61 |
| 170 | 2.13 | 1.94 | 2.10 | 1.92 | 0.58 | 0.55 | 0.38 | 0.36 | 1.15 | 1.08 |
| 160 | 5.03 | 4.61 | 4.99 | 4.57 | 1.88 | 1.74 | 1.39 | 1.30 | 3.08 | 2.84 |
| 150 | 9.72 | 8.54 | 9.68 | 8.50 | 4.33 | 4.02 | 3.48 | 3.21 | 6.93 | 6.20 |
| 140 | 17.28 | 14.99 | 17.22 | 14.94 | 9.05 | 7.92 | 7.17 | 6.35 | 13.51 | 11.71 |
| 130 | 29.07 | 25.63 | 28.96 | 25.53 | 16.96 | 14.77 | 14.06 | 12.23 | 23.73 | 20.44 |
| 120 | 49.69 | 44.19 | 49.35 | 43.87 | 30.25 | 27.08 | 26.00 | 22.92 | 40.98 | 36.32 |

Table F-163. Monopile foundation (14 m typical monopile with an MHU 5500 hammer, 4400 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 for 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.09 | 0.09 | 0.09 | 0.09 | - | - | - | - | 0.05 | 0.05 |
| 180 | 0.48 | 0.46 | 0.48 | 0.46 | 0.09 | 0.09 | 0.06 | 0.06 | 0.20 | 0.20 |
| 175 | 0.97 | 0.92 | 0.96 | 0.91 | 0.17 | 0.17 | 0.11 | 0.11 | 0.47 | 0.45 |
| 170 | 1.74 | 1.62 | 1.71 | 1.60 | 0.41 | 0.39 | 0.28 | 0.27 | 0.93 | 0.89 |
| 160 | 4.33 | 4.02 | 4.29 | 3.99 | 1.52 | 1.42 | 1.09 | 1.02 | 2.68 | 2.46 |
| 150 | 8.71 | 7.63 | 8.66 | 7.59 | 3.74 | 3.46 | 2.94 | 2.72 | 6.02 | 5.42 |
| 140 | 15.59 | 13.53 | 15.53 | 13.48 | 7.91 | 6.93 | 6.26 | 5.58 | 12.02 | 10.30 |
| 130 | 26.48 | 23.20 | 26.39 | 23.10 | 15.11 | 13.16 | 12.50 | 10.76 | 20.78 | 18.00 |
| 120 | 44.60 | 39.37 | 44.33 | 39.12 | 27.24 | 24.08 | 22.93 | 19.79 | 36.20 | 32.23 |

Table F-164. Monopile foundation (14 m typical monopile with an MHU 5500 hammer, 4400 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 for 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.06 | 0.06 | - | - | - | - | - | - |
| 180 | 0.34 | 0.33 | 0.34 | 0.32 | 0.06 | 0.06 | 0.02 | 0.02 | 0.12 | 0.12 |
| 175 | 0.67 | 0.64 | 0.66 | 0.63 | 0.11 | 0.11 | 0.09 | 0.08 | 0.32 | 0.31 |
| 170 | 1.22 | 1.16 | 1.20 | 1.14 | 0.27 | 0.26 | 0.13 | 0.13 | 0.64 | 0.61 |
| 160 | 3.43 | 3.13 | 3.38 | 3.09 | 1.08 | 1.01 | 0.75 | 0.71 | 1.98 | 1.83 |
| 150 | 7.14 | 6.34 | 7.08 | 6.30 | 2.93 | 2.70 | 2.30 | 2.12 | 4.74 | 4.38 |
| 140 | 13.32 | 11.53 | 13.27 | 11.48 | 6.37 | 5.69 | 5.00 | 4.56 | 9.70 | 8.53 |
| 130 | 22.61 | 19.27 | 22.50 | 19.18 | 12.70 | 10.95 | 9.95 | 8.76 | 17.78 | 15.45 |
| 120 | 37.60 | 33.33 | 37.38 | 33.15 | 22.88 | 19.67 | 18.73 | 16.54 | 30.64 | 27.19 |

Table F-165. Monopile foundation (14 m typical monopile with an MHU 5500 hammer, 4400 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 for 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.12 | 0.12 | 0.12 | 0.12 | - | - | - | - | 0.06 | 0.06 |
| 190 | 0.69 | 0.66 | 0.68 | 0.65 | 0.11 | 0.11 | 0.09 | 0.09 | 0.35 | 0.34 |
| 180 | 2.25 | 2.06 | 2.23 | 2.03 | 0.61 | 0.59 | 0.39 | 0.38 | 1.21 | 1.15 |
| 175 | 3.70 | 3.38 | 3.66 | 3.34 | 1.13 | 1.07 | 0.80 | 0.74 | 2.09 | 1.92 |
| 170 | 5.48 | 5.01 | 5.43 | 4.98 | 1.96 | 1.82 | 1.46 | 1.37 | 3.42 | 3.09 |
| 160 | 11.65 | 9.94 | 11.57 | 9.87 | 4.74 | 4.38 | 3.74 | 3.44 | 7.99 | 7.05 |
| 150 | 22.60 | 19.33 | 22.45 | 19.19 | 10.64 | 9.22 | 8.29 | 7.27 | 16.71 | 14.54 |
| 140 | 47.59 | 41.72 | 47.09 | 41.27 | 22.69 | 19.67 | 17.65 | 15.51 | 34.79 | 30.92 |
| 130 | >90.00 | 85.13 | >90.00 | 85.01 | 56.10 | 50.03 | 42.43 | 37.70 | >90.00 | 84.09 |
| 120 | >90.00 | 86.08 | >90.00 | 86.02 | >90.00 | 85.76 | >90.00 | 85.34 | >90.00 | 85.96 |

Table F-166. Monopile foundation (14 m typical monopile with an MHU 5500 hammer, 4400 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 for 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 190 | 0.12 | 0.12 | 0.12 | 0.12 | - | - | - | - | 0.06 | 0.06 |
| 180 | 0.69 | 0.66 | 0.68 | 0.65 | 0.11 | 0.11 | 0.09 | 0.09 | 0.35 | 0.34 |
| 175 | 1.29 | 1.23 | 1.27 | 1.21 | 0.26 | 0.25 | 0.13 | 0.13 | 0.67 | 0.64 |
| 170 | 2.25 | 2.06 | 2.23 | 2.03 | 0.61 | 0.59 | 0.39 | 0.38 | 1.21 | 1.15 |
| 160 | 5.48 | 5.01 | 5.43 | 4.98 | 1.96 | 1.82 | 1.46 | 1.37 | 3.42 | 3.09 |
| 150 | 11.65 | 9.94 | 11.57 | 9.87 | 4.74 | 4.38 | 3.74 | 3.44 | 7.99 | 7.05 |
| 140 | 22.60 | 19.33 | 22.45 | 19.19 | 10.64 | 9.22 | 8.29 | 7.27 | 16.71 | 14.54 |
| 130 | 47.59 | 41.72 | 47.09 | 41.27 | 22.69 | 19.67 | 17.65 | 15.51 | 34.79 | 30.92 |
| 120 | >90.00 | 85.13 | >90.00 | 85.01 | 56.10 | 50.03 | 42.43 | 37.70 | >90.00 | 84.09 |

Table F-167. Monopile foundation (14 m typical monopile with an MHU 5500 hammer, 4400 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 for 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.09 | 0.09 | 0.09 | 0.09 | - | - | - | - | 0.05 | 0.05 |
| 180 | 0.49 | 0.47 | 0.49 | 0.47 | 0.09 | 0.09 | 0.06 | 0.06 | 0.21 | 0.20 |
| 175 | 0.99 | 0.94 | 0.98 | 0.93 | 0.17 | 0.16 | 0.12 | 0.12 | 0.48 | 0.46 |
| 170 | 1.82 | 1.69 | 1.80 | 1.67 | 0.42 | 0.40 | 0.28 | 0.27 | 0.96 | 0.92 |
| 160 | 4.65 | 4.32 | 4.61 | 4.28 | 1.60 | 1.50 | 1.15 | 1.08 | 2.78 | 2.57 |
| 150 | 9.86 | 8.70 | 9.81 | 8.66 | 4.07 | 3.74 | 3.11 | 2.85 | 6.73 | 6.08 |
| 140 | 19.38 | 16.95 | 19.30 | 16.87 | 9.15 | 8.04 | 7.00 | 6.26 | 14.62 | 12.69 |
| 130 | 40.40 | 35.41 | 39.99 | 35.09 | 19.16 | 16.89 | 15.29 | 13.37 | 29.66 | 26.47 |
| 120 | >90.00 | 84.69 | >90.00 | 84.60 | 45.68 | 40.50 | 34.53 | 30.98 | 84.56 | 71.53 |

Table F-168. Monopile foundation (14 m typical monopile with an MHU 5500 hammer, 4400 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 for 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.06 | 0.06 | - | - | - | - | - | - |
| 180 | 0.36 | 0.35 | 0.36 | 0.34 | 0.06 | 0.06 | 0.02 | 0.02 | 0.12 | 0.12 |
| 175 | 0.69 | 0.66 | 0.68 | 0.65 | 0.11 | 0.11 | 0.09 | 0.09 | 0.35 | 0.34 |
| 170 | 1.29 | 1.23 | 1.27 | 1.21 | 0.26 | 0.25 | 0.13 | 0.13 | 0.67 | 0.64 |
| 160 | 3.70 | 3.38 | 3.66 | 3.34 | 1.13 | 1.07 | 0.80 | 0.74 | 2.09 | 1.92 |
| 150 | 8.10 | 7.12 | 8.03 | 7.08 | 3.09 | 2.84 | 2.46 | 2.25 | 5.24 | 4.82 |
| 140 | 16.15 | 14.02 | 16.07 | 13.96 | 7.17 | 6.40 | 5.53 | 5.02 | 11.83 | 10.13 |
| 130 | 31.69 | 28.19 | 31.46 | 28.00 | 15.59 | 13.61 | 12.29 | 10.61 | 24.08 | 20.91 |
| 120 | 86.88 | 74.87 | 82.44 | 71.36 | 34.07 | 30.52 | 26.56 | 23.72 | 53.51 | 48.13 |

Table F-169. Monopile foundation (14 m typical monopile with an MHU 5500 hammer, 4400 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 for 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.17 | 0.16 | 0.16 | 0.16 | - | - | - | - | 0.09 | 0.09 |
| 190 | 0.92 | 0.88 | 0.90 | 0.78 | 0.16 | 0.16 | 0.11 | 0.11 | 0.37 | 0.36 |
| 180 | 2.82 | 2.70 | 2.79 | 2.68 | 0.67 | 0.64 | 0.54 | 0.52 | 1.63 | 1.56 |
| 175 | 4.40 | 4.19 | 4.36 | 4.15 | 1.45 | 1.38 | 1.00 | 0.95 | 2.69 | 2.57 |
| 170 | 6.40 | 6.07 | 6.32 | 6.00 | 2.54 | 2.43 | 1.85 | 1.77 | 4.19 | 4.00 |
| 160 | 13.02 | 12.01 | 12.90 | 11.90 | 5.54 | 5.24 | 4.62 | 4.36 | 8.43 | 7.88 |
| 150 | 25.60 | 22.88 | 25.38 | 22.67 | 10.49 | 9.65 | 8.68 | 8.08 | 15.85 | 14.46 |
| 140 | 58.23 | 49.04 | 57.65 | 48.60 | 19.06 | 17.32 | 15.59 | 14.24 | 33.24 | 29.45 |
| 130 | 89.99 | 78.65 | 89.99 | 78.10 | 44.23 | 38.42 | 31.73 | 28.35 | 72.32 | 60.42 |
| 120 | >90.00 | 85.29 | >90.00 | 85.28 | 84.81 | 72.72 | 76.85 | 63.60 | >90.00 | 84.17 |

Table F-170. Monopile foundation (14 m typical monopile with an MHU 5500 hammer, 4400 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 for 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.17 | 0.16 | 0.16 | 0.16 | - | - | - | - | 0.09 | 0.09 |
| 180 | 0.92 | 0.88 | 0.90 | 0.78 | 0.16 | 0.16 | 0.11 | 0.11 | 0.37 | 0.36 |
| 175 | 1.69 | 1.61 | 1.67 | 1.60 | 0.35 | 0.34 | 0.18 | 0.18 | 0.78 | 0.76 |
| 170 | 2.82 | 2.70 | 2.79 | 2.68 | 0.67 | 0.64 | 0.54 | 0.52 | 1.63 | 1.56 |
| 160 | 6.40 | 6.07 | 6.32 | 6.00 | 2.54 | 2.43 | 1.85 | 1.77 | 4.19 | 4.00 |
| 150 | 13.02 | 12.01 | 12.90 | 11.90 | 5.54 | 5.24 | 4.62 | 4.36 | 8.43 | 7.88 |
| 140 | 25.60 | 22.88 | 25.38 | 22.67 | 10.49 | 9.65 | 8.68 | 8.08 | 15.85 | 14.46 |
| 130 | 58.23 | 49.04 | 57.65 | 48.60 | 19.06 | 17.32 | 15.59 | 14.24 | 33.24 | 29.45 |
| 120 | 89.99 | 78.65 | 89.99 | 78.10 | 44.23 | 38.42 | 31.73 | 28.35 | 72.32 | 60.42 |

Table F-171. Monopile foundation (14 m typical monopile with an MHU 5500 hammer, 4400 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 for 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.14 | 0.13 | 0.14 | 0.13 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.63 | 0.61 | 0.63 | 0.60 | 0.13 | 0.13 | 0.04 | 0.04 | 0.29 | 0.28 |
| 175 | 1.30 | 1.25 | 1.28 | 1.23 | 0.19 | 0.19 | 0.16 | 0.16 | 0.61 | 0.59 |
| 170 | 2.36 | 2.26 | 2.32 | 2.24 | 0.58 | 0.56 | 0.36 | 0.35 | 1.26 | 1.20 |
| 160 | 5.45 | 5.17 | 5.39 | 5.12 | 2.04 | 1.96 | 1.47 | 1.40 | 3.57 | 3.41 |
| 150 | 11.37 | 10.48 | 11.25 | 10.36 | 4.90 | 4.64 | 4.00 | 3.79 | 7.30 | 6.84 |
| 140 | 22.00 | 19.58 | 21.76 | 19.36 | 9.30 | 8.66 | 7.60 | 7.11 | 13.98 | 12.88 |
| 130 | 48.21 | 41.31 | 47.69 | 40.87 | 16.97 | 15.44 | 13.94 | 12.82 | 28.34 | 25.34 |
| 120 | 82.97 | 72.21 | 82.79 | 71.87 | 36.19 | 32.00 | 26.95 | 24.23 | 64.45 | 55.67 |

Table F-172. Monopile foundation (14 m typical monopile with an MHU 5500 hammer, 4400 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 for 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.10 | 0.09 | 0.09 | 0.09 | - | - | - | - | - | - |
| 180 | 0.37 | 0.36 | 0.37 | 0.36 | 0.04 | 0.04 | - | - | 0.16 | 0.16 |
| 175 | 0.92 | 0.88 | 0.90 | 0.78 | 0.16 | 0.16 | 0.11 | 0.11 | 0.37 | 0.36 |
| 170 | 1.69 | 1.61 | 1.67 | 1.60 | 0.35 | 0.34 | 0.18 | 0.18 | 0.78 | 0.76 |
| 160 | 4.40 | 4.19 | 4.36 | 4.15 | 1.45 | 1.38 | 1.00 | 0.95 | 2.69 | 2.57 |
| 150 | 9.22 | 8.60 | 9.14 | 8.53 | 3.98 | 3.78 | 2.99 | 2.86 | 5.88 | 5.55 |
| 140 | 17.93 | 16.26 | 17.77 | 16.13 | 7.69 | 7.18 | 6.28 | 5.88 | 11.71 | 10.80 |
| 130 | 36.95 | 32.31 | 36.60 | 32.04 | 14.25 | 13.08 | 11.83 | 10.89 | 22.47 | 20.05 |
| 120 | 74.30 | 61.55 | 73.77 | 61.23 | 28.07 | 25.20 | 21.17 | 18.95 | 53.47 | 45.78 |

Table F-173. Monopile foundation (14 m typical monopile with an MHU 5500 hammer, 4400 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 for 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.17 | 0.17 | 0.17 | 0.17 | - | - | - | - | 0.07 | 0.07 |
| 190 | 0.94 | 0.90 | 0.93 | 0.88 | 0.16 | 0.16 | 0.10 | 0.10 | 0.37 | 0.36 |
| 180 | 2.92 | 2.80 | 2.89 | 2.78 | 0.69 | 0.67 | 0.54 | 0.53 | 1.68 | 1.60 |
| 175 | 4.61 | 4.38 | 4.57 | 4.34 | 1.55 | 1.47 | 1.04 | 0.99 | 2.80 | 2.69 |
| 170 | 6.87 | 6.47 | 6.80 | 6.40 | 2.64 | 2.51 | 1.92 | 1.84 | 4.43 | 4.21 |
| 160 | 14.99 | 13.69 | 14.82 | 13.55 | 5.88 | 5.53 | 4.84 | 4.58 | 9.11 | 8.47 |
| 150 | 37.18 | 32.76 | 36.67 | 32.35 | 11.72 | 10.76 | 9.33 | 8.67 | 19.08 | 17.40 |
| 140 | >90.00 | 84.96 | >90.00 | 84.94 | 25.78 | 23.30 | 18.19 | 16.56 | 68.99 | 59.69 |
| 130 | >90.00 | 85.42 | >90.00 | 85.42 | >90.00 | 84.60 | 64.42 | 55.68 | >90.00 | 85.25 |
| 120 | >90.00 | 85.75 | >90.00 | 85.68 | >90.00 | 85.24 | >90.00 | 85.18 | >90.00 | 85.49 |

Table F-174. Monopile foundation (14 m typical monopile with an MHU 5500 hammer, 4400 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 for 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.17 | 0.17 | 0.17 | 0.17 | - | - | - | - | 0.07 | 0.07 |
| 180 | 0.94 | 0.90 | 0.93 | 0.88 | 0.16 | 0.16 | 0.10 | 0.10 | 0.37 | 0.36 |
| 175 | 1.73 | 1.66 | 1.71 | 1.64 | 0.34 | 0.33 | 0.19 | 0.19 | 0.80 | 0.77 |
| 170 | 2.92 | 2.80 | 2.89 | 2.78 | 0.69 | 0.67 | 0.54 | 0.53 | 1.68 | 1.60 |
| 160 | 6.87 | 6.47 | 6.80 | 6.40 | 2.64 | 2.51 | 1.92 | 1.84 | 4.43 | 4.21 |
| 150 | 14.99 | 13.69 | 14.82 | 13.55 | 5.88 | 5.53 | 4.84 | 4.58 | 9.11 | 8.47 |
| 140 | 37.18 | 32.76 | 36.67 | 32.35 | 11.72 | 10.76 | 9.33 | 8.67 | 19.08 | 17.40 |
| 130 | >90.00 | 84.96 | >90.00 | 84.94 | 25.78 | 23.30 | 18.19 | 16.56 | 68.99 | 59.69 |
| 120 | >90.00 | 85.42 | >90.00 | 85.42 | >90.00 | 84.60 | 64.42 | 55.68 | >90.00 | 85.25 |

Table F-175. Monopile foundation (14 m typical monopile with an MHU 5500 hammer, 4400 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 for 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.14 | 0.14 | 0.14 | 0.13 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.64 | 0.62 | 0.64 | 0.61 | 0.13 | 0.13 | 0.05 | 0.05 | 0.21 | 0.20 |
| 175 | 1.35 | 1.29 | 1.33 | 1.27 | 0.20 | 0.20 | 0.16 | 0.16 | 0.63 | 0.61 |
| 170 | 2.45 | 2.35 | 2.41 | 2.32 | 0.60 | 0.58 | 0.35 | 0.34 | 1.30 | 1.25 |
| 160 | 5.84 | 5.53 | 5.76 | 5.46 | 2.15 | 2.05 | 1.57 | 1.49 | 3.80 | 3.61 |
| 150 | 12.88 | 11.84 | 12.74 | 11.70 | 5.18 | 4.88 | 4.20 | 3.99 | 7.93 | 7.41 |
| 140 | 30.15 | 27.00 | 29.80 | 26.71 | 9.98 | 9.26 | 8.27 | 7.69 | 16.31 | 14.86 |
| 130 | >90.00 | 84.64 | >90.00 | 84.57 | 20.63 | 18.64 | 15.75 | 14.39 | 49.03 | 42.32 |
| 120 | >90.00 | 85.41 | >90.00 | 85.40 | 89.79 | 78.61 | 45.16 | 39.16 | >90.00 | 85.05 |

Table F-176. Monopile foundation (14 m typical monopile with an MHU 5500 hammer, 4400 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 for 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.09 | 0.09 | 0.09 | 0.09 | - | - | - | - | - | - |
| 180 | 0.37 | 0.36 | 0.37 | 0.36 | 0.04 | 0.04 | - | - | 0.17 | 0.17 |
| 175 | 0.94 | 0.90 | 0.93 | 0.88 | 0.16 | 0.16 | 0.10 | 0.10 | 0.37 | 0.36 |
| 170 | 1.73 | 1.66 | 1.71 | 1.64 | 0.34 | 0.33 | 0.19 | 0.19 | 0.80 | 0.77 |
| 160 | 4.61 | 4.38 | 4.57 | 4.34 | 1.55 | 1.47 | 1.04 | 0.99 | 2.80 | 2.69 |
| 150 | 9.90 | 9.21 | 9.80 | 9.13 | 4.17 | 3.97 | 3.17 | 3.02 | 6.27 | 5.91 |
| 140 | 22.62 | 20.33 | 22.30 | 20.05 | 8.36 | 7.78 | 6.65 | 6.25 | 12.98 | 11.95 |
| 130 | 78.26 | 67.84 | 76.37 | 66.06 | 16.29 | 14.85 | 13.00 | 11.98 | 32.42 | 28.97 |
| 120 | >90.00 | 85.24 | >90.00 | 85.21 | 49.38 | 42.67 | 30.04 | 26.92 | >90.00 | 84.92 |

## F.2.2. Monopile Foundation (Difficult-to-drive)

### F.2.2.1. 14 m Difficult to Drive Monopile with an MHU 5500 Hammer Scaled to 6600 kJ

Table F-177. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ, 6600 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 for 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.17 | 0.17 | 0.17 | 0.17 | 0.02 | 0.02 | - | - | 0.08 | 0.07 |
| 190 | 0.88 | 0.84 | 0.87 | 0.83 | 0.13 | 0.13 | 0.10 | 0.09 | 0.40 | 0.38 |
| 180 | 2.65 | 2.43 | 2.62 | 2.40 | 0.73 | 0.69 | 0.44 | 0.42 | 1.46 | 1.37 |
| 175 | 4.07 | 3.77 | 4.03 | 3.74 | 1.36 | 1.28 | 0.97 | 0.92 | 2.47 | 2.26 |
| 170 | 5.87 | 5.30 | 5.83 | 5.26 | 2.28 | 2.08 | 1.70 | 1.58 | 3.81 | 3.50 |
| 160 | 11.24 | 9.59 | 11.18 | 9.54 | 5.09 | 4.66 | 4.02 | 3.74 | 8.11 | 7.12 |
| 150 | 19.11 | 16.69 | 19.05 | 16.64 | 10.29 | 8.96 | 8.36 | 7.30 | 15.22 | 13.21 |
| 140 | 32.15 | 28.56 | 32.02 | 28.43 | 18.97 | 16.68 | 15.93 | 13.92 | 26.54 | 23.27 |
| 130 | 55.56 | 50.38 | 55.00 | 49.88 | 34.71 | 30.92 | 29.01 | 26.06 | 46.70 | 41.34 |
| 120 | >90.00 | 84.71 | >90.00 | 84.57 | >90.00 | 70.06 | 65.16 | 55.34 | >90.00 | 83.32 |

Table F-178. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ, 6600 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 for 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.04 | 0.04 | 0.04 | 0.04 | - | - | - | - | - | - |
| 190 | 0.17 | 0.17 | 0.17 | 0.17 | 0.02 | 0.02 | - | - | 0.08 | 0.07 |
| 180 | 0.88 | 0.84 | 0.87 | 0.83 | 0.13 | 0.13 | 0.10 | 0.09 | 0.40 | 0.38 |
| 175 | 1.55 | 1.46 | 1.53 | 1.44 | 0.38 | 0.36 | 0.20 | 0.20 | 0.81 | 0.77 |
| 170 | 2.65 | 2.43 | 2.62 | 2.40 | 0.73 | 0.69 | 0.44 | 0.42 | 1.46 | 1.37 |
| 160 | 5.87 | 5.30 | 5.83 | 5.26 | 2.28 | 2.08 | 1.70 | 1.58 | 3.81 | 3.50 |
| 150 | 11.24 | 9.59 | 11.18 | 9.54 | 5.09 | 4.66 | 4.02 | 3.74 | 8.11 | 7.12 |
| 140 | 19.11 | 16.69 | 19.05 | 16.64 | 10.29 | 8.96 | 8.36 | 7.30 | 15.22 | 13.21 |
| 130 | 32.15 | 28.56 | 32.02 | 28.43 | 18.97 | 16.68 | 15.93 | 13.92 | 26.54 | 23.27 |
| 120 | 55.56 | 50.38 | 55.00 | 49.88 | 34.71 | 30.92 | 29.01 | 26.06 | 46.70 | 41.34 |

Table F-179. Monopile foundation (14 m difficult to drive monopile with an MHU5500 hammer scaled to 6600 kJ, 6600 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 for 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 190 | 0.12 | 0.12 | 0.12 | 0.12 | - | - | - | - | 0.06 | 0.06 |
| 180 | 0.67 | 0.64 | 0.66 | 0.63 | 0.11 | 0.11 | 0.08 | 0.08 | 0.32 | 0.31 |
| 175 | 1.23 | 1.17 | 1.21 | 1.15 | 0.26 | 0.24 | 0.13 | 0.13 | 0.64 | 0.61 |
| 170 | 2.14 | 1.95 | 2.11 | 1.93 | 0.58 | 0.55 | 0.37 | 0.36 | 1.14 | 1.07 |
| 160 | 5.07 | 4.64 | 5.04 | 4.61 | 1.87 | 1.73 | 1.37 | 1.29 | 3.11 | 2.85 |
| 150 | 9.77 | 8.59 | 9.73 | 8.55 | 4.36 | 4.04 | 3.48 | 3.20 | 6.99 | 6.24 |
| 140 | 17.39 | 15.09 | 17.32 | 15.04 | 9.10 | 7.96 | 7.22 | 6.38 | 13.60 | 11.79 |
| 130 | 29.21 | 25.77 | 29.10 | 25.67 | 17.06 | 14.87 | 14.16 | 12.32 | 23.88 | 20.57 |
| 120 | 50.05 | 44.50 | 49.72 | 44.17 | 30.40 | 27.25 | 26.13 | 23.06 | 41.35 | 36.56 |

Table F-180. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ, 6600 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 for 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.07 | 0.07 | 0.07 | 0.07 | - | - | - | - | 0.03 | 0.03 |
| 180 | 0.41 | 0.39 | 0.41 | 0.39 | 0.08 | 0.07 | 0.05 | 0.05 | 0.17 | 0.16 |
| 175 | 0.88 | 0.84 | 0.87 | 0.83 | 0.13 | 0.13 | 0.10 | 0.09 | 0.40 | 0.38 |
| 170 | 1.55 | 1.46 | 1.53 | 1.44 | 0.38 | 0.36 | 0.20 | 0.20 | 0.81 | 0.77 |
| 160 | 4.07 | 3.77 | 4.03 | 3.74 | 1.36 | 1.28 | 0.97 | 0.92 | 2.47 | 2.26 |
| 150 | 8.25 | 7.23 | 8.21 | 7.19 | 3.45 | 3.18 | 2.75 | 2.52 | 5.61 | 5.09 |
| 140 | 14.88 | 12.93 | 14.81 | 12.88 | 7.39 | 6.51 | 5.85 | 5.25 | 11.33 | 9.65 |
| 130 | 25.37 | 22.08 | 25.27 | 21.98 | 14.36 | 12.49 | 11.76 | 10.06 | 19.67 | 17.26 |
| 120 | 42.48 | 37.47 | 42.20 | 37.25 | 25.96 | 22.82 | 21.43 | 18.59 | 34.29 | 30.60 |

Table F-181. Monopile foundation (14 m difficult to drive monopile with an MHU5500 hammer scaled to 6600 kJ, 6600 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 for 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.18 | 0.17 | 0.18 | 0.17 | - | - | - | - | 0.08 | 0.08 |
| 190 | 0.92 | 0.88 | 0.91 | 0.87 | 0.13 | 0.13 | 0.10 | 0.10 | 0.41 | 0.39 |
| 180 | 2.77 | 2.55 | 2.75 | 2.52 | 0.77 | 0.73 | 0.48 | 0.44 | 1.54 | 1.43 |
| 175 | 4.33 | 4.04 | 4.31 | 4.00 | 1.43 | 1.35 | 1.00 | 0.95 | 2.57 | 2.37 |
| 170 | 6.46 | 5.82 | 6.41 | 5.78 | 2.41 | 2.21 | 1.80 | 1.67 | 4.14 | 3.80 |
| 160 | 13.41 | 11.61 | 13.33 | 11.55 | 5.64 | 5.13 | 4.33 | 4.01 | 9.35 | 8.22 |
| 150 | 26.11 | 22.92 | 25.96 | 22.77 | 12.63 | 10.94 | 9.60 | 8.46 | 19.09 | 16.74 |
| 140 | 55.51 | 50.06 | 54.88 | 49.34 | 26.69 | 23.79 | 20.33 | 18.01 | 41.68 | 36.76 |
| 130 | >90.00 | 85.44 | >90.00 | 85.35 | 80.22 | 66.77 | 52.96 | 47.16 | >90.00 | 84.90 |
| 120 | >90.00 | 86.09 | >90.00 | 86.07 | >90.00 | 85.99 | >90.00 | 85.83 | >90.00 | 86.06 |

Table F-182. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ, 6600 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 for 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.04 | 0.04 | 0.04 | 0.04 | - | - | - | - | - | - |
| 190 | 0.18 | 0.17 | 0.18 | 0.17 | - | - | - | - | 0.08 | 0.08 |
| 180 | 0.92 | 0.88 | 0.91 | 0.87 | 0.13 | 0.13 | 0.10 | 0.10 | 0.41 | 0.39 |
| 175 | 1.62 | 1.52 | 1.60 | 1.50 | 0.39 | 0.37 | 0.21 | 0.20 | 0.87 | 0.82 |
| 170 | 2.77 | 2.55 | 2.75 | 2.52 | 0.77 | 0.73 | 0.48 | 0.44 | 1.54 | 1.43 |
| 160 | 6.46 | 5.82 | 6.41 | 5.78 | 2.41 | 2.21 | 1.80 | 1.67 | 4.14 | 3.80 |
| 150 | 13.41 | 11.61 | 13.33 | 11.55 | 5.64 | 5.13 | 4.33 | 4.01 | 9.35 | 8.22 |
| 140 | 26.11 | 22.92 | 25.96 | 22.77 | 12.63 | 10.94 | 9.60 | 8.46 | 19.09 | 16.74 |
| 130 | 55.51 | 50.06 | 54.88 | 49.34 | 26.69 | 23.79 | 20.33 | 18.01 | 41.68 | 36.76 |
| 120 | >90.00 | 85.44 | >90.00 | 85.35 | 80.22 | 66.77 | 52.96 | 47.16 | >90.00 | 84.90 |

Table F-183. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ, 6600 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 for 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 190 | 0.12 | 0.12 | 0.12 | 0.12 | - | - | - | - | 0.06 | 0.06 |
| 180 | 0.68 | 0.66 | 0.68 | 0.65 | 0.11 | 0.11 | 0.09 | 0.08 | 0.34 | 0.33 |
| 175 | 1.29 | 1.23 | 1.27 | 1.21 | 0.24 | 0.23 | 0.13 | 0.13 | 0.66 | 0.63 |
| 170 | 2.27 | 2.07 | 2.23 | 2.03 | 0.60 | 0.58 | 0.39 | 0.37 | 1.20 | 1.15 |
| 160 | 5.52 | 5.04 | 5.48 | 5.01 | 1.94 | 1.81 | 1.44 | 1.36 | 3.44 | 3.11 |
| 150 | 11.71 | 10.01 | 11.65 | 9.95 | 4.76 | 4.40 | 3.73 | 3.44 | 8.03 | 7.09 |
| 140 | 22.69 | 19.47 | 22.54 | 19.31 | 10.70 | 9.26 | 8.32 | 7.30 | 16.80 | 14.62 |
| 130 | 47.82 | 41.93 | 47.31 | 41.47 | 22.74 | 19.77 | 17.71 | 15.59 | 34.96 | 31.07 |
| 120 | >90.00 | 85.17 | >90.00 | 85.07 | 56.58 | 50.28 | 42.78 | 37.91 | >90.00 | 84.12 |

Table F-184. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ, 6600 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 for 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.08 | 0.08 | 0.08 | 0.07 | - | - | - | - | 0.03 | 0.03 |
| 180 | 0.45 | 0.41 | 0.42 | 0.40 | 0.08 | 0.08 | 0.05 | 0.05 | 0.17 | 0.17 |
| 175 | 0.92 | 0.88 | 0.91 | 0.87 | 0.13 | 0.13 | 0.10 | 0.10 | 0.41 | 0.39 |
| 170 | 1.62 | 1.52 | 1.60 | 1.50 | 0.39 | 0.37 | 0.21 | 0.20 | 0.87 | 0.82 |
| 160 | 4.33 | 4.04 | 4.31 | 4.00 | 1.43 | 1.35 | 1.00 | 0.95 | 2.57 | 2.37 |
| 150 | 9.35 | 8.22 | 9.30 | 8.17 | 3.77 | 3.43 | 2.85 | 2.63 | 6.27 | 5.67 |
| 140 | 18.38 | 16.01 | 18.30 | 15.93 | 8.53 | 7.49 | 6.50 | 5.85 | 13.70 | 11.89 |
| 130 | 37.43 | 32.92 | 37.09 | 32.64 | 17.99 | 15.80 | 14.27 | 12.46 | 27.76 | 24.67 |
| 120 | >90.00 | 84.34 | >90.00 | 84.17 | 41.63 | 36.86 | 31.47 | 28.40 | 70.04 | 60.81 |

Table F-185. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ, 6600 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 for 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.18 | 0.18 | 0.18 | 0.18 | - | - | - | - | 0.12 | 0.12 |
| 190 | 1.16 | 1.11 | 1.15 | 1.09 | 0.18 | 0.17 | 0.14 | 0.14 | 0.54 | 0.52 |
| 180 | 3.40 | 3.25 | 3.36 | 3.21 | 0.97 | 0.93 | 0.63 | 0.60 | 1.95 | 1.86 |
| 175 | 5.06 | 4.80 | 5.01 | 4.75 | 1.80 | 1.73 | 1.28 | 1.22 | 3.18 | 3.03 |
| 170 | 7.43 | 6.97 | 7.34 | 6.89 | 2.95 | 2.82 | 2.30 | 2.19 | 4.81 | 4.55 |
| 160 | 14.77 | 13.51 | 14.62 | 13.39 | 6.21 | 5.86 | 5.24 | 4.91 | 9.46 | 8.83 |
| 150 | 29.21 | 25.98 | 28.93 | 25.77 | 11.96 | 11.03 | 9.61 | 8.94 | 17.89 | 16.26 |
| 140 | 63.82 | 54.68 | 63.58 | 54.39 | 21.98 | 19.63 | 17.42 | 15.81 | 39.41 | 34.36 |
| 130 | 89.99 | 80.52 | 89.99 | 80.44 | 54.40 | 46.73 | 37.78 | 33.37 | 79.45 | 66.47 |
| 120 | >90.00 | 85.33 | >90.00 | 85.32 | 89.99 | 77.96 | 83.28 | 70.42 | >90.00 | 85.17 |

Table F-186. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ, 6600 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 for 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 190 | 0.18 | 0.18 | 0.18 | 0.18 | - | - | - | - | 0.12 | 0.12 |
| 180 | 1.16 | 1.11 | 1.15 | 1.09 | 0.18 | 0.17 | 0.14 | 0.14 | 0.54 | 0.52 |
| 175 | 2.08 | 2.00 | 2.05 | 1.97 | 0.51 | 0.48 | 0.33 | 0.32 | 1.08 | 1.02 |
| 170 | 3.40 | 3.25 | 3.36 | 3.21 | 0.97 | 0.93 | 0.63 | 0.60 | 1.95 | 1.86 |
| 160 | 7.43 | 6.97 | 7.34 | 6.89 | 2.95 | 2.82 | 2.30 | 2.19 | 4.81 | 4.55 |
| 150 | 14.77 | 13.51 | 14.62 | 13.39 | 6.21 | 5.86 | 5.24 | 4.91 | 9.46 | 8.83 |
| 140 | 29.21 | 25.98 | 28.93 | 25.77 | 11.96 | 11.03 | 9.61 | 8.94 | 17.89 | 16.26 |
| 130 | 63.82 | 54.68 | 63.58 | 54.39 | 21.98 | 19.63 | 17.42 | 15.81 | 39.41 | 34.36 |
| 120 | 89.99 | 80.52 | 89.99 | 80.44 | 54.40 | 46.73 | 37.78 | 33.37 | 79.45 | 66.47 |

Table F-187. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ, 6600 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 for 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.16 | 0.16 | 0.16 | 0.16 | - | - | - | - | 0.09 | 0.09 |
| 180 | 0.91 | 0.86 | 0.80 | 0.77 | 0.16 | 0.15 | 0.10 | 0.10 | 0.36 | 0.35 |
| 175 | 1.67 | 1.60 | 1.65 | 1.58 | 0.34 | 0.33 | 0.18 | 0.18 | 0.78 | 0.75 |
| 170 | 2.80 | 2.69 | 2.77 | 2.66 | 0.66 | 0.64 | 0.53 | 0.51 | 1.61 | 1.54 |
| 160 | 6.36 | 6.03 | 6.28 | 5.96 | 2.50 | 2.40 | 1.82 | 1.74 | 4.16 | 3.97 |
| 150 | 12.98 | 11.97 | 12.86 | 11.86 | 5.50 | 5.20 | 4.58 | 4.32 | 8.37 | 7.83 |
| 140 | 25.44 | 22.72 | 25.22 | 22.52 | 10.39 | 9.57 | 8.60 | 8.01 | 15.75 | 14.38 |
| 130 | 57.89 | 48.76 | 57.29 | 48.32 | 18.95 | 17.21 | 15.49 | 14.15 | 32.95 | 29.21 |
| 120 | 89.99 | 78.39 | 89.99 | 77.70 | 43.81 | 38.06 | 31.42 | 28.09 | 71.79 | 60.19 |

Table F-188. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ, 6600 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 for 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.12 | 0.12 | 0.12 | 0.12 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.55 | 0.54 | 0.55 | 0.53 | 0.10 | 0.10 | 0.03 | 0.03 | 0.18 | 0.18 |
| 175 | 1.16 | 1.11 | 1.15 | 1.09 | 0.18 | 0.17 | 0.14 | 0.14 | 0.54 | 0.52 |
| 170 | 2.08 | 2.00 | 2.05 | 1.97 | 0.51 | 0.48 | 0.33 | 0.32 | 1.08 | 1.02 |
| 160 | 5.06 | 4.80 | 5.01 | 4.75 | 1.80 | 1.73 | 1.28 | 1.22 | 3.18 | 3.03 |
| 150 | 10.44 | 9.62 | 10.30 | 9.52 | 4.56 | 4.32 | 3.61 | 3.43 | 6.70 | 6.32 |
| 140 | 19.99 | 18.11 | 19.85 | 17.99 | 8.71 | 8.11 | 6.98 | 6.58 | 13.15 | 12.12 |
| 130 | 43.71 | 37.61 | 43.23 | 37.24 | 15.89 | 14.50 | 13.16 | 12.10 | 26.07 | 23.38 |
| 120 | 81.44 | 68.85 | 80.23 | 68.31 | 32.77 | 29.19 | 24.81 | 22.24 | 62.04 | 52.74 |

Table F-189. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ, 6600 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 for 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.20 | 0.19 | 0.19 | 0.19 | - | - | - | - | 0.12 | 0.12 |
| 190 | 1.20 | 1.15 | 1.19 | 1.14 | 0.18 | 0.18 | 0.14 | 0.14 | 0.55 | 0.53 |
| 180 | 3.60 | 3.44 | 3.55 | 3.40 | 1.00 | 0.95 | 0.64 | 0.62 | 2.04 | 1.95 |
| 175 | 5.35 | 5.06 | 5.29 | 5.01 | 1.88 | 1.79 | 1.32 | 1.26 | 3.38 | 3.23 |
| 170 | 8.02 | 7.49 | 7.93 | 7.41 | 3.10 | 2.95 | 2.38 | 2.28 | 5.06 | 4.78 |
| 160 | 17.27 | 15.74 | 17.08 | 15.58 | 6.61 | 6.21 | 5.49 | 5.16 | 10.24 | 9.43 |
| 150 | 47.92 | 41.18 | 47.01 | 40.45 | 13.18 | 12.12 | 10.47 | 9.62 | 23.14 | 20.90 |
| 140 | >90.00 | 85.04 | >90.00 | 85.03 | 31.58 | 28.21 | 21.28 | 19.19 | >90.00 | 83.00 |
| 130 | >90.00 | 85.39 | >90.00 | 85.40 | >90.00 | 84.86 | >90.00 | 82.19 | >90.00 | 85.35 |
| 120 | >90.00 | 85.87 | >90.00 | 85.78 | >90.00 | 85.11 | >90.00 | 85.04 | >90.00 | 85.69 |

Table F-190. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ, 6600 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 for 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 190 | 0.20 | 0.19 | 0.19 | 0.19 | - | - | - | - | 0.12 | 0.12 |
| 180 | 1.20 | 1.15 | 1.19 | 1.14 | 0.18 | 0.18 | 0.14 | 0.14 | 0.55 | 0.53 |
| 175 | 2.17 | 2.08 | 2.14 | 2.05 | 0.50 | 0.48 | 0.21 | 0.20 | 1.13 | 1.08 |
| 170 | 3.60 | 3.44 | 3.55 | 3.40 | 1.00 | 0.95 | 0.64 | 0.62 | 2.04 | 1.95 |
| 160 | 8.02 | 7.49 | 7.93 | 7.41 | 3.10 | 2.95 | 2.38 | 2.28 | 5.06 | 4.78 |
| 150 | 17.27 | 15.74 | 17.08 | 15.58 | 6.61 | 6.21 | 5.49 | 5.16 | 10.24 | 9.43 |
| 140 | 47.92 | 41.18 | 47.01 | 40.45 | 13.18 | 12.12 | 10.47 | 9.62 | 23.14 | 20.90 |
| 130 | >90.00 | 85.04 | >90.00 | 85.03 | 31.58 | 28.21 | 21.28 | 19.19 | >90.00 | 83.00 |
| 120 | >90.00 | 85.39 | >90.00 | 85.40 | >90.00 | 84.86 | >90.00 | 82.19 | >90.00 | 85.35 |

Table F-191. Monopile foundation (14 m difficult to drive monopile with an MHU5500 hammer scaled to 6600 kJ, 6600 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 for 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.17 | 0.17 | 0.17 | 0.16 | - | - | - | - | 0.05 | 0.05 |
| 180 | 0.94 | 0.90 | 0.92 | 0.85 | 0.16 | 0.16 | 0.10 | 0.10 | 0.36 | 0.35 |
| 175 | 1.71 | 1.64 | 1.70 | 1.63 | 0.33 | 0.32 | 0.18 | 0.18 | 0.79 | 0.76 |
| 170 | 2.90 | 2.78 | 2.87 | 2.76 | 0.68 | 0.66 | 0.52 | 0.51 | 1.66 | 1.59 |
| 160 | 6.82 | 6.42 | 6.75 | 6.35 | 2.60 | 2.48 | 1.89 | 1.81 | 4.40 | 4.18 |
| 150 | 14.89 | 13.60 | 14.74 | 13.46 | 5.84 | 5.48 | 4.79 | 4.54 | 9.04 | 8.40 |
| 140 | 36.65 | 32.32 | 36.13 | 31.92 | 11.58 | 10.64 | 9.25 | 8.60 | 18.87 | 17.21 |
| 130 | >90.00 | 84.95 | >90.00 | 84.93 | 25.36 | 22.91 | 17.99 | 16.38 | 67.24 | 58.08 |
| 120 | >90.00 | 85.42 | >90.00 | 85.42 | >90.00 | 84.53 | 62.91 | 54.18 | >90.00 | 85.23 |

Table F-192. Monopile foundation (14 m difficult to drive monopile with an MHU 5500 hammer scaled to 6600 kJ, 6600 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 for 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.12 | 0.12 | 0.12 | 0.12 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.57 | 0.54 | 0.55 | 0.54 | 0.10 | 0.10 | 0.02 | 0.02 | 0.19 | 0.19 |
| 175 | 1.20 | 1.15 | 1.19 | 1.14 | 0.18 | 0.18 | 0.14 | 0.14 | 0.55 | 0.53 |
| 170 | 2.17 | 2.08 | 2.14 | 2.05 | 0.50 | 0.48 | 0.21 | 0.20 | 1.13 | 1.08 |
| 160 | 5.35 | 5.06 | 5.29 | 5.01 | 1.88 | 1.79 | 1.32 | 1.26 | 3.38 | 3.23 |
| 150 | 11.84 | 10.86 | 11.68 | 10.72 | 4.78 | 4.53 | 3.83 | 3.65 | 7.24 | 6.79 |
| 140 | 27.10 | 24.36 | 26.78 | 24.09 | 9.37 | 8.70 | 7.60 | 7.09 | 14.93 | 13.65 |
| 130 | >90.00 | 83.89 | >90.00 | 83.73 | 18.70 | 17.04 | 14.60 | 13.39 | 41.06 | 35.91 |
| 120 | >90.00 | 85.38 | >90.00 | 85.37 | 69.50 | 60.29 | 37.81 | 33.36 | >90.00 | 85.01 |

## F.2.3. Jacket Foundation (Typical)

### F.2.3.1. 4 m Typical Jacket Foundation with an MHU 3500S Hammer

Table F-193. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 190 | 0.15 | 0.15 | 0.15 | 0.15 | 0.03 | 0.03 | 0.03 | 0.03 | 0.10 | 0.09 |
| 180 | 0.64 | 0.61 | 0.63 | 0.60 | 0.18 | 0.17 | 0.13 | 0.13 | 0.35 | 0.34 |
| 175 | 1.21 | 1.15 | 1.19 | 1.13 | 0.38 | 0.37 | 0.26 | 0.25 | 0.75 | 0.72 |
| 170 | 2.18 | 1.98 | 2.14 | 1.96 | 0.83 | 0.79 | 0.62 | 0.58 | 1.42 | 1.35 |
| 160 | 5.63 | 5.15 | 5.59 | 5.13 | 2.91 | 2.70 | 2.30 | 2.09 | 4.33 | 4.03 |
| 150 | 12.99 | 11.50 | 12.93 | 11.43 | 8.47 | 7.70 | 7.21 | 6.49 | 10.92 | 9.64 |
| 140 | 27.75 | 24.62 | 27.32 | 24.29 | 20.31 | 17.94 | 18.30 | 16.18 | 24.87 | 21.83 |
| 130 | 75.64 | 63.65 | 68.19 | 59.15 | 52.93 | 45.66 | 46.68 | 40.49 | 61.76 | 53.93 |
| 120 | >90 | 85.54 | >90 | 85.45 | >90 | 85.34 | >90 | 85.25 | >90 | 85.41 |

Table F-194. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.15 | 0.15 | 0.15 | 0.15 | 0.03 | 0.03 | 0.03 | 0.03 | 0.10 | 0.09 |
| 175 | 0.30 | 0.29 | 0.29 | 0.28 | 0.10 | 0.09 | 0.05 | 0.05 | 0.17 | 0.17 |
| 170 | 0.64 | 0.61 | 0.63 | 0.60 | 0.18 | 0.17 | 0.13 | 0.13 | 0.35 | 0.34 |
| 160 | 2.18 | 1.98 | 2.14 | 1.96 | 0.83 | 0.79 | 0.62 | 0.58 | 1.42 | 1.35 |
| 150 | 5.63 | 5.15 | 5.59 | 5.13 | 2.91 | 2.70 | 2.30 | 2.09 | 4.33 | 4.03 |
| 140 | 12.99 | 11.50 | 12.93 | 11.43 | 8.47 | 7.70 | 7.21 | 6.49 | 10.92 | 9.64 |
| 130 | 27.75 | 24.62 | 27.32 | 24.29 | 20.31 | 17.94 | 18.30 | 16.18 | 24.87 | 21.83 |
| 120 | 75.64 | 63.65 | 68.19 | 59.15 | 52.93 | 45.66 | 46.68 | 40.49 | 61.76 | 53.93 |

Table F-195. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.12 | 0.12 | 0.12 | 0.12 | 0.03 | 0.03 | 0.02 | 0.02 | 0.05 | 0.05 |
| 175 | 0.23 | 0.23 | 0.23 | 0.23 | 0.05 | 0.05 | 0.03 | 0.03 | 0.14 | 0.13 |
| 170 | 0.48 | 0.46 | 0.47 | 0.45 | 0.15 | 0.14 | 0.10 | 0.09 | 0.26 | 0.26 |
| 160 | 1.74 | 1.62 | 1.73 | 1.61 | 0.65 | 0.61 | 0.42 | 0.40 | 1.09 | 1.01 |
| 150 | 4.73 | 4.38 | 4.70 | 4.35 | 2.34 | 2.14 | 1.73 | 1.62 | 3.57 | 3.30 |
| 140 | 11.07 | 9.64 | 10.99 | 9.58 | 6.97 | 6.32 | 5.79 | 5.32 | 9.23 | 8.27 |
| 130 | 23.97 | 20.96 | 23.73 | 20.70 | 17.37 | 15.40 | 15.26 | 13.71 | 20.93 | 18.27 |
| 120 | 57.93 | 50.66 | 55.10 | 48.45 | 42.49 | 37.09 | 38.16 | 32.81 | 50.92 | 44.28 |

Table F-196. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | - | - | - | - | - | - | - | - | - | - |
| 180 | 0.05 | 0.05 | 0.05 | 0.05 | 0.02 | 0.02 | - | - | 0.03 | 0.03 |
| 175 | 0.15 | 0.15 | 0.15 | 0.15 | 0.03 | 0.03 | 0.03 | 0.03 | 0.10 | 0.09 |
| 170 | 0.30 | 0.29 | 0.29 | 0.28 | 0.10 | 0.09 | 0.05 | 0.05 | 0.17 | 0.17 |
| 160 | 1.21 | 1.15 | 1.19 | 1.13 | 0.38 | 0.37 | 0.26 | 0.25 | 0.75 | 0.72 |
| 150 | 3.59 | 3.35 | 3.56 | 3.33 | 1.61 | 1.52 | 1.16 | 1.10 | 2.56 | 2.39 |
| 140 | 8.73 | 7.75 | 8.68 | 7.71 | 5.13 | 4.72 | 4.19 | 3.91 | 6.91 | 6.33 |
| 130 | 18.84 | 16.57 | 18.68 | 16.44 | 13.40 | 12.09 | 11.76 | 10.51 | 16.45 | 14.64 |
| 120 | 42.76 | 37.67 | 41.14 | 36.58 | 32.39 | 27.91 | 29.37 | 24.91 | 37.59 | 33.21 |

Table F-197. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 190 | 0.15 | 0.14 | 0.15 | 0.14 | 0.03 | 0.03 | 0.03 | 0.03 | 0.09 | 0.09 |
| 180 | 0.63 | 0.60 | 0.62 | 0.60 | 0.17 | 0.17 | 0.13 | 0.13 | 0.36 | 0.35 |
| 175 | 1.19 | 1.14 | 1.17 | 1.12 | 0.40 | 0.38 | 0.27 | 0.27 | 0.75 | 0.72 |
| 170 | 2.09 | 1.93 | 2.05 | 1.91 | 0.84 | 0.80 | 0.59 | 0.57 | 1.41 | 1.33 |
| 160 | 5.69 | 5.17 | 5.65 | 5.13 | 2.84 | 2.65 | 2.30 | 2.08 | 4.26 | 3.94 |
| 150 | 15.35 | 13.44 | 15.20 | 13.31 | 8.66 | 7.86 | 7.34 | 6.46 | 12.35 | 10.86 |
| 140 | 54.95 | 48.48 | 51.40 | 45.24 | 28.87 | 25.71 | 23.60 | 20.69 | 42.13 | 37.03 |
| 130 | >90 | 86.04 | >90 | 85.95 | >90 | 85.51 | >90 | 85.06 | >90 | 85.85 |
| 120 | >90 | 86.12 | >90 | 86.12 | >90 | 86.11 | >90 | 86.10 | >90 | 86.12 |

Table F-198. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 10 dB.

| Level (dB re 1µPa$^2$) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.15 | 0.14 | 0.15 | 0.14 | 0.03 | 0.03 | 0.03 | 0.03 | 0.09 | 0.09 |
| 175 | 0.31 | 0.29 | 0.30 | 0.29 | 0.09 | 0.09 | 0.05 | 0.05 | 0.16 | 0.16 |
| 170 | 0.63 | 0.60 | 0.62 | 0.60 | 0.17 | 0.17 | 0.13 | 0.13 | 0.36 | 0.35 |
| 160 | 2.09 | 1.93 | 2.05 | 1.91 | 0.84 | 0.80 | 0.59 | 0.57 | 1.41 | 1.33 |
| 150 | 5.69 | 5.17 | 5.65 | 5.13 | 2.84 | 2.65 | 2.30 | 2.08 | 4.26 | 3.94 |
| 140 | 15.35 | 13.44 | 15.20 | 13.31 | 8.66 | 7.86 | 7.34 | 6.46 | 12.35 | 10.86 |
| 130 | 54.95 | 48.48 | 51.40 | 45.24 | 28.87 | 25.71 | 23.60 | 20.69 | 42.13 | 37.03 |
| 120 | >90 | 86.04 | >90 | 85.95 | >90 | 85.51 | >90 | 85.06 | >90 | 85.85 |

Table F-199. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 12 dB.

| Level (dB re 1µPa$^2$) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.12 | 0.12 | 0.12 | 0.11 | 0.03 | 0.03 | 0.02 | 0.02 | 0.05 | 0.05 |
| 175 | 0.23 | 0.23 | 0.23 | 0.22 | 0.05 | 0.05 | 0.04 | 0.04 | 0.13 | 0.13 |
| 170 | 0.48 | 0.46 | 0.48 | 0.46 | 0.14 | 0.13 | 0.09 | 0.09 | 0.26 | 0.26 |
| 160 | 1.69 | 1.58 | 1.66 | 1.56 | 0.63 | 0.60 | 0.46 | 0.44 | 1.09 | 1.03 |
| 150 | 4.67 | 4.32 | 4.64 | 4.29 | 2.34 | 2.12 | 1.73 | 1.61 | 3.44 | 3.17 |
| 140 | 12.67 | 11.04 | 12.55 | 10.95 | 7.12 | 6.31 | 5.69 | 5.18 | 9.75 | 8.73 |
| 130 | 39.53 | 34.84 | 37.63 | 33.32 | 22.15 | 19.38 | 18.06 | 16.10 | 30.72 | 27.36 |
| 120 | >90 | 85.87 | >90 | 85.56 | >90 | 84.65 | 89.99 | 79.51 | >90 | 85.38 |

Table F-200. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | - | - | - | - | - | - | - | - | - | - |
| 180 | 0.05 | 0.05 | 0.05 | 0.05 | 0.02 | 0.02 | - | - | 0.03 | 0.03 |
| 175 | 0.15 | 0.14 | 0.15 | 0.14 | 0.03 | 0.03 | 0.03 | 0.03 | 0.09 | 0.09 |
| 170 | 0.31 | 0.29 | 0.30 | 0.29 | 0.09 | 0.09 | 0.05 | 0.05 | 0.16 | 0.16 |
| 160 | 1.19 | 1.14 | 1.17 | 1.12 | 0.40 | 0.38 | 0.27 | 0.27 | 0.75 | 0.72 |
| 150 | 3.51 | 3.26 | 3.49 | 3.23 | 1.56 | 1.46 | 1.19 | 1.13 | 2.50 | 2.30 |
| 140 | 9.32 | 8.24 | 9.26 | 8.19 | 5.01 | 4.61 | 4.14 | 3.77 | 7.17 | 6.42 |
| 130 | 26.24 | 23.24 | 25.74 | 22.76 | 15.46 | 13.75 | 12.75 | 11.37 | 21.15 | 18.50 |
| 120 | >90 | 85.15 | >90 | 84.83 | 65.94 | 58.80 | 52.76 | 46.50 | >90 | 83.70 |

Table F-201. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 190 | 0.17 | 0.17 | 0.17 | 0.16 | 0.03 | 0.03 | 0.02 | 0.02 | 0.06 | 0.06 |
| 180 | 0.49 | 0.48 | 0.48 | 0.47 | 0.18 | 0.17 | 0.08 | 0.08 | 0.30 | 0.29 |
| 175 | 1.16 | 1.11 | 1.15 | 1.09 | 0.32 | 0.30 | 0.23 | 0.22 | 0.64 | 0.62 |
| 170 | 1.94 | 1.86 | 1.91 | 1.83 | 0.66 | 0.64 | 0.46 | 0.44 | 1.27 | 1.22 |
| 160 | 5.57 | 5.32 | 5.50 | 5.26 | 2.53 | 2.42 | 1.79 | 1.72 | 3.96 | 3.78 |
| 150 | 15.44 | 14.29 | 15.30 | 14.16 | 8.08 | 7.70 | 6.42 | 6.13 | 11.95 | 11.00 |
| 140 | 49.72 | 43.09 | 47.24 | 41.16 | 27.52 | 24.53 | 23.12 | 20.37 | 36.95 | 32.95 |
| 130 | >90 | 85.37 | >90 | 85.30 | >90 | 84.94 | >90 | 83.67 | >90 | 85.27 |
| 120 | >90 | 85.65 | >90 | 85.62 | >90 | 85.61 | >90 | 85.60 | >90 | 85.62 |

Table F-202. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.17 | 0.17 | 0.17 | 0.16 | 0.03 | 0.03 | 0.02 | 0.02 | 0.06 | 0.06 |
| 175 | 0.29 | 0.28 | 0.28 | 0.28 | 0.06 | 0.06 | 0.05 | 0.05 | 0.18 | 0.17 |
| 170 | 0.49 | 0.48 | 0.48 | 0.47 | 0.18 | 0.17 | 0.08 | 0.08 | 0.30 | 0.29 |
| 160 | 1.94 | 1.86 | 1.91 | 1.83 | 0.66 | 0.64 | 0.46 | 0.44 | 1.27 | 1.22 |
| 150 | 5.57 | 5.32 | 5.50 | 5.26 | 2.53 | 2.42 | 1.79 | 1.72 | 3.96 | 3.78 |
| 140 | 15.44 | 14.29 | 15.30 | 14.16 | 8.08 | 7.70 | 6.42 | 6.13 | 11.95 | 11.00 |
| 130 | 49.72 | 43.09 | 47.24 | 41.16 | 27.52 | 24.53 | 23.12 | 20.37 | 36.95 | 32.95 |
| 120 | >90 | 85.37 | >90 | 85.30 | >90 | 84.94 | >90 | 83.67 | >90 | 85.27 |

Table F-203. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.08 | 0.08 | 0.08 | 0.08 | 0.03 | 0.03 | 0.02 | 0.02 | 0.05 | 0.05 |
| 175 | 0.22 | 0.21 | 0.21 | 0.21 | 0.05 | 0.05 | 0.03 | 0.03 | 0.10 | 0.10 |
| 170 | 0.43 | 0.42 | 0.43 | 0.42 | 0.10 | 0.10 | 0.06 | 0.06 | 0.23 | 0.23 |
| 160 | 1.58 | 1.52 | 1.56 | 1.50 | 0.48 | 0.46 | 0.34 | 0.33 | 1.03 | 0.99 |
| 150 | 4.59 | 4.39 | 4.53 | 4.34 | 1.84 | 1.76 | 1.46 | 1.40 | 3.01 | 2.88 |
| 140 | 12.62 | 11.75 | 12.52 | 11.65 | 6.36 | 6.10 | 5.00 | 4.77 | 9.32 | 8.81 |
| 130 | 36.61 | 32.66 | 35.63 | 31.84 | 21.49 | 19.08 | 17.35 | 16.08 | 29.14 | 26.04 |
| 120 | >90 | 85.28 | >90 | 85.11 | 86.92 | 76.99 | 74.30 | 65.03 | >90 | 84.41 |

Table F-204. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | - | - | - | - | - | - | - | - | - | - |
| 180 | 0.05 | 0.05 | 0.05 | 0.05 | 0.02 | 0.02 | - | - | 0.03 | 0.03 |
| 175 | 0.17 | 0.17 | 0.17 | 0.16 | 0.03 | 0.03 | 0.02 | 0.02 | 0.06 | 0.06 |
| 170 | 0.29 | 0.28 | 0.28 | 0.28 | 0.06 | 0.06 | 0.05 | 0.05 | 0.18 | 0.17 |
| 160 | 1.16 | 1.11 | 1.15 | 1.09 | 0.32 | 0.30 | 0.23 | 0.22 | 0.64 | 0.62 |
| 150 | 3.30 | 3.14 | 3.24 | 3.08 | 1.41 | 1.35 | 1.06 | 1.02 | 2.21 | 2.10 |
| 140 | 9.19 | 8.67 | 9.11 | 8.60 | 4.56 | 4.36 | 3.38 | 3.23 | 6.72 | 6.39 |
| 130 | 26.46 | 23.74 | 26.07 | 23.40 | 14.88 | 13.75 | 12.20 | 11.30 | 20.47 | 18.44 |
| 120 | 86.66 | 77.70 | 82.04 | 71.78 | 59.03 | 49.91 | 45.27 | 39.54 | 73.17 | 64.76 |

Table F-205. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 190 | 0.16 | 0.16 | 0.16 | 0.16 | 0.03 | 0.03 | 0.03 | 0.03 | 0.06 | 0.06 |
| 180 | 0.50 | 0.49 | 0.50 | 0.48 | 0.17 | 0.17 | 0.10 | 0.10 | 0.31 | 0.31 |
| 175 | 1.17 | 1.11 | 1.15 | 1.10 | 0.33 | 0.32 | 0.23 | 0.22 | 0.66 | 0.63 |
| 170 | 1.90 | 1.82 | 1.88 | 1.81 | 0.69 | 0.66 | 0.48 | 0.47 | 1.27 | 1.23 |
| 160 | 5.30 | 5.03 | 5.26 | 4.99 | 2.45 | 2.34 | 1.87 | 1.78 | 3.86 | 3.66 |
| 150 | 14.48 | 13.33 | 14.31 | 13.18 | 7.48 | 7.10 | 6.08 | 5.78 | 10.42 | 9.66 |
| 140 | 64.97 | 56.35 | 59.75 | 51.76 | 25.15 | 22.31 | 19.68 | 17.90 | 38.77 | 33.71 |
| 130 | >90 | 85.58 | >90 | 85.48 | >90 | 85.15 | >90 | 84.65 | >90 | 85.33 |
| 120 | >90 | 85.96 | >90 | 85.92 | >90 | 85.84 | >90 | 85.82 | >90 | 85.90 |

Table F-206. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.16 | 0.16 | 0.16 | 0.16 | 0.03 | 0.03 | 0.03 | 0.03 | 0.06 | 0.06 |
| 175 | 0.29 | 0.28 | 0.29 | 0.28 | 0.06 | 0.06 | 0.05 | 0.05 | 0.17 | 0.17 |
| 170 | 0.50 | 0.49 | 0.50 | 0.48 | 0.17 | 0.17 | 0.10 | 0.10 | 0.31 | 0.31 |
| 160 | 1.90 | 1.82 | 1.88 | 1.81 | 0.69 | 0.66 | 0.48 | 0.47 | 1.27 | 1.23 |
| 150 | 5.30 | 5.03 | 5.26 | 4.99 | 2.45 | 2.34 | 1.87 | 1.78 | 3.86 | 3.66 |
| 140 | 14.48 | 13.33 | 14.31 | 13.18 | 7.48 | 7.10 | 6.08 | 5.78 | 10.42 | 9.66 |
| 130 | 64.97 | 56.35 | 59.75 | 51.76 | 25.15 | 22.31 | 19.68 | 17.90 | 38.77 | 33.71 |
| 120 | >90 | 85.58 | >90 | 85.48 | >90 | 85.15 | >90 | 84.65 | >90 | 85.33 |

Table F-207. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.08 | 0.08 | 0.08 | 0.08 | 0.03 | 0.03 | 0.02 | 0.02 | 0.05 | 0.05 |
| 175 | 0.20 | 0.20 | 0.20 | 0.20 | 0.05 | 0.05 | 0.03 | 0.03 | 0.10 | 0.10 |
| 170 | 0.43 | 0.42 | 0.42 | 0.41 | 0.10 | 0.10 | 0.06 | 0.06 | 0.23 | 0.23 |
| 160 | 1.58 | 1.52 | 1.56 | 1.50 | 0.49 | 0.48 | 0.35 | 0.34 | 1.05 | 1.01 |
| 150 | 4.38 | 4.17 | 4.35 | 4.13 | 1.90 | 1.82 | 1.50 | 1.44 | 2.97 | 2.85 |
| 140 | 11.60 | 10.75 | 11.45 | 10.62 | 6.06 | 5.74 | 4.84 | 4.60 | 8.64 | 8.11 |
| 130 | 42.25 | 36.44 | 40.16 | 34.80 | 18.85 | 17.14 | 15.40 | 14.22 | 28.01 | 24.84 |
| 120 | >90 | 85.37 | >90 | 85.30 | >90 | 84.43 | 85.84 | 76.00 | >90 | 85.19 |

Table F-208. Jacket foundation (pre-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | - | - | - | - | - | - | - | - | - | - |
| 180 | 0.05 | 0.05 | 0.05 | 0.05 | 0.02 | 0.02 | - | - | 0.03 | 0.03 |
| 175 | 0.16 | 0.16 | 0.16 | 0.16 | 0.03 | 0.03 | 0.03 | 0.03 | 0.06 | 0.06 |
| 170 | 0.29 | 0.28 | 0.29 | 0.28 | 0.06 | 0.06 | 0.05 | 0.05 | 0.17 | 0.17 |
| 160 | 1.17 | 1.11 | 1.15 | 1.10 | 0.33 | 0.32 | 0.23 | 0.22 | 0.66 | 0.63 |
| 150 | 3.15 | 3.02 | 3.12 | 2.98 | 1.42 | 1.36 | 1.06 | 1.01 | 2.23 | 2.12 |
| 140 | 8.57 | 8.05 | 8.50 | 7.99 | 4.36 | 4.14 | 3.41 | 3.25 | 6.30 | 5.97 |
| 130 | 26.20 | 23.32 | 25.67 | 22.84 | 13.16 | 12.23 | 10.71 | 9.92 | 18.65 | 16.94 |
| 120 | >90 | 85.13 | >90 | 84.92 | 62.53 | 54.77 | 45.98 | 39.81 | >90 | 84.24 |

Table F-209. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 190 | 0.21 | 0.20 | 0.21 | 0.20 | 0.05 | 0.05 | 0.03 | 0.03 | 0.12 | 0.12 |
| 180 | 0.85 | 0.81 | 0.84 | 0.80 | 0.24 | 0.23 | 0.17 | 0.17 | 0.48 | 0.46 |
| 175 | 1.52 | 1.45 | 1.51 | 1.43 | 0.54 | 0.52 | 0.36 | 0.34 | 0.94 | 0.90 |
| 170 | 2.66 | 2.50 | 2.64 | 2.48 | 1.02 | 0.98 | 0.79 | 0.76 | 1.80 | 1.66 |
| 160 | 6.70 | 6.06 | 6.67 | 6.03 | 3.81 | 3.51 | 2.90 | 2.69 | 5.24 | 4.84 |
| 150 | 15.05 | 13.33 | 14.96 | 13.24 | 10.05 | 9.11 | 8.81 | 7.98 | 12.99 | 11.61 |
| 140 | 32.50 | 28.92 | 31.75 | 28.39 | 24.89 | 21.47 | 21.86 | 18.87 | 29.36 | 25.75 |
| 130 | 89.99 | 82.86 | 88.39 | 76.13 | 65.12 | 56.20 | 58.21 | 49.93 | 81.31 | 68.36 |
| 120 | >90 | 85.56 | >90 | 85.53 | >90 | 85.49 | >90 | 85.42 | >90 | 85.52 |

Table F-210. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.21 | 0.20 | 0.21 | 0.20 | 0.05 | 0.05 | 0.03 | 0.03 | 0.12 | 0.12 |
| 175 | 0.42 | 0.40 | 0.41 | 0.39 | 0.13 | 0.13 | 0.07 | 0.07 | 0.23 | 0.22 |
| 170 | 0.85 | 0.81 | 0.84 | 0.80 | 0.24 | 0.23 | 0.17 | 0.17 | 0.48 | 0.46 |
| 160 | 2.66 | 2.50 | 2.64 | 2.48 | 1.02 | 0.98 | 0.79 | 0.76 | 1.80 | 1.66 |
| 150 | 6.70 | 6.06 | 6.67 | 6.03 | 3.81 | 3.51 | 2.90 | 2.69 | 5.24 | 4.84 |
| 140 | 15.05 | 13.33 | 14.96 | 13.24 | 10.05 | 9.11 | 8.81 | 7.98 | 12.99 | 11.61 |
| 130 | 32.50 | 28.92 | 31.75 | 28.39 | 24.89 | 21.47 | 21.86 | 18.87 | 29.36 | 25.75 |
| 120 | 89.99 | 82.86 | 88.39 | 76.13 | 65.12 | 56.20 | 58.21 | 49.93 | 81.31 | 68.36 |

Table F-211. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.15 | 0.15 | 0.15 | 0.15 | 0.03 | 0.03 | 0.03 | 0.03 | 0.10 | 0.09 |
| 175 | 0.30 | 0.29 | 0.29 | 0.28 | 0.10 | 0.09 | 0.05 | 0.05 | 0.17 | 0.17 |
| 170 | 0.64 | 0.61 | 0.63 | 0.60 | 0.18 | 0.17 | 0.13 | 0.13 | 0.35 | 0.34 |
| 160 | 2.18 | 1.98 | 2.14 | 1.96 | 0.83 | 0.79 | 0.62 | 0.58 | 1.42 | 1.35 |
| 150 | 5.63 | 5.15 | 5.59 | 5.13 | 2.91 | 2.70 | 2.30 | 2.09 | 4.33 | 4.03 |
| 140 | 12.99 | 11.50 | 12.93 | 11.42 | 8.47 | 7.70 | 7.21 | 6.49 | 10.92 | 9.64 |
| 130 | 27.75 | 24.62 | 27.32 | 24.30 | 20.31 | 17.94 | 18.30 | 16.18 | 24.87 | 21.83 |
| 120 | 75.64 | 63.65 | 68.19 | 59.15 | 52.93 | 45.66 | 46.68 | 40.49 | 61.76 | 53.93 |

Table F-212. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | - | - | - | - | - | - | - | - | - | - |
| 180 | 0.10 | 0.10 | 0.10 | 0.10 | 0.02 | 0.02 | 0.02 | 0.02 | 0.04 | 0.04 |
| 175 | 0.21 | 0.20 | 0.21 | 0.20 | 0.05 | 0.05 | 0.03 | 0.03 | 0.12 | 0.12 |
| 170 | 0.42 | 0.40 | 0.41 | 0.39 | 0.13 | 0.13 | 0.07 | 0.07 | 0.23 | 0.22 |
| 160 | 1.52 | 1.45 | 1.51 | 1.43 | 0.54 | 0.52 | 0.36 | 0.34 | 0.94 | 0.90 |
| 150 | 4.33 | 4.03 | 4.30 | 4.00 | 1.99 | 1.86 | 1.58 | 1.49 | 3.17 | 2.88 |
| 140 | 10.03 | 8.97 | 9.97 | 8.93 | 6.30 | 5.75 | 5.25 | 4.81 | 8.47 | 7.60 |
| 130 | 22.13 | 19.10 | 21.85 | 18.88 | 16.00 | 14.20 | 14.01 | 12.59 | 19.31 | 17.04 |
| 120 | 52.59 | 45.86 | 50.31 | 44.09 | 38.58 | 33.55 | 34.76 | 29.87 | 45.83 | 40.11 |

Table F-213. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 190 | 0.21 | 0.20 | 0.21 | 0.20 | 0.05 | 0.05 | 0.03 | 0.03 | 0.12 | 0.11 |
| 180 | 0.85 | 0.80 | 0.84 | 0.79 | 0.24 | 0.23 | 0.17 | 0.16 | 0.51 | 0.48 |
| 175 | 1.50 | 1.41 | 1.50 | 1.40 | 0.56 | 0.54 | 0.38 | 0.37 | 0.96 | 0.91 |
| 170 | 2.59 | 2.41 | 2.58 | 2.38 | 1.08 | 1.02 | 0.80 | 0.76 | 1.78 | 1.65 |
| 160 | 6.88 | 6.21 | 6.83 | 6.17 | 3.64 | 3.34 | 2.83 | 2.63 | 5.18 | 4.76 |
| 150 | 18.71 | 16.47 | 18.47 | 16.26 | 10.89 | 9.61 | 8.88 | 8.09 | 15.29 | 13.47 |
| 140 | 79.29 | 71.00 | 69.62 | 62.86 | 40.14 | 35.21 | 30.95 | 27.59 | 57.71 | 51.26 |
| 130 | >90 | 86.09 | >90 | 86.03 | >90 | 85.97 | >90 | 85.80 | >90 | 86.01 |
| 120 | >90 | 86.09 | >90 | 86.11 | >90 | 86.11 | >90 | 86.12 | >90 | 86.11 |

Table F-214. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.21 | 0.20 | 0.21 | 0.20 | 0.05 | 0.05 | 0.03 | 0.03 | 0.12 | 0.11 |
| 175 | 0.43 | 0.40 | 0.42 | 0.39 | 0.12 | 0.12 | 0.08 | 0.08 | 0.23 | 0.22 |
| 170 | 0.85 | 0.80 | 0.84 | 0.79 | 0.24 | 0.23 | 0.17 | 0.16 | 0.51 | 0.48 |
| 160 | 2.59 | 2.41 | 2.58 | 2.38 | 1.08 | 1.02 | 0.80 | 0.76 | 1.78 | 1.65 |
| 150 | 6.88 | 6.21 | 6.83 | 6.17 | 3.64 | 3.34 | 2.83 | 2.63 | 5.18 | 4.76 |
| 140 | 18.71 | 16.47 | 18.47 | 16.26 | 10.89 | 9.61 | 8.88 | 8.09 | 15.29 | 13.47 |
| 130 | 79.29 | 71.00 | 69.62 | 62.86 | 40.14 | 35.21 | 30.95 | 27.59 | 57.71 | 51.26 |
| 120 | >90 | 86.09 | >90 | 86.03 | >90 | 85.97 | >90 | 85.80 | >90 | 86.01 |

Table F-215. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.15 | 0.14 | 0.15 | 0.14 | 0.03 | 0.03 | 0.03 | 0.03 | 0.09 | 0.09 |
| 175 | 0.31 | 0.29 | 0.30 | 0.29 | 0.09 | 0.09 | 0.05 | 0.05 | 0.16 | 0.16 |
| 170 | 0.63 | 0.60 | 0.62 | 0.60 | 0.17 | 0.17 | 0.13 | 0.13 | 0.36 | 0.35 |
| 160 | 2.09 | 1.93 | 2.05 | 1.91 | 0.84 | 0.80 | 0.59 | 0.57 | 1.41 | 1.33 |
| 150 | 5.69 | 5.17 | 5.65 | 5.13 | 2.84 | 2.65 | 2.30 | 2.08 | 4.26 | 3.94 |
| 140 | 15.35 | 13.44 | 15.20 | 13.31 | 8.66 | 7.86 | 7.34 | 6.46 | 12.35 | 10.86 |
| 130 | 54.95 | 48.48 | 51.40 | 45.24 | 28.87 | 25.71 | 23.60 | 20.69 | 42.13 | 37.03 |
| 120 | >90 | 86.04 | >90 | 85.95 | >90 | 85.51 | >90 | 85.06 | >90 | 85.85 |

Table F-216. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | - | - | - | - | - | - | - | - | - | - |
| 180 | 0.10 | 0.10 | 0.10 | 0.10 | 0.02 | 0.02 | 0.02 | 0.02 | 0.04 | 0.04 |
| 175 | 0.21 | 0.20 | 0.21 | 0.20 | 0.05 | 0.05 | 0.03 | 0.03 | 0.12 | 0.11 |
| 170 | 0.43 | 0.40 | 0.42 | 0.39 | 0.12 | 0.12 | 0.08 | 0.08 | 0.23 | 0.22 |
| 160 | 1.50 | 1.41 | 1.50 | 1.40 | 0.56 | 0.54 | 0.38 | 0.37 | 0.96 | 0.91 |
| 150 | 4.27 | 3.96 | 4.24 | 3.94 | 1.95 | 1.84 | 1.52 | 1.43 | 3.01 | 2.80 |
| 140 | 11.41 | 9.87 | 11.33 | 9.78 | 6.29 | 5.67 | 5.09 | 4.67 | 8.87 | 7.94 |
| 130 | 33.62 | 29.95 | 32.41 | 28.96 | 19.42 | 17.29 | 15.98 | 14.33 | 27.13 | 24.07 |
| 120 | >90 | 85.64 | >90 | 85.35 | 89.99 | 83.26 | 74.97 | 66.40 | >90 | 85.05 |

Table F-217. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 190 | 0.20 | 0.20 | 0.20 | 0.20 | 0.05 | 0.05 | 0.03 | 0.03 | 0.07 | 0.07 |
| 180 | 0.74 | 0.71 | 0.73 | 0.70 | 0.22 | 0.22 | 0.16 | 0.15 | 0.40 | 0.39 |
| 175 | 1.43 | 1.37 | 1.42 | 1.36 | 0.42 | 0.40 | 0.29 | 0.28 | 0.89 | 0.76 |
| 170 | 2.45 | 2.34 | 2.40 | 2.30 | 0.97 | 0.93 | 0.62 | 0.60 | 1.58 | 1.51 |
| 160 | 6.79 | 6.45 | 6.73 | 6.40 | 3.05 | 2.92 | 2.45 | 2.32 | 4.86 | 4.63 |
| 150 | 18.95 | 17.31 | 18.73 | 17.15 | 10.00 | 9.46 | 8.33 | 7.84 | 14.68 | 13.60 |
| 140 | 65.19 | 56.29 | 62.60 | 53.88 | 35.10 | 31.31 | 29.38 | 26.08 | 50.55 | 44.04 |
| 130 | >90 | 85.41 | >90 | 85.35 | >90 | 85.31 | >90 | 85.23 | >90 | 85.35 |
| 120 | >90 | 85.71 | >90 | 85.67 | >90 | 85.63 | >90 | 85.63 | >90 | 85.65 |

Table F-218. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.20 | 0.20 | 0.20 | 0.20 | 0.05 | 0.05 | 0.03 | 0.03 | 0.07 | 0.07 |
| 175 | 0.39 | 0.37 | 0.38 | 0.37 | 0.08 | 0.08 | 0.06 | 0.06 | 0.21 | 0.20 |
| 170 | 0.74 | 0.71 | 0.73 | 0.70 | 0.22 | 0.22 | 0.16 | 0.15 | 0.40 | 0.39 |
| 160 | 2.45 | 2.34 | 2.40 | 2.30 | 0.97 | 0.93 | 0.62 | 0.60 | 1.58 | 1.51 |
| 150 | 6.79 | 6.45 | 6.73 | 6.40 | 3.05 | 2.92 | 2.45 | 2.32 | 4.86 | 4.63 |
| 140 | 18.95 | 17.31 | 18.73 | 17.15 | 10.00 | 9.46 | 8.33 | 7.84 | 14.68 | 13.60 |
| 130 | 65.19 | 56.29 | 62.60 | 53.88 | 35.10 | 31.31 | 29.38 | 26.08 | 50.55 | 44.04 |
| 120 | >90 | 85.41 | >90 | 85.35 | >90 | 85.31 | >90 | 85.23 | >90 | 85.35 |

Table F-219. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.17 | 0.17 | 0.17 | 0.16 | 0.03 | 0.03 | 0.02 | 0.02 | 0.06 | 0.06 |
| 175 | 0.29 | 0.28 | 0.28 | 0.28 | 0.06 | 0.06 | 0.05 | 0.05 | 0.18 | 0.17 |
| 170 | 0.49 | 0.48 | 0.48 | 0.47 | 0.18 | 0.17 | 0.08 | 0.08 | 0.30 | 0.29 |
| 160 | 1.94 | 1.86 | 1.91 | 1.83 | 0.66 | 0.64 | 0.46 | 0.44 | 1.27 | 1.22 |
| 150 | 5.57 | 5.32 | 5.50 | 5.26 | 2.53 | 2.42 | 1.79 | 1.72 | 3.96 | 3.78 |
| 140 | 15.44 | 14.29 | 15.30 | 14.16 | 8.08 | 7.70 | 6.42 | 6.13 | 11.95 | 11.00 |
| 130 | 49.72 | 43.09 | 47.24 | 41.16 | 27.52 | 24.53 | 23.12 | 20.37 | 36.95 | 32.94 |
| 120 | >90 | 85.37 | >90 | 85.30 | >90 | 84.94 | >90 | 83.67 | >90 | 85.27 |

Table F-220. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | - | - | - | - | - | - | - | - | - | - |
| 180 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | 0.02 | 0.02 | 0.04 | 0.04 |
| 175 | 0.20 | 0.20 | 0.20 | 0.20 | 0.05 | 0.05 | 0.03 | 0.03 | 0.07 | 0.07 |
| 170 | 0.39 | 0.37 | 0.38 | 0.37 | 0.08 | 0.08 | 0.06 | 0.06 | 0.21 | 0.20 |
| 160 | 1.43 | 1.37 | 1.42 | 1.36 | 0.42 | 0.40 | 0.29 | 0.28 | 0.89 | 0.76 |
| 150 | 4.13 | 3.95 | 4.10 | 3.92 | 1.68 | 1.61 | 1.36 | 1.31 | 2.82 | 2.70 |
| 140 | 11.45 | 10.60 | 11.30 | 10.48 | 5.76 | 5.45 | 4.55 | 4.34 | 8.38 | 7.93 |
| 130 | 32.46 | 29.12 | 31.82 | 28.55 | 18.78 | 17.18 | 15.44 | 14.30 | 26.16 | 23.46 |
| 120 | >90 | 85.11 | >90 | 83.98 | 75.54 | 66.83 | 65.19 | 55.67 | 89.99 | 81.88 |

Table F-221. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 190 | 0.19 | 0.19 | 0.19 | 0.19 | 0.05 | 0.05 | 0.03 | 0.03 | 0.07 | 0.07 |
| 180 | 0.74 | 0.72 | 0.74 | 0.71 | 0.22 | 0.21 | 0.16 | 0.15 | 0.41 | 0.39 |
| 175 | 1.44 | 1.38 | 1.42 | 1.36 | 0.44 | 0.42 | 0.30 | 0.28 | 0.91 | 0.78 |
| 170 | 2.38 | 2.27 | 2.35 | 2.24 | 0.98 | 0.93 | 0.65 | 0.63 | 1.61 | 1.54 |
| 160 | 6.36 | 6.04 | 6.32 | 5.99 | 2.99 | 2.88 | 2.38 | 2.27 | 4.66 | 4.44 |
| 150 | 18.00 | 16.36 | 17.79 | 16.17 | 9.30 | 8.73 | 7.69 | 7.25 | 13.25 | 12.26 |
| 140 | >90 | 83.66 | 89.99 | 80.51 | 34.31 | 29.91 | 26.88 | 23.81 | 58.17 | 50.65 |
| 130 | >90 | 85.70 | >90 | 85.63 | >90 | 85.33 | >90 | 85.22 | >90 | 85.55 |
| 120 | >90 | 85.99 | >90 | 85.98 | >90 | 85.90 | >90 | 85.86 | >90 | 85.96 |

Table F-222. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.19 | 0.19 | 0.19 | 0.19 | 0.05 | 0.05 | 0.03 | 0.03 | 0.07 | 0.07 |
| 175 | 0.38 | 0.37 | 0.37 | 0.36 | 0.10 | 0.10 | 0.06 | 0.06 | 0.20 | 0.20 |
| 170 | 0.74 | 0.72 | 0.74 | 0.71 | 0.22 | 0.21 | 0.16 | 0.15 | 0.41 | 0.39 |
| 160 | 2.38 | 2.27 | 2.35 | 2.24 | 0.98 | 0.93 | 0.65 | 0.63 | 1.61 | 1.54 |
| 150 | 6.36 | 6.04 | 6.32 | 5.99 | 2.99 | 2.88 | 2.38 | 2.27 | 4.66 | 4.44 |
| 140 | 18.00 | 16.36 | 17.79 | 16.17 | 9.30 | 8.73 | 7.69 | 7.25 | 13.25 | 12.26 |
| 130 | >90 | 83.66 | 89.99 | 80.51 | 34.31 | 29.91 | 26.88 | 23.81 | 58.17 | 50.65 |
| 120 | >90 | 85.70 | >90 | 85.63 | >90 | 85.33 | >90 | 85.22 | >90 | 85.55 |

Table F-223. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.16 | 0.16 | 0.16 | 0.16 | 0.03 | 0.03 | 0.03 | 0.03 | 0.06 | 0.06 |
| 175 | 0.29 | 0.28 | 0.29 | 0.28 | 0.06 | 0.06 | 0.05 | 0.05 | 0.17 | 0.17 |
| 170 | 0.50 | 0.49 | 0.50 | 0.48 | 0.17 | 0.17 | 0.10 | 0.10 | 0.31 | 0.31 |
| 160 | 1.90 | 1.82 | 1.88 | 1.81 | 0.69 | 0.66 | 0.48 | 0.47 | 1.27 | 1.23 |
| 150 | 5.30 | 5.03 | 5.26 | 4.99 | 2.45 | 2.34 | 1.87 | 1.78 | 3.86 | 3.66 |
| 140 | 14.48 | 13.33 | 14.31 | 13.18 | 7.48 | 7.10 | 6.08 | 5.78 | 10.42 | 9.66 |
| 130 | 64.97 | 56.35 | 59.75 | 51.76 | 25.15 | 22.31 | 19.68 | 17.90 | 38.77 | 33.71 |
| 120 | >90 | 85.58 | >90 | 85.48 | >90 | 85.15 | >90 | 84.65 | >90 | 85.33 |

Table F-224. Jacket foundation (post-piled 4 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | - | - | - | - | - | - | - | - | - | - |
| 180 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | 0.02 | 0.02 | 0.04 | 0.04 |
| 175 | 0.19 | 0.19 | 0.19 | 0.19 | 0.05 | 0.05 | 0.03 | 0.03 | 0.07 | 0.07 |
| 170 | 0.38 | 0.37 | 0.37 | 0.36 | 0.10 | 0.10 | 0.06 | 0.06 | 0.20 | 0.20 |
| 160 | 1.44 | 1.38 | 1.42 | 1.36 | 0.44 | 0.42 | 0.30 | 0.28 | 0.91 | 0.78 |
| 150 | 4.01 | 3.84 | 3.96 | 3.80 | 1.78 | 1.71 | 1.34 | 1.28 | 2.73 | 2.61 |
| 140 | 10.26 | 9.52 | 10.13 | 9.43 | 5.42 | 5.12 | 4.34 | 4.12 | 7.78 | 7.34 |
| 130 | 35.05 | 30.59 | 33.75 | 29.63 | 16.65 | 15.31 | 13.67 | 12.68 | 24.50 | 21.80 |
| 120 | >90 | 85.32 | >90 | 85.25 | >90 | 82.44 | 69.81 | 61.32 | >90 | 84.97 |

## F.2.3.2. 4.25 m Typical Jacket Foundation with an MHU 3500S Hammer

Table F-225. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.06 | 0.06 | 0.06 | 0.06 | - | - | - | - | 0.03 | 0.03 |
| 190 | 0.31 | 0.30 | 0.30 | 0.29 | 0.06 | 0.06 | 0.05 | 0.05 | 0.14 | 0.14 |
| 180 | 1.36 | 1.29 | 1.35 | 1.27 | 0.37 | 0.35 | 0.24 | 0.24 | 0.72 | 0.68 |
| 175 | 2.57 | 2.37 | 2.55 | 2.35 | 0.76 | 0.73 | 0.54 | 0.51 | 1.41 | 1.35 |
| 170 | 4.19 | 3.91 | 4.16 | 3.88 | 1.43 | 1.36 | 1.08 | 1.00 | 2.72 | 2.49 |
| 160 | 9.38 | 8.29 | 9.35 | 8.25 | 4.46 | 4.15 | 3.46 | 3.14 | 6.91 | 6.27 |
| 150 | 18.43 | 16.12 | 18.36 | 16.05 | 10.72 | 9.34 | 8.59 | 7.66 | 15.11 | 13.23 |
| 140 | 35.46 | 31.70 | 35.17 | 31.47 | 22.69 | 19.74 | 18.68 | 16.51 | 29.79 | 26.78 |
| 130 | 82.92 | 74.16 | 79.56 | 71.48 | 49.38 | 43.70 | 40.50 | 36.03 | 65.46 | 59.44 |
| 120 | >90 | 85.40 | >90 | 85.36 | >90 | 84.96 | >90 | 84.52 | >90 | 85.29 |

Table F-226. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.06 | 0.06 | - | - | - | - | 0.03 | 0.03 |
| 180 | 0.31 | 0.30 | 0.30 | 0.29 | 0.06 | 0.06 | 0.05 | 0.05 | 0.14 | 0.14 |
| 175 | 0.67 | 0.64 | 0.65 | 0.63 | 0.16 | 0.15 | 0.09 | 0.09 | 0.33 | 0.32 |
| 170 | 1.36 | 1.29 | 1.35 | 1.27 | 0.37 | 0.35 | 0.24 | 0.24 | 0.72 | 0.68 |
| 160 | 4.19 | 3.91 | 4.16 | 3.88 | 1.43 | 1.36 | 1.08 | 1.00 | 2.72 | 2.49 |
| 150 | 9.38 | 8.29 | 9.35 | 8.25 | 4.46 | 4.15 | 3.46 | 3.14 | 6.91 | 6.27 |
| 140 | 18.43 | 16.12 | 18.36 | 16.05 | 10.72 | 9.34 | 8.59 | 7.66 | 15.11 | 13.23 |
| 130 | 35.46 | 31.70 | 35.17 | 31.47 | 22.69 | 19.74 | 18.68 | 16.51 | 29.79 | 26.78 |
| 120 | 82.92 | 74.16 | 79.56 | 71.48 | 49.38 | 43.70 | 40.50 | 36.03 | 65.46 | 59.44 |

Table F-227. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.04 | 0.04 | 0.04 | 0.04 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.22 | 0.21 | 0.22 | 0.21 | 0.06 | 0.06 | 0.05 | 0.05 | 0.10 | 0.09 |
| 175 | 0.48 | 0.46 | 0.48 | 0.44 | 0.10 | 0.10 | 0.06 | 0.06 | 0.24 | 0.24 |
| 170 | 1.03 | 0.97 | 1.01 | 0.96 | 0.26 | 0.26 | 0.17 | 0.17 | 0.53 | 0.51 |
| 160 | 3.49 | 3.22 | 3.47 | 3.19 | 1.15 | 1.07 | 0.82 | 0.78 | 2.10 | 1.92 |
| 150 | 8.12 | 7.18 | 8.08 | 7.14 | 3.72 | 3.43 | 2.78 | 2.54 | 5.87 | 5.35 |
| 140 | 16.24 | 14.17 | 16.17 | 14.11 | 9.11 | 8.12 | 7.08 | 6.44 | 13.22 | 11.55 |
| 130 | 30.85 | 27.71 | 30.68 | 27.55 | 19.30 | 17.11 | 16.19 | 14.23 | 26.35 | 23.42 |
| 120 | 65.80 | 60.00 | 64.38 | 58.68 | 41.32 | 36.76 | 34.01 | 30.52 | 55.37 | 49.60 |

Table F-228. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | - | - |
| 180 | 0.13 | 0.13 | 0.13 | 0.13 | 0.04 | 0.04 | 0.03 | 0.03 | 0.06 | 0.06 |
| 175 | 0.31 | 0.30 | 0.30 | 0.29 | 0.06 | 0.06 | 0.05 | 0.05 | 0.14 | 0.14 |
| 170 | 0.67 | 0.64 | 0.65 | 0.63 | 0.16 | 0.15 | 0.09 | 0.09 | 0.33 | 0.32 |
| 160 | 2.57 | 2.37 | 2.55 | 2.35 | 0.76 | 0.73 | 0.54 | 0.51 | 1.41 | 1.35 |
| 150 | 6.37 | 5.75 | 6.34 | 5.72 | 2.72 | 2.47 | 1.91 | 1.78 | 4.48 | 4.17 |
| 140 | 13.42 | 11.71 | 13.38 | 11.66 | 6.91 | 6.31 | 5.50 | 5.02 | 10.44 | 9.14 |
| 130 | 25.83 | 22.84 | 25.72 | 22.72 | 15.71 | 13.80 | 13.01 | 11.41 | 21.22 | 18.44 |
| 120 | 52.18 | 46.25 | 51.48 | 45.62 | 32.11 | 29.02 | 27.40 | 24.40 | 43.52 | 38.67 |

Table F-229. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.06 | 0.06 | 0.06 | 0.06 | - | - | - | - | 0.03 | 0.03 |
| 190 | 0.30 | 0.29 | 0.30 | 0.29 | 0.06 | 0.06 | 0.05 | 0.05 | 0.13 | 0.13 |
| 180 | 1.38 | 1.30 | 1.36 | 1.29 | 0.37 | 0.36 | 0.24 | 0.24 | 0.73 | 0.70 |
| 175 | 2.68 | 2.45 | 2.66 | 2.42 | 0.78 | 0.74 | 0.56 | 0.52 | 1.46 | 1.39 |
| 170 | 4.47 | 4.16 | 4.44 | 4.13 | 1.50 | 1.42 | 1.09 | 1.02 | 2.88 | 2.63 |
| 160 | 11.35 | 9.88 | 11.28 | 9.81 | 5.11 | 4.69 | 3.89 | 3.57 | 8.32 | 7.47 |
| 150 | 28.24 | 25.79 | 27.84 | 25.45 | 14.66 | 13.25 | 11.34 | 10.14 | 21.80 | 19.60 |
| 140 | >90 | 84.99 | >90 | 84.55 | 52.72 | 46.36 | 37.60 | 33.56 | >90 | 80.70 |
| 130 | >90 | 86.09 | >90 | 86.06 | >90 | 85.99 | >90 | 85.95 | >90 | 86.04 |
| 120 | >90 | 86.08 | >90 | 86.08 | >90 | 86.09 | >90 | 86.10 | >90 | 86.09 |

Table F-230. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.06 | 0.06 | - | - | - | - | 0.03 | 0.03 |
| 180 | 0.30 | 0.29 | 0.30 | 0.29 | 0.06 | 0.06 | 0.05 | 0.05 | 0.13 | 0.13 |
| 175 | 0.67 | 0.64 | 0.67 | 0.64 | 0.15 | 0.15 | 0.08 | 0.08 | 0.34 | 0.33 |
| 170 | 1.38 | 1.30 | 1.36 | 1.29 | 0.37 | 0.36 | 0.24 | 0.24 | 0.73 | 0.70 |
| 160 | 4.47 | 4.16 | 4.44 | 4.13 | 1.50 | 1.42 | 1.09 | 1.02 | 2.88 | 2.63 |
| 150 | 11.35 | 9.88 | 11.28 | 9.81 | 5.11 | 4.69 | 3.89 | 3.57 | 8.32 | 7.47 |
| 140 | 28.24 | 25.79 | 27.84 | 25.45 | 14.66 | 13.25 | 11.34 | 10.14 | 21.80 | 19.60 |
| 130 | >90 | 84.99 | >90 | 84.55 | 52.72 | 46.36 | 37.60 | 33.56 | >90 | 80.70 |
| 120 | >90 | 86.09 | >90 | 86.06 | >90 | 85.99 | >90 | 85.95 | >90 | 86.04 |

Table F-231. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.04 | 0.04 | 0.04 | 0.04 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.22 | 0.21 | 0.21 | 0.20 | 0.06 | 0.06 | 0.05 | 0.05 | 0.09 | 0.09 |
| 175 | 0.48 | 0.46 | 0.47 | 0.45 | 0.10 | 0.10 | 0.06 | 0.06 | 0.24 | 0.23 |
| 170 | 1.04 | 0.98 | 1.02 | 0.96 | 0.27 | 0.26 | 0.16 | 0.16 | 0.54 | 0.51 |
| 160 | 3.73 | 3.42 | 3.71 | 3.39 | 1.16 | 1.10 | 0.84 | 0.79 | 2.22 | 2.03 |
| 150 | 9.44 | 8.39 | 9.40 | 8.35 | 4.16 | 3.83 | 3.04 | 2.77 | 6.80 | 6.14 |
| 140 | 23.19 | 20.85 | 22.93 | 20.59 | 11.94 | 10.69 | 9.05 | 8.25 | 17.87 | 16.08 |
| 130 | >90 | 82.24 | >90 | 78.74 | 37.62 | 33.49 | 28.70 | 26.02 | 65.76 | 56.76 |
| 120 | >90 | 86.07 | >90 | 86.01 | >90 | 85.79 | >90 | 85.36 | >90 | 85.98 |

Table F-232. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | - | - |
| 180 | 0.13 | 0.13 | 0.13 | 0.13 | 0.04 | 0.04 | 0.03 | 0.03 | 0.06 | 0.06 |
| 175 | 0.30 | 0.29 | 0.30 | 0.29 | 0.06 | 0.06 | 0.05 | 0.05 | 0.13 | 0.13 |
| 170 | 0.67 | 0.64 | 0.67 | 0.64 | 0.15 | 0.15 | 0.08 | 0.08 | 0.34 | 0.33 |
| 160 | 2.68 | 2.45 | 2.66 | 2.42 | 0.78 | 0.74 | 0.56 | 0.52 | 1.46 | 1.39 |
| 150 | 7.15 | 6.46 | 7.10 | 6.43 | 2.92 | 2.66 | 2.08 | 1.90 | 5.00 | 4.59 |
| 140 | 17.49 | 15.60 | 17.37 | 15.49 | 8.64 | 7.85 | 6.73 | 6.01 | 13.51 | 12.08 |
| 130 | 54.88 | 48.32 | 52.24 | 46.27 | 25.60 | 23.32 | 19.32 | 17.59 | 39.00 | 34.89 |
| 120 | >90 | 85.90 | >90 | 85.72 | >90 | 84.84 | >90 | 80.39 | >90 | 85.49 |

Table F-233. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.06 | 0.06 | 0.05 | 0.05 | - | - | - | - | 0.03 | 0.03 |
| 190 | 0.26 | 0.24 | 0.24 | 0.24 | 0.06 | 0.06 | 0.05 | 0.05 | 0.10 | 0.10 |
| 180 | 1.13 | 1.09 | 1.11 | 1.07 | 0.27 | 0.26 | 0.20 | 0.20 | 0.61 | 0.58 |
| 175 | 2.17 | 2.08 | 2.15 | 2.06 | 0.63 | 0.61 | 0.41 | 0.39 | 1.19 | 1.15 |
| 170 | 4.18 | 4.00 | 4.12 | 3.95 | 1.27 | 1.21 | 0.93 | 0.89 | 2.35 | 2.26 |
| 160 | 12.59 | 11.66 | 12.50 | 11.57 | 4.52 | 4.33 | 3.21 | 3.08 | 8.03 | 7.57 |
| 150 | 32.65 | 29.30 | 32.32 | 29.01 | 14.62 | 13.42 | 10.82 | 10.01 | 23.65 | 21.37 |
| 140 | 86.08 | 73.97 | 84.74 | 72.33 | 48.39 | 42.03 | 34.71 | 31.07 | 74.61 | 63.68 |
| 130 | >90 | 85.39 | >90 | 85.33 | >90 | 85.31 | >90 | 85.23 | >90 | 85.33 |
| 120 | >90 | 85.74 | >90 | 85.71 | >90 | 85.63 | >90 | 85.63 | >90 | 85.69 |

Table F-234. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.05 | 0.05 | - | - | - | - | 0.03 | 0.03 |
| 180 | 0.26 | 0.24 | 0.24 | 0.24 | 0.06 | 0.06 | 0.05 | 0.05 | 0.10 | 0.10 |
| 175 | 0.52 | 0.48 | 0.49 | 0.47 | 0.11 | 0.11 | 0.08 | 0.08 | 0.26 | 0.26 |
| 170 | 1.13 | 1.09 | 1.11 | 1.07 | 0.27 | 0.26 | 0.20 | 0.20 | 0.61 | 0.58 |
| 160 | 4.18 | 4.00 | 4.12 | 3.95 | 1.27 | 1.21 | 0.93 | 0.89 | 2.35 | 2.26 |
| 150 | 12.59 | 11.66 | 12.50 | 11.57 | 4.52 | 4.33 | 3.21 | 3.08 | 8.03 | 7.57 |
| 140 | 32.65 | 29.30 | 32.32 | 29.01 | 14.62 | 13.42 | 10.82 | 10.01 | 23.65 | 21.37 |
| 130 | 86.08 | 73.97 | 84.74 | 72.33 | 48.39 | 42.03 | 34.71 | 31.07 | 74.61 | 63.68 |
| 120 | >90 | 85.39 | >90 | 85.33 | >90 | 85.31 | >90 | 85.23 | >90 | 85.33 |

Table F-235. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.04 | 0.04 | 0.04 | 0.04 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.18 | 0.18 | 0.18 | 0.18 | 0.05 | 0.05 | 0.05 | 0.05 | 0.08 | 0.08 |
| 175 | 0.41 | 0.39 | 0.40 | 0.39 | 0.09 | 0.09 | 0.06 | 0.06 | 0.20 | 0.20 |
| 170 | 0.86 | 0.82 | 0.84 | 0.81 | 0.22 | 0.22 | 0.11 | 0.11 | 0.42 | 0.41 |
| 160 | 3.31 | 3.16 | 3.26 | 3.11 | 0.97 | 0.93 | 0.68 | 0.65 | 1.78 | 1.70 |
| 150 | 9.95 | 9.37 | 9.88 | 9.30 | 3.53 | 3.37 | 2.56 | 2.45 | 6.32 | 6.01 |
| 140 | 27.05 | 24.43 | 26.81 | 24.23 | 11.57 | 10.75 | 8.51 | 8.04 | 18.98 | 17.31 |
| 130 | 78.23 | 65.49 | 76.74 | 64.23 | 35.71 | 31.97 | 27.36 | 24.75 | 62.28 | 53.45 |
| 120 | >90 | 85.34 | >90 | 85.31 | >90 | 85.15 | >90 | 84.24 | >90 | 85.30 |

Table F-236. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | - | - |
| 180 | 0.09 | 0.09 | 0.09 | 0.09 | 0.04 | 0.04 | 0.03 | 0.03 | 0.06 | 0.06 |
| 175 | 0.26 | 0.24 | 0.24 | 0.24 | 0.06 | 0.06 | 0.05 | 0.05 | 0.10 | 0.10 |
| 170 | 0.52 | 0.48 | 0.49 | 0.47 | 0.11 | 0.11 | 0.08 | 0.08 | 0.26 | 0.26 |
| 160 | 2.17 | 2.08 | 2.15 | 2.06 | 0.63 | 0.61 | 0.41 | 0.39 | 1.19 | 1.15 |
| 150 | 7.30 | 6.91 | 7.24 | 6.85 | 2.43 | 2.31 | 1.73 | 1.64 | 4.47 | 4.27 |
| 140 | 19.77 | 18.09 | 19.66 | 17.98 | 8.17 | 7.71 | 6.00 | 5.73 | 14.11 | 12.98 |
| 130 | 61.07 | 52.19 | 60.01 | 51.25 | 25.46 | 23.05 | 19.15 | 17.44 | 40.79 | 35.97 |
| 120 | >90 | 85.29 | >90 | 85.25 | 86.52 | 76.92 | 72.22 | 63.77 | >90 | 85.06 |

Table F-237. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.06 | 0.06 | 0.05 | 0.05 | - | - | - | - | 0.03 | 0.03 |
| 190 | 0.26 | 0.25 | 0.26 | 0.25 | 0.06 | 0.06 | 0.05 | 0.05 | 0.10 | 0.10 |
| 180 | 1.14 | 1.10 | 1.12 | 1.08 | 0.26 | 0.25 | 0.20 | 0.19 | 0.62 | 0.60 |
| 175 | 2.19 | 2.10 | 2.16 | 2.07 | 0.65 | 0.62 | 0.42 | 0.41 | 1.22 | 1.16 |
| 170 | 4.01 | 3.82 | 3.97 | 3.78 | 1.29 | 1.23 | 0.94 | 0.90 | 2.27 | 2.18 |
| 160 | 12.33 | 11.50 | 12.22 | 11.39 | 4.26 | 4.06 | 3.05 | 2.92 | 7.41 | 7.07 |
| 150 | 48.05 | 41.46 | 46.59 | 40.26 | 13.75 | 12.81 | 9.76 | 9.30 | 25.97 | 23.41 |
| 140 | >90 | 85.37 | >90 | 85.35 | 75.53 | 66.29 | 43.49 | 37.98 | >90 | 85.18 |
| 130 | >90 | 85.89 | >90 | 85.87 | >90 | 85.67 | >90 | 85.54 | >90 | 85.82 |
| 120 | >90 | 86.12 | >90 | 86.10 | >90 | 86.04 | >90 | 86.00 | >90 | 86.09 |

Table F-238. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.05 | 0.05 | - | - | - | - | 0.03 | 0.03 |
| 180 | 0.26 | 0.25 | 0.26 | 0.25 | 0.06 | 0.06 | 0.05 | 0.05 | 0.10 | 0.10 |
| 175 | 0.58 | 0.56 | 0.56 | 0.50 | 0.11 | 0.11 | 0.08 | 0.08 | 0.26 | 0.25 |
| 170 | 1.14 | 1.10 | 1.12 | 1.08 | 0.26 | 0.25 | 0.20 | 0.19 | 0.62 | 0.60 |
| 160 | 4.01 | 3.82 | 3.97 | 3.78 | 1.29 | 1.23 | 0.94 | 0.90 | 2.27 | 2.18 |
| 150 | 12.33 | 11.50 | 12.22 | 11.39 | 4.26 | 4.06 | 3.05 | 2.92 | 7.41 | 7.07 |
| 140 | 48.05 | 41.46 | 46.59 | 40.26 | 13.75 | 12.81 | 9.76 | 9.30 | 25.97 | 23.41 |
| 130 | >90 | 85.37 | >90 | 85.35 | 75.53 | 66.29 | 43.49 | 37.98 | >90 | 85.18 |
| 120 | >90 | 85.89 | >90 | 85.87 | >90 | 85.67 | >90 | 85.54 | >90 | 85.82 |

Table F-239. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.04 | 0.04 | 0.04 | 0.04 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.19 | 0.19 | 0.18 | 0.18 | 0.06 | 0.06 | 0.05 | 0.05 | 0.08 | 0.08 |
| 175 | 0.41 | 0.40 | 0.41 | 0.40 | 0.09 | 0.09 | 0.06 | 0.06 | 0.19 | 0.19 |
| 170 | 0.87 | 0.82 | 0.84 | 0.80 | 0.22 | 0.21 | 0.11 | 0.11 | 0.42 | 0.41 |
| 160 | 3.04 | 2.90 | 2.98 | 2.86 | 0.98 | 0.94 | 0.69 | 0.66 | 1.74 | 1.68 |
| 150 | 9.61 | 9.12 | 9.52 | 9.04 | 3.34 | 3.19 | 2.47 | 2.35 | 5.92 | 5.62 |
| 140 | 32.98 | 29.29 | 32.39 | 28.80 | 10.79 | 10.01 | 7.94 | 7.46 | 19.55 | 17.89 |
| 130 | >90 | 85.29 | >90 | 85.26 | 48.43 | 42.10 | 29.25 | 26.14 | >90 | 84.59 |
| 120 | >90 | 85.84 | >90 | 85.81 | >90 | 85.55 | >90 | 85.33 | >90 | 85.73 |

Table F-240. Jacket foundation (pre-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | - | - |
| 180 | 0.09 | 0.09 | 0.09 | 0.09 | 0.04 | 0.04 | 0.03 | 0.03 | 0.06 | 0.06 |
| 175 | 0.26 | 0.25 | 0.26 | 0.25 | 0.06 | 0.06 | 0.05 | 0.05 | 0.10 | 0.10 |
| 170 | 0.58 | 0.56 | 0.56 | 0.50 | 0.11 | 0.11 | 0.08 | 0.08 | 0.26 | 0.25 |
| 160 | 2.19 | 2.10 | 2.16 | 2.07 | 0.65 | 0.62 | 0.42 | 0.41 | 1.22 | 1.16 |
| 150 | 6.88 | 6.53 | 6.82 | 6.47 | 2.29 | 2.19 | 1.76 | 1.68 | 4.18 | 4.00 |
| 140 | 21.99 | 19.87 | 21.70 | 19.61 | 7.52 | 7.15 | 5.61 | 5.36 | 13.59 | 12.62 |
| 130 | >90 | 84.74 | >90 | 84.64 | 27.09 | 24.36 | 18.70 | 17.16 | 67.74 | 59.07 |
| 120 | >90 | 85.71 | >90 | 85.67 | >90 | 85.24 | >90 | 84.62 | >90 | 85.58 |

Table F-241. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | - | - | 0.05 | 0.05 |
| 190 | 0.41 | 0.39 | 0.40 | 0.39 | 0.07 | 0.07 | 0.06 | 0.06 | 0.18 | 0.18 |
| 180 | 1.75 | 1.65 | 1.73 | 1.63 | 0.48 | 0.46 | 0.35 | 0.34 | 0.94 | 0.89 |
| 175 | 3.11 | 2.87 | 3.08 | 2.84 | 1.00 | 0.93 | 0.74 | 0.69 | 1.84 | 1.73 |
| 170 | 4.99 | 4.58 | 4.95 | 4.56 | 1.84 | 1.72 | 1.35 | 1.28 | 3.36 | 3.08 |
| 160 | 10.89 | 9.38 | 10.83 | 9.35 | 5.39 | 4.92 | 4.16 | 3.88 | 8.28 | 7.38 |
| 150 | 20.92 | 18.19 | 20.79 | 18.11 | 12.68 | 11.09 | 9.97 | 8.91 | 17.32 | 15.17 |
| 140 | 41.32 | 36.63 | 40.89 | 36.28 | 26.29 | 23.35 | 21.83 | 18.90 | 34.25 | 30.79 |
| 130 | >90 | 83.58 | >90 | 83.05 | 58.58 | 52.70 | 48.87 | 43.09 | 82.80 | 73.79 |
| 120 | >90 | 85.53 | >90 | 85.50 | >90 | 85.25 | >90 | 85.03 | >90 | 85.39 |

Table F-242. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | - | - | 0.05 | 0.05 |
| 180 | 0.41 | 0.39 | 0.40 | 0.39 | 0.07 | 0.07 | 0.06 | 0.06 | 0.18 | 0.18 |
| 175 | 0.89 | 0.85 | 0.88 | 0.84 | 0.22 | 0.21 | 0.15 | 0.14 | 0.43 | 0.42 |
| 170 | 1.75 | 1.65 | 1.73 | 1.63 | 0.48 | 0.46 | 0.35 | 0.34 | 0.94 | 0.89 |
| 160 | 4.99 | 4.58 | 4.95 | 4.56 | 1.84 | 1.72 | 1.35 | 1.28 | 3.36 | 3.08 |
| 150 | 10.89 | 9.38 | 10.83 | 9.35 | 5.39 | 4.92 | 4.16 | 3.88 | 8.28 | 7.38 |
| 140 | 20.92 | 18.19 | 20.79 | 18.11 | 12.68 | 11.09 | 9.97 | 8.91 | 17.32 | 15.17 |
| 130 | 41.32 | 36.63 | 40.89 | 36.28 | 26.29 | 23.35 | 21.83 | 18.90 | 34.25 | 30.79 |
| 120 | >90 | 83.58 | >90 | 83.05 | 58.58 | 52.70 | 48.87 | 43.09 | 82.80 | 73.79 |

Table F-243. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.06 | 0.06 | - | - | - | - | 0.03 | 0.03 |
| 180 | 0.31 | 0.30 | 0.30 | 0.29 | 0.06 | 0.06 | 0.05 | 0.05 | 0.14 | 0.14 |
| 175 | 0.67 | 0.64 | 0.65 | 0.63 | 0.16 | 0.15 | 0.09 | 0.09 | 0.33 | 0.32 |
| 170 | 1.36 | 1.29 | 1.35 | 1.27 | 0.37 | 0.35 | 0.24 | 0.24 | 0.72 | 0.68 |
| 160 | 4.19 | 3.91 | 4.16 | 3.88 | 1.43 | 1.36 | 1.08 | 1.00 | 2.72 | 2.49 |
| 150 | 9.38 | 8.29 | 9.35 | 8.25 | 4.46 | 4.15 | 3.46 | 3.14 | 6.91 | 6.27 |
| 140 | 18.43 | 16.12 | 18.36 | 16.05 | 10.72 | 9.34 | 8.59 | 7.66 | 15.11 | 13.23 |
| 130 | 35.46 | 31.69 | 35.17 | 31.46 | 22.69 | 19.73 | 18.68 | 16.51 | 29.79 | 26.79 |
| 120 | 82.92 | 74.16 | 79.56 | 71.48 | 49.38 | 43.70 | 40.50 | 36.03 | 65.46 | 59.44 |

Table F-244. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.17 | 0.17 | 0.17 | 0.17 | 0.05 | 0.05 | 0.04 | 0.04 | 0.07 | 0.07 |
| 175 | 0.41 | 0.39 | 0.40 | 0.39 | 0.07 | 0.07 | 0.06 | 0.06 | 0.18 | 0.18 |
| 170 | 0.89 | 0.85 | 0.88 | 0.84 | 0.22 | 0.21 | 0.15 | 0.14 | 0.43 | 0.42 |
| 160 | 3.11 | 2.87 | 3.08 | 2.84 | 1.00 | 0.93 | 0.74 | 0.69 | 1.84 | 1.73 |
| 150 | 7.47 | 6.63 | 7.43 | 6.60 | 3.36 | 3.04 | 2.50 | 2.27 | 5.39 | 4.93 |
| 140 | 15.24 | 13.30 | 15.17 | 13.25 | 8.38 | 7.48 | 6.52 | 5.94 | 12.35 | 10.72 |
| 130 | 29.03 | 25.96 | 28.89 | 25.81 | 18.10 | 15.94 | 15.03 | 13.22 | 24.74 | 21.74 |
| 120 | 60.46 | 54.90 | 59.45 | 53.85 | 37.89 | 33.85 | 31.48 | 28.26 | 51.28 | 45.52 |

Table F-245. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | - | - | 0.05 | 0.05 |
| 190 | 0.42 | 0.40 | 0.41 | 0.40 | 0.07 | 0.07 | 0.06 | 0.06 | 0.18 | 0.18 |
| 180 | 1.78 | 1.68 | 1.76 | 1.66 | 0.50 | 0.48 | 0.35 | 0.34 | 0.96 | 0.91 |
| 175 | 3.31 | 3.03 | 3.27 | 3.00 | 1.00 | 0.94 | 0.74 | 0.71 | 1.92 | 1.79 |
| 170 | 5.45 | 4.97 | 5.42 | 4.94 | 1.94 | 1.82 | 1.40 | 1.32 | 3.66 | 3.36 |
| 160 | 13.55 | 11.99 | 13.47 | 11.92 | 6.45 | 5.76 | 4.77 | 4.40 | 9.89 | 8.92 |
| 150 | 35.25 | 31.78 | 34.59 | 31.23 | 17.97 | 16.27 | 14.10 | 12.78 | 27.22 | 24.86 |
| 140 | >90 | 85.36 | >90 | 85.25 | 77.94 | 67.11 | 53.36 | 47.19 | >90 | 84.84 |
| 130 | >90 | 86.10 | >90 | 86.08 | >90 | 86.06 | >90 | 86.03 | >90 | 86.07 |
| 120 | >90 | 86.16 | >90 | 86.07 | >90 | 86.07 | >90 | 86.08 | >90 | 86.07 |

Table F-246. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | - | - | 0.05 | 0.05 |
| 180 | 0.42 | 0.40 | 0.41 | 0.40 | 0.07 | 0.07 | 0.06 | 0.06 | 0.18 | 0.18 |
| 175 | 0.89 | 0.85 | 0.89 | 0.84 | 0.22 | 0.21 | 0.14 | 0.14 | 0.44 | 0.43 |
| 170 | 1.78 | 1.68 | 1.76 | 1.66 | 0.50 | 0.48 | 0.35 | 0.34 | 0.96 | 0.91 |
| 160 | 5.45 | 4.97 | 5.42 | 4.94 | 1.94 | 1.82 | 1.40 | 1.32 | 3.66 | 3.36 |
| 150 | 13.55 | 11.99 | 13.47 | 11.92 | 6.45 | 5.76 | 4.77 | 4.40 | 9.89 | 8.92 |
| 140 | 35.25 | 31.78 | 34.59 | 31.23 | 17.97 | 16.27 | 14.10 | 12.78 | 27.22 | 24.86 |
| 130 | >90 | 85.36 | >90 | 85.25 | 77.94 | 67.11 | 53.36 | 47.19 | >90 | 84.84 |
| 120 | >90 | 86.10 | >90 | 86.08 | >90 | 86.06 | >90 | 86.03 | >90 | 86.07 |

Table F-247. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.06 | 0.06 | - | - | - | - | 0.03 | 0.03 |
| 180 | 0.30 | 0.29 | 0.30 | 0.29 | 0.06 | 0.06 | 0.05 | 0.05 | 0.13 | 0.13 |
| 175 | 0.67 | 0.64 | 0.67 | 0.64 | 0.15 | 0.15 | 0.08 | 0.08 | 0.34 | 0.33 |
| 170 | 1.38 | 1.30 | 1.36 | 1.29 | 0.37 | 0.36 | 0.24 | 0.24 | 0.73 | 0.70 |
| 160 | 4.47 | 4.16 | 4.44 | 4.13 | 1.50 | 1.42 | 1.09 | 1.02 | 2.88 | 2.63 |
| 150 | 11.35 | 9.88 | 11.28 | 9.81 | 5.11 | 4.69 | 3.89 | 3.57 | 8.31 | 7.47 |
| 140 | 28.24 | 25.79 | 27.84 | 25.45 | 14.66 | 13.25 | 11.34 | 10.14 | 21.80 | 19.61 |
| 130 | >90 | 84.99 | >90 | 84.55 | 52.72 | 46.36 | 37.60 | 33.56 | >90 | 80.70 |
| 120 | >90 | 86.09 | >90 | 86.06 | >90 | 85.99 | >90 | 85.95 | >90 | 86.04 |

Table F-248. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.17 | 0.16 | 0.17 | 0.16 | 0.05 | 0.05 | 0.04 | 0.04 | 0.07 | 0.07 |
| 175 | 0.42 | 0.40 | 0.41 | 0.40 | 0.07 | 0.07 | 0.06 | 0.06 | 0.18 | 0.18 |
| 170 | 0.89 | 0.85 | 0.89 | 0.84 | 0.22 | 0.21 | 0.14 | 0.14 | 0.44 | 0.43 |
| 160 | 3.31 | 3.03 | 3.27 | 3.00 | 1.00 | 0.94 | 0.74 | 0.71 | 1.92 | 1.79 |
| 150 | 8.73 | 7.74 | 8.68 | 7.69 | 3.73 | 3.42 | 2.74 | 2.49 | 6.19 | 5.57 |
| 140 | 20.76 | 18.48 | 20.52 | 18.32 | 10.55 | 9.46 | 8.12 | 7.44 | 16.33 | 14.62 |
| 130 | 82.70 | 70.58 | 76.68 | 65.68 | 32.96 | 29.58 | 25.14 | 22.93 | 54.06 | 47.43 |
| 120 | >90 | 86.04 | >90 | 85.97 | >90 | 85.49 | >90 | 84.88 | >90 | 85.88 |

Table F-249. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | - | - | 0.05 | 0.05 |
| 190 | 0.37 | 0.36 | 0.32 | 0.31 | 0.07 | 0.07 | 0.06 | 0.06 | 0.17 | 0.17 |
| 180 | 1.51 | 1.45 | 1.49 | 1.43 | 0.39 | 0.37 | 0.26 | 0.26 | 0.79 | 0.75 |
| 175 | 2.82 | 2.70 | 2.79 | 2.67 | 0.83 | 0.79 | 0.60 | 0.57 | 1.56 | 1.49 |
| 170 | 5.31 | 5.05 | 5.26 | 5.00 | 1.61 | 1.53 | 1.22 | 1.16 | 2.94 | 2.83 |
| 160 | 15.25 | 14.01 | 15.13 | 13.91 | 5.70 | 5.44 | 4.25 | 4.06 | 9.84 | 9.31 |
| 150 | 40.82 | 35.96 | 40.14 | 35.44 | 18.13 | 16.52 | 13.85 | 12.70 | 28.99 | 26.16 |
| 140 | 89.99 | 82.90 | 89.99 | 81.03 | 64.69 | 55.99 | 47.02 | 41.07 | 85.39 | 74.03 |
| 130 | >90 | 85.53 | >90 | 85.48 | >90 | 85.35 | >90 | 85.33 | >90 | 85.39 |
| 120 | >90 | 85.83 | >90 | 85.80 | >90 | 85.70 | >90 | 85.66 | >90 | 85.75 |

Table F-250. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | - | - | 0.05 | 0.05 |
| 180 | 0.37 | 0.36 | 0.32 | 0.31 | 0.07 | 0.07 | 0.06 | 0.06 | 0.17 | 0.17 |
| 175 | 0.74 | 0.72 | 0.74 | 0.71 | 0.18 | 0.18 | 0.10 | 0.09 | 0.37 | 0.35 |
| 170 | 1.51 | 1.45 | 1.49 | 1.43 | 0.39 | 0.37 | 0.26 | 0.26 | 0.79 | 0.75 |
| 160 | 5.31 | 5.05 | 5.26 | 5.00 | 1.61 | 1.53 | 1.22 | 1.16 | 2.94 | 2.83 |
| 150 | 15.25 | 14.01 | 15.13 | 13.91 | 5.70 | 5.44 | 4.25 | 4.06 | 9.84 | 9.31 |
| 140 | 40.82 | 35.96 | 40.14 | 35.44 | 18.13 | 16.52 | 13.85 | 12.70 | 28.99 | 26.16 |
| 130 | 89.99 | 82.90 | 89.99 | 81.03 | 64.69 | 55.99 | 47.02 | 41.07 | 85.39 | 74.03 |
| 120 | >90 | 85.53 | >90 | 85.48 | >90 | 85.35 | >90 | 85.33 | >90 | 85.39 |

Table F-251. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.05 | 0.05 | - | - | - | - | 0.03 | 0.03 |
| 180 | 0.26 | 0.24 | 0.24 | 0.24 | 0.06 | 0.06 | 0.05 | 0.05 | 0.10 | 0.10 |
| 175 | 0.52 | 0.48 | 0.49 | 0.47 | 0.11 | 0.11 | 0.08 | 0.08 | 0.26 | 0.26 |
| 170 | 1.13 | 1.09 | 1.11 | 1.07 | 0.27 | 0.26 | 0.20 | 0.20 | 0.61 | 0.58 |
| 160 | 4.18 | 4.00 | 4.12 | 3.95 | 1.27 | 1.21 | 0.93 | 0.89 | 2.35 | 2.26 |
| 150 | 12.59 | 11.66 | 12.50 | 11.57 | 4.52 | 4.33 | 3.21 | 3.08 | 8.03 | 7.57 |
| 140 | 32.65 | 29.30 | 32.32 | 29.01 | 14.62 | 13.42 | 10.82 | 10.01 | 23.65 | 21.37 |
| 130 | 86.08 | 73.97 | 84.74 | 72.33 | 48.39 | 42.03 | 34.71 | 31.08 | 74.61 | 63.66 |
| 120 | >90 | 85.39 | >90 | 85.33 | >90 | 85.31 | >90 | 85.23 | >90 | 85.33 |

Table F-252. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.14 | 0.13 | 0.13 | 0.13 | 0.05 | 0.05 | 0.04 | 0.04 | 0.07 | 0.07 |
| 175 | 0.37 | 0.36 | 0.32 | 0.31 | 0.07 | 0.07 | 0.06 | 0.06 | 0.17 | 0.17 |
| 170 | 0.74 | 0.72 | 0.74 | 0.71 | 0.18 | 0.18 | 0.10 | 0.09 | 0.37 | 0.35 |
| 160 | 2.82 | 2.70 | 2.79 | 2.67 | 0.83 | 0.79 | 0.60 | 0.57 | 1.56 | 1.49 |
| 150 | 9.12 | 8.58 | 9.04 | 8.51 | 3.00 | 2.87 | 2.28 | 2.16 | 5.62 | 5.35 |
| 140 | 24.66 | 22.29 | 24.44 | 22.09 | 10.08 | 9.48 | 7.50 | 7.15 | 17.25 | 15.75 |
| 130 | 71.38 | 60.96 | 69.45 | 59.93 | 31.76 | 28.53 | 24.47 | 22.12 | 55.16 | 47.45 |
| 120 | >90 | 85.33 | >90 | 85.30 | >90 | 84.64 | 89.99 | 81.10 | >90 | 85.27 |

Table F-253. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | - | - | 0.05 | 0.05 |
| 190 | 0.38 | 0.37 | 0.37 | 0.36 | 0.07 | 0.07 | 0.06 | 0.06 | 0.17 | 0.16 |
| 180 | 1.51 | 1.45 | 1.49 | 1.43 | 0.40 | 0.39 | 0.26 | 0.24 | 0.78 | 0.74 |
| 175 | 2.76 | 2.65 | 2.75 | 2.63 | 0.84 | 0.80 | 0.62 | 0.59 | 1.57 | 1.50 |
| 170 | 4.98 | 4.74 | 4.94 | 4.70 | 1.64 | 1.57 | 1.24 | 1.18 | 2.85 | 2.73 |
| 160 | 15.51 | 14.32 | 15.36 | 14.19 | 5.36 | 5.12 | 3.99 | 3.81 | 9.38 | 8.88 |
| 150 | 74.14 | 64.62 | 70.61 | 61.50 | 17.75 | 16.31 | 12.84 | 11.99 | 35.95 | 31.65 |
| 140 | >90 | 85.56 | >90 | 85.52 | >90 | 84.32 | 66.70 | 58.64 | >90 | 85.32 |
| 130 | >90 | 85.96 | >90 | 85.93 | >90 | 85.80 | >90 | 85.70 | >90 | 85.89 |
| 120 | >90 | 86.14 | >90 | 86.13 | >90 | 86.11 | >90 | 86.10 | >90 | 86.12 |

Table F-254. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | - | - | 0.05 | 0.05 |
| 180 | 0.38 | 0.37 | 0.37 | 0.36 | 0.07 | 0.07 | 0.06 | 0.06 | 0.17 | 0.16 |
| 175 | 0.74 | 0.71 | 0.73 | 0.70 | 0.18 | 0.18 | 0.10 | 0.09 | 0.38 | 0.37 |
| 170 | 1.51 | 1.45 | 1.49 | 1.43 | 0.40 | 0.39 | 0.26 | 0.24 | 0.78 | 0.74 |
| 160 | 4.98 | 4.74 | 4.94 | 4.70 | 1.64 | 1.57 | 1.24 | 1.18 | 2.85 | 2.73 |
| 150 | 15.51 | 14.32 | 15.36 | 14.19 | 5.36 | 5.12 | 3.99 | 3.81 | 9.38 | 8.88 |
| 140 | 74.14 | 64.62 | 70.61 | 61.50 | 17.75 | 16.31 | 12.84 | 11.99 | 35.95 | 31.65 |
| 130 | >90 | 85.56 | >90 | 85.52 | >90 | 84.32 | 66.70 | 58.64 | >90 | 85.32 |
| 120 | >90 | 85.96 | >90 | 85.93 | >90 | 85.80 | >90 | 85.70 | >90 | 85.89 |

Table F-255. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.05 | 0.05 | - | - | - | - | 0.03 | 0.03 |
| 180 | 0.26 | 0.25 | 0.26 | 0.25 | 0.06 | 0.06 | 0.05 | 0.05 | 0.10 | 0.10 |
| 175 | 0.58 | 0.56 | 0.56 | 0.50 | 0.11 | 0.11 | 0.08 | 0.08 | 0.26 | 0.25 |
| 170 | 1.14 | 1.10 | 1.12 | 1.08 | 0.26 | 0.25 | 0.20 | 0.19 | 0.62 | 0.60 |
| 160 | 4.01 | 3.82 | 3.97 | 3.78 | 1.29 | 1.23 | 0.94 | 0.90 | 2.27 | 2.18 |
| 150 | 12.33 | 11.51 | 12.22 | 11.39 | 4.26 | 4.06 | 3.05 | 2.92 | 7.41 | 7.07 |
| 140 | 48.05 | 41.46 | 46.59 | 40.26 | 13.75 | 12.81 | 9.76 | 9.30 | 25.97 | 23.41 |
| 130 | >90 | 85.37 | >90 | 85.35 | 75.53 | 66.29 | 43.49 | 37.98 | >90 | 85.18 |
| 120 | >90 | 85.89 | >90 | 85.87 | >90 | 85.67 | >90 | 85.54 | >90 | 85.82 |

Table F-256. Jacket foundation (post-piled 4.25 m typical jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.14 | 0.14 | 0.13 | 0.13 | 0.05 | 0.05 | 0.04 | 0.04 | 0.07 | 0.07 |
| 175 | 0.38 | 0.37 | 0.37 | 0.36 | 0.07 | 0.07 | 0.06 | 0.06 | 0.17 | 0.16 |
| 170 | 0.74 | 0.71 | 0.73 | 0.70 | 0.18 | 0.18 | 0.10 | 0.09 | 0.38 | 0.37 |
| 160 | 2.76 | 2.65 | 2.75 | 2.63 | 0.84 | 0.80 | 0.62 | 0.59 | 1.57 | 1.50 |
| 150 | 8.67 | 8.26 | 8.56 | 8.17 | 2.91 | 2.79 | 2.14 | 2.04 | 5.33 | 5.04 |
| 140 | 28.51 | 25.53 | 28.09 | 25.19 | 9.45 | 8.97 | 6.94 | 6.59 | 17.41 | 15.98 |
| 130 | >90 | 85.21 | >90 | 85.13 | 39.15 | 34.29 | 25.02 | 22.59 | >90 | 84.00 |
| 120 | >90 | 85.80 | >90 | 85.77 | >90 | 85.48 | >90 | 85.20 | >90 | 85.68 |

## F.2.4. Jacket Foundation (Difficult-to-drive)

### F.2.4.1. 4 m Difficult to Drive Jacket Foundation with an MHU 3500S Hammer

Table F-257. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 190 | 0.15 | 0.15 | 0.15 | 0.15 | 0.03 | 0.03 | 0.03 | 0.03 | 0.10 | 0.09 |
| 180 | 0.63 | 0.60 | 0.62 | 0.60 | 0.18 | 0.17 | 0.13 | 0.13 | 0.35 | 0.34 |
| 175 | 1.20 | 1.14 | 1.19 | 1.12 | 0.38 | 0.36 | 0.26 | 0.24 | 0.75 | 0.72 |
| 170 | 2.16 | 1.97 | 2.13 | 1.95 | 0.83 | 0.79 | 0.61 | 0.58 | 1.42 | 1.34 |
| 160 | 5.61 | 5.14 | 5.57 | 5.11 | 2.90 | 2.70 | 2.30 | 2.08 | 4.31 | 4.02 |
| 150 | 12.97 | 11.48 | 12.90 | 11.40 | 8.47 | 7.69 | 7.21 | 6.48 | 10.89 | 9.62 |
| 140 | 27.71 | 24.57 | 27.28 | 24.25 | 20.29 | 17.92 | 18.30 | 16.16 | 24.85 | 21.80 |
| 130 | 75.53 | 63.53 | 68.06 | 59.05 | 52.89 | 45.62 | 46.65 | 40.47 | 61.69 | 53.86 |
| 120 | >90 | 85.54 | >90 | 85.45 | >90 | 85.33 | >90 | 85.25 | >90 | 85.41 |

Table F-258. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.15 | 0.15 | 0.15 | 0.15 | 0.03 | 0.03 | 0.03 | 0.03 | 0.10 | 0.09 |
| 175 | 0.29 | 0.28 | 0.29 | 0.28 | 0.10 | 0.09 | 0.05 | 0.05 | 0.17 | 0.16 |
| 170 | 0.63 | 0.60 | 0.62 | 0.60 | 0.18 | 0.17 | 0.13 | 0.13 | 0.35 | 0.34 |
| 160 | 2.16 | 1.97 | 2.13 | 1.95 | 0.83 | 0.79 | 0.61 | 0.58 | 1.42 | 1.34 |
| 150 | 5.61 | 5.14 | 5.57 | 5.11 | 2.90 | 2.70 | 2.30 | 2.08 | 4.31 | 4.02 |
| 140 | 12.97 | 11.48 | 12.90 | 11.40 | 8.47 | 7.69 | 7.21 | 6.48 | 10.89 | 9.62 |
| 130 | 27.71 | 24.57 | 27.28 | 24.25 | 20.29 | 17.92 | 18.30 | 16.16 | 24.85 | 21.80 |
| 120 | 75.53 | 63.53 | 68.06 | 59.05 | 52.89 | 45.62 | 46.65 | 40.47 | 61.69 | 53.86 |

Table F-259. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.12 | 0.12 | 0.12 | 0.12 | 0.03 | 0.03 | 0.02 | 0.02 | 0.05 | 0.05 |
| 175 | 0.23 | 0.23 | 0.23 | 0.22 | 0.05 | 0.05 | 0.03 | 0.03 | 0.14 | 0.13 |
| 170 | 0.47 | 0.46 | 0.46 | 0.45 | 0.14 | 0.14 | 0.10 | 0.09 | 0.26 | 0.26 |
| 160 | 1.74 | 1.61 | 1.72 | 1.60 | 0.65 | 0.60 | 0.42 | 0.40 | 1.08 | 1.01 |
| 150 | 4.71 | 4.36 | 4.68 | 4.34 | 2.33 | 2.13 | 1.73 | 1.62 | 3.55 | 3.29 |
| 140 | 11.04 | 9.62 | 10.97 | 9.56 | 6.96 | 6.31 | 5.78 | 5.31 | 9.22 | 8.26 |
| 130 | 23.92 | 20.91 | 23.68 | 20.65 | 17.36 | 15.39 | 15.24 | 13.71 | 20.89 | 18.24 |
| 120 | 57.86 | 50.58 | 55.03 | 48.37 | 42.46 | 37.06 | 38.13 | 32.78 | 50.86 | 44.22 |

Table F-260. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | - | - | - | - | - | - | - | - | - | - |
| 180 | 0.05 | 0.05 | 0.05 | 0.05 | 0.02 | 0.02 | - | - | 0.03 | 0.03 |
| 175 | 0.15 | 0.15 | 0.15 | 0.15 | 0.03 | 0.03 | 0.03 | 0.03 | 0.10 | 0.09 |
| 170 | 0.29 | 0.28 | 0.29 | 0.28 | 0.10 | 0.09 | 0.05 | 0.05 | 0.17 | 0.16 |
| 160 | 1.20 | 1.14 | 1.19 | 1.12 | 0.38 | 0.36 | 0.26 | 0.24 | 0.75 | 0.72 |
| 150 | 3.56 | 3.34 | 3.55 | 3.31 | 1.60 | 1.52 | 1.16 | 1.09 | 2.54 | 2.38 |
| 140 | 8.70 | 7.73 | 8.65 | 7.69 | 5.13 | 4.72 | 4.19 | 3.91 | 6.91 | 6.32 |
| 130 | 18.81 | 16.54 | 18.64 | 16.41 | 13.38 | 12.08 | 11.76 | 10.49 | 16.44 | 14.62 |
| 120 | 42.69 | 37.61 | 41.07 | 36.52 | 32.36 | 27.88 | 29.36 | 24.89 | 37.55 | 33.14 |

Table F-261. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 190 | 0.15 | 0.14 | 0.15 | 0.14 | 0.03 | 0.03 | 0.03 | 0.03 | 0.09 | 0.09 |
| 180 | 0.62 | 0.60 | 0.61 | 0.59 | 0.17 | 0.17 | 0.13 | 0.12 | 0.36 | 0.35 |
| 175 | 1.18 | 1.13 | 1.17 | 1.12 | 0.40 | 0.38 | 0.27 | 0.26 | 0.74 | 0.71 |
| 170 | 2.08 | 1.92 | 2.04 | 1.90 | 0.84 | 0.80 | 0.58 | 0.57 | 1.40 | 1.32 |
| 160 | 5.68 | 5.15 | 5.63 | 5.12 | 2.84 | 2.64 | 2.30 | 2.08 | 4.25 | 3.93 |
| 150 | 15.31 | 13.41 | 15.16 | 13.28 | 8.65 | 7.85 | 7.34 | 6.45 | 12.32 | 10.83 |
| 140 | 54.81 | 48.35 | 51.26 | 45.12 | 28.84 | 25.67 | 23.57 | 20.67 | 42.02 | 36.94 |
| 130 | >90 | 86.04 | >90 | 85.95 | >90 | 85.51 | >90 | 85.05 | >90 | 85.85 |
| 120 | >90 | 86.12 | >90 | 86.12 | >90 | 86.11 | >90 | 86.10 | >90 | 86.12 |

Table F-262. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.15 | 0.14 | 0.15 | 0.14 | 0.03 | 0.03 | 0.03 | 0.03 | 0.09 | 0.09 |
| 175 | 0.30 | 0.29 | 0.29 | 0.28 | 0.09 | 0.09 | 0.05 | 0.05 | 0.16 | 0.16 |
| 170 | 0.62 | 0.60 | 0.61 | 0.59 | 0.17 | 0.17 | 0.13 | 0.12 | 0.36 | 0.35 |
| 160 | 2.08 | 1.92 | 2.04 | 1.90 | 0.84 | 0.80 | 0.58 | 0.57 | 1.40 | 1.32 |
| 150 | 5.68 | 5.15 | 5.63 | 5.12 | 2.84 | 2.64 | 2.30 | 2.08 | 4.25 | 3.93 |
| 140 | 15.31 | 13.41 | 15.16 | 13.28 | 8.65 | 7.85 | 7.34 | 6.45 | 12.32 | 10.83 |
| 130 | 54.81 | 48.35 | 51.26 | 45.12 | 28.84 | 25.67 | 23.57 | 20.67 | 42.02 | 36.94 |
| 120 | >90 | 86.04 | >90 | 85.95 | >90 | 85.51 | >90 | 85.05 | >90 | 85.85 |

Table F-263. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.11 | 0.11 | 0.11 | 0.11 | 0.03 | 0.03 | 0.02 | 0.02 | 0.05 | 0.05 |
| 175 | 0.23 | 0.22 | 0.23 | 0.22 | 0.05 | 0.05 | 0.04 | 0.04 | 0.13 | 0.13 |
| 170 | 0.48 | 0.46 | 0.47 | 0.46 | 0.14 | 0.13 | 0.09 | 0.09 | 0.26 | 0.25 |
| 160 | 1.67 | 1.57 | 1.64 | 1.56 | 0.62 | 0.59 | 0.45 | 0.43 | 1.09 | 1.03 |
| 150 | 4.65 | 4.31 | 4.61 | 4.28 | 2.33 | 2.12 | 1.73 | 1.60 | 3.44 | 3.16 |
| 140 | 12.63 | 11.01 | 12.52 | 10.92 | 7.10 | 6.30 | 5.69 | 5.18 | 9.73 | 8.72 |
| 130 | 39.42 | 34.74 | 37.52 | 33.23 | 22.12 | 19.35 | 18.06 | 16.08 | 30.66 | 27.31 |
| 120 | >90 | 85.87 | >90 | 85.56 | >90 | 84.64 | 89.99 | 79.47 | >90 | 85.38 |

Table F-264. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | - | - | - | - | - | - | - | - | - | - |
| 180 | 0.05 | 0.05 | 0.05 | 0.05 | 0.02 | 0.02 | - | - | 0.03 | 0.03 |
| 175 | 0.15 | 0.14 | 0.15 | 0.14 | 0.03 | 0.03 | 0.03 | 0.03 | 0.09 | 0.09 |
| 170 | 0.30 | 0.29 | 0.29 | 0.28 | 0.09 | 0.09 | 0.05 | 0.05 | 0.16 | 0.16 |
| 160 | 1.18 | 1.13 | 1.17 | 1.12 | 0.40 | 0.38 | 0.27 | 0.26 | 0.74 | 0.71 |
| 150 | 3.51 | 3.25 | 3.47 | 3.22 | 1.56 | 1.46 | 1.19 | 1.13 | 2.50 | 2.30 |
| 140 | 9.29 | 8.22 | 9.24 | 8.17 | 4.99 | 4.60 | 4.14 | 3.77 | 7.15 | 6.41 |
| 130 | 26.17 | 23.18 | 25.68 | 22.69 | 15.44 | 13.73 | 12.75 | 11.36 | 21.11 | 18.46 |
| 120 | >90 | 85.15 | >90 | 84.83 | 65.87 | 58.73 | 52.73 | 46.47 | >90 | 83.68 |

Table F-265. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 190 | 0.17 | 0.16 | 0.16 | 0.16 | 0.03 | 0.03 | 0.02 | 0.02 | 0.06 | 0.06 |
| 180 | 0.49 | 0.48 | 0.48 | 0.47 | 0.17 | 0.17 | 0.08 | 0.08 | 0.29 | 0.28 |
| 175 | 1.15 | 1.10 | 1.14 | 1.09 | 0.31 | 0.30 | 0.23 | 0.22 | 0.64 | 0.61 |
| 170 | 1.93 | 1.84 | 1.90 | 1.81 | 0.66 | 0.63 | 0.46 | 0.43 | 1.27 | 1.22 |
| 160 | 5.54 | 5.30 | 5.48 | 5.24 | 2.53 | 2.41 | 1.79 | 1.72 | 3.95 | 3.78 |
| 150 | 15.40 | 14.24 | 15.26 | 14.11 | 8.08 | 7.70 | 6.42 | 6.13 | 11.92 | 10.98 |
| 140 | 49.49 | 42.93 | 47.10 | 41.02 | 27.50 | 24.51 | 23.11 | 20.36 | 36.87 | 32.88 |
| 130 | >90 | 85.37 | >90 | 85.30 | >90 | 84.93 | >90 | 83.66 | >90 | 85.27 |
| 120 | >90 | 85.65 | >90 | 85.62 | >90 | 85.61 | >90 | 85.61 | >90 | 85.62 |

Table F-266. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.17 | 0.16 | 0.16 | 0.16 | 0.03 | 0.03 | 0.02 | 0.02 | 0.06 | 0.06 |
| 175 | 0.28 | 0.28 | 0.28 | 0.27 | 0.06 | 0.06 | 0.05 | 0.05 | 0.17 | 0.17 |
| 170 | 0.49 | 0.48 | 0.48 | 0.47 | 0.17 | 0.17 | 0.08 | 0.08 | 0.29 | 0.28 |
| 160 | 1.93 | 1.84 | 1.90 | 1.81 | 0.66 | 0.63 | 0.46 | 0.43 | 1.27 | 1.22 |
| 150 | 5.54 | 5.30 | 5.48 | 5.24 | 2.53 | 2.41 | 1.79 | 1.72 | 3.95 | 3.78 |
| 140 | 15.40 | 14.24 | 15.26 | 14.11 | 8.08 | 7.70 | 6.42 | 6.13 | 11.92 | 10.98 |
| 130 | 49.49 | 42.93 | 47.10 | 41.02 | 27.50 | 24.51 | 23.11 | 20.36 | 36.87 | 32.88 |
| 120 | >90 | 85.37 | >90 | 85.30 | >90 | 84.93 | >90 | 83.66 | >90 | 85.27 |

Table F-267. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | - | - | - | - | - | - | - | - |
| 180 | 0.08 | 0.08 | 0.08 | 0.08 | 0.03 | 0.03 | 0.02 | 0.02 | 0.05 | 0.05 |
| 175 | 0.21 | 0.21 | 0.21 | 0.20 | 0.05 | 0.05 | 0.03 | 0.03 | 0.10 | 0.10 |
| 170 | 0.43 | 0.42 | 0.42 | 0.41 | 0.10 | 0.10 | 0.06 | 0.06 | 0.23 | 0.22 |
| 160 | 1.58 | 1.51 | 1.56 | 1.50 | 0.47 | 0.46 | 0.34 | 0.32 | 1.02 | 0.98 |
| 150 | 4.57 | 4.37 | 4.52 | 4.32 | 1.84 | 1.76 | 1.46 | 1.40 | 3.00 | 2.88 |
| 140 | 12.58 | 11.71 | 12.48 | 11.61 | 6.36 | 6.09 | 5.00 | 4.77 | 9.30 | 8.80 |
| 130 | 36.50 | 32.56 | 35.52 | 31.76 | 21.48 | 19.06 | 17.33 | 16.07 | 29.10 | 26.00 |
| 120 | >90 | 85.28 | >90 | 85.10 | 86.83 | 76.92 | 74.24 | 64.97 | >90 | 84.40 |

Table F-268. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | - | - | - | - | - | - | - | - | - | - |
| 180 | 0.05 | 0.05 | 0.05 | 0.05 | 0.02 | 0.02 | - | - | 0.03 | 0.03 |
| 175 | 0.17 | 0.16 | 0.16 | 0.16 | 0.03 | 0.03 | 0.02 | 0.02 | 0.06 | 0.06 |
| 170 | 0.28 | 0.28 | 0.28 | 0.27 | 0.06 | 0.06 | 0.05 | 0.05 | 0.17 | 0.17 |
| 160 | 1.15 | 1.10 | 1.14 | 1.09 | 0.31 | 0.30 | 0.23 | 0.22 | 0.64 | 0.61 |
| 150 | 3.28 | 3.12 | 3.22 | 3.07 | 1.41 | 1.35 | 1.06 | 1.02 | 2.21 | 2.10 |
| 140 | 9.16 | 8.64 | 9.08 | 8.58 | 4.56 | 4.36 | 3.38 | 3.23 | 6.70 | 6.38 |
| 130 | 26.39 | 23.68 | 26.00 | 23.33 | 14.86 | 13.74 | 12.20 | 11.29 | 20.40 | 18.40 |
| 120 | 86.58 | 77.60 | 81.93 | 71.68 | 59.00 | 49.88 | 45.19 | 39.51 | 73.04 | 64.67 |

Table F-269. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 190 | 0.16 | 0.16 | 0.16 | 0.16 | 0.03 | 0.03 | 0.03 | 0.03 | 0.06 | 0.06 |
| 180 | 0.50 | 0.48 | 0.50 | 0.48 | 0.17 | 0.17 | 0.10 | 0.10 | 0.31 | 0.30 |
| 175 | 1.16 | 1.11 | 1.15 | 1.10 | 0.33 | 0.32 | 0.23 | 0.22 | 0.65 | 0.63 |
| 170 | 1.90 | 1.82 | 1.88 | 1.80 | 0.69 | 0.66 | 0.48 | 0.47 | 1.27 | 1.22 |
| 160 | 5.28 | 5.02 | 5.24 | 4.97 | 2.45 | 2.34 | 1.86 | 1.78 | 3.84 | 3.65 |
| 150 | 14.44 | 13.28 | 14.26 | 13.14 | 7.48 | 7.10 | 6.10 | 5.78 | 10.40 | 9.65 |
| 140 | 64.60 | 56.02 | 59.43 | 51.47 | 25.15 | 22.31 | 19.68 | 17.91 | 38.67 | 33.63 |
| 130 | >90 | 85.58 | >90 | 85.48 | >90 | 85.15 | >90 | 84.65 | >90 | 85.33 |
| 120 | >90 | 85.96 | >90 | 85.92 | >90 | 85.84 | >90 | 85.82 | >90 | 85.90 |

Table F-270. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.16 | 0.16 | 0.16 | 0.16 | 0.03 | 0.03 | 0.03 | 0.03 | 0.06 | 0.06 |
| 175 | 0.29 | 0.28 | 0.28 | 0.28 | 0.06 | 0.06 | 0.05 | 0.05 | 0.17 | 0.17 |
| 170 | 0.50 | 0.48 | 0.50 | 0.48 | 0.17 | 0.17 | 0.10 | 0.10 | 0.31 | 0.30 |
| 160 | 1.90 | 1.82 | 1.88 | 1.80 | 0.69 | 0.66 | 0.48 | 0.47 | 1.27 | 1.22 |
| 150 | 5.28 | 5.02 | 5.24 | 4.97 | 2.45 | 2.34 | 1.86 | 1.78 | 3.84 | 3.65 |
| 140 | 14.44 | 13.28 | 14.26 | 13.14 | 7.48 | 7.10 | 6.10 | 5.78 | 10.40 | 9.65 |
| 130 | 64.60 | 56.02 | 59.43 | 51.47 | 25.15 | 22.31 | 19.68 | 17.91 | 38.67 | 33.63 |
| 120 | >90 | 85.58 | >90 | 85.48 | >90 | 85.15 | >90 | 84.65 | >90 | 85.33 |

Table F-271. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | - | - | - | - | - | - | - | - |
| 180 | 0.08 | 0.08 | 0.08 | 0.08 | 0.03 | 0.03 | 0.02 | 0.02 | 0.05 | 0.05 |
| 175 | 0.20 | 0.20 | 0.20 | 0.20 | 0.05 | 0.05 | 0.03 | 0.03 | 0.10 | 0.10 |
| 170 | 0.43 | 0.42 | 0.42 | 0.41 | 0.10 | 0.10 | 0.06 | 0.06 | 0.23 | 0.22 |
| 160 | 1.58 | 1.51 | 1.56 | 1.50 | 0.49 | 0.47 | 0.35 | 0.34 | 1.05 | 1.00 |
| 150 | 4.37 | 4.15 | 4.33 | 4.12 | 1.90 | 1.82 | 1.50 | 1.44 | 2.97 | 2.85 |
| 140 | 11.56 | 10.71 | 11.41 | 10.58 | 6.06 | 5.74 | 4.84 | 4.60 | 8.62 | 8.10 |
| 130 | 42.03 | 36.26 | 39.97 | 34.63 | 18.84 | 17.13 | 15.42 | 14.22 | 27.97 | 24.80 |
| 120 | >90 | 85.37 | >90 | 85.30 | >90 | 84.43 | 85.83 | 75.99 | >90 | 85.19 |

Table F-272. Jacket foundation (pre-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | - | - | - | - | - | - | - | - | - | - |
| 180 | 0.05 | 0.05 | 0.05 | 0.05 | 0.02 | 0.02 | - | - | 0.03 | 0.03 |
| 175 | 0.16 | 0.16 | 0.16 | 0.16 | 0.03 | 0.03 | 0.03 | 0.03 | 0.06 | 0.06 |
| 170 | 0.29 | 0.28 | 0.28 | 0.28 | 0.06 | 0.06 | 0.05 | 0.05 | 0.17 | 0.17 |
| 160 | 1.16 | 1.11 | 1.15 | 1.10 | 0.33 | 0.32 | 0.23 | 0.22 | 0.65 | 0.63 |
| 150 | 3.14 | 3.01 | 3.11 | 2.97 | 1.42 | 1.36 | 1.05 | 1.01 | 2.22 | 2.11 |
| 140 | 8.55 | 8.03 | 8.48 | 7.96 | 4.34 | 4.14 | 3.41 | 3.26 | 6.30 | 5.97 |
| 130 | 26.11 | 23.24 | 25.58 | 22.78 | 13.16 | 12.22 | 10.72 | 9.92 | 18.62 | 16.91 |
| 120 | >90 | 85.12 | >90 | 84.91 | 62.47 | 54.72 | 46.00 | 39.83 | >90 | 84.22 |

Table F-273. Jacket foundation (post-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 190 | 0.21 | 0.20 | 0.20 | 0.20 | 0.05 | 0.05 | 0.03 | 0.03 | 0.12 | 0.12 |
| 180 | 0.84 | 0.80 | 0.83 | 0.79 | 0.24 | 0.23 | 0.17 | 0.16 | 0.48 | 0.46 |
| 175 | 1.52 | 1.44 | 1.50 | 1.42 | 0.54 | 0.52 | 0.36 | 0.34 | 0.94 | 0.90 |
| 170 | 2.66 | 2.49 | 2.64 | 2.47 | 1.02 | 0.97 | 0.79 | 0.76 | 1.78 | 1.66 |
| 160 | 6.69 | 6.05 | 6.65 | 6.02 | 3.81 | 3.51 | 2.89 | 2.69 | 5.23 | 4.83 |
| 150 | 15.03 | 13.30 | 14.92 | 13.22 | 10.04 | 9.10 | 8.81 | 7.97 | 12.97 | 11.60 |
| 140 | 32.44 | 28.86 | 31.71 | 28.35 | 24.86 | 21.45 | 21.86 | 18.87 | 29.33 | 25.71 |
| 130 | 89.99 | 82.80 | 88.23 | 75.97 | 65.07 | 56.15 | 58.17 | 49.90 | 81.24 | 68.26 |
| 120 | >90 | 85.56 | >90 | 85.53 | >90 | 85.48 | >90 | 85.42 | >90 | 85.52 |

Table F-274. Jacket foundation (post-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.21 | 0.20 | 0.20 | 0.20 | 0.05 | 0.05 | 0.03 | 0.03 | 0.12 | 0.12 |
| 175 | 0.41 | 0.39 | 0.41 | 0.38 | 0.13 | 0.12 | 0.07 | 0.07 | 0.23 | 0.22 |
| 170 | 0.84 | 0.80 | 0.83 | 0.79 | 0.24 | 0.23 | 0.17 | 0.16 | 0.48 | 0.46 |
| 160 | 2.66 | 2.49 | 2.64 | 2.47 | 1.02 | 0.97 | 0.79 | 0.76 | 1.78 | 1.66 |
| 150 | 6.69 | 6.05 | 6.65 | 6.02 | 3.81 | 3.51 | 2.89 | 2.69 | 5.23 | 4.83 |
| 140 | 15.03 | 13.30 | 14.92 | 13.22 | 10.04 | 9.10 | 8.81 | 7.97 | 12.97 | 11.60 |
| 130 | 32.44 | 28.86 | 31.71 | 28.35 | 24.86 | 21.45 | 21.86 | 18.87 | 29.33 | 25.71 |
| 120 | 89.99 | 82.80 | 88.23 | 75.97 | 65.07 | 56.15 | 58.17 | 49.90 | 81.24 | 68.26 |

Table F-275. Jacket foundation (post-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.15 | 0.15 | 0.15 | 0.15 | 0.03 | 0.03 | 0.03 | 0.03 | 0.10 | 0.09 |
| 175 | 0.29 | 0.28 | 0.29 | 0.28 | 0.10 | 0.09 | 0.05 | 0.05 | 0.17 | 0.16 |
| 170 | 0.63 | 0.60 | 0.62 | 0.60 | 0.18 | 0.17 | 0.13 | 0.13 | 0.35 | 0.34 |
| 160 | 2.16 | 1.97 | 2.13 | 1.95 | 0.83 | 0.79 | 0.61 | 0.58 | 1.42 | 1.34 |
| 150 | 5.61 | 5.14 | 5.57 | 5.11 | 2.90 | 2.70 | 2.30 | 2.08 | 4.31 | 4.02 |
| 140 | 12.97 | 11.47 | 12.90 | 11.40 | 8.47 | 7.69 | 7.21 | 6.48 | 10.89 | 9.62 |
| 130 | 27.71 | 24.57 | 27.28 | 24.26 | 20.29 | 17.93 | 18.30 | 16.17 | 24.85 | 21.80 |
| 120 | 75.53 | 63.53 | 68.06 | 59.05 | 52.89 | 45.63 | 46.65 | 40.46 | 61.69 | 53.86 |

Table F-276. Jacket foundation (post-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | - | - | - | - | - | - | - | - | - | - |
| 180 | 0.10 | 0.10 | 0.10 | 0.10 | 0.02 | 0.02 | 0.02 | 0.02 | 0.04 | 0.04 |
| 175 | 0.21 | 0.20 | 0.20 | 0.20 | 0.05 | 0.05 | 0.03 | 0.03 | 0.12 | 0.12 |
| 170 | 0.41 | 0.39 | 0.41 | 0.38 | 0.13 | 0.12 | 0.07 | 0.07 | 0.23 | 0.22 |
| 160 | 1.52 | 1.44 | 1.50 | 1.42 | 0.54 | 0.52 | 0.36 | 0.34 | 0.94 | 0.90 |
| 150 | 4.31 | 4.01 | 4.29 | 3.99 | 1.98 | 1.86 | 1.58 | 1.49 | 3.16 | 2.87 |
| 140 | 10.00 | 8.95 | 9.95 | 8.91 | 6.30 | 5.74 | 5.24 | 4.80 | 8.47 | 7.59 |
| 130 | 22.09 | 19.05 | 21.81 | 18.85 | 15.98 | 14.19 | 14.01 | 12.58 | 19.29 | 17.02 |
| 120 | 52.52 | 45.78 | 50.23 | 44.02 | 38.57 | 33.51 | 34.75 | 29.87 | 45.77 | 40.06 |

Table F-277. Jacket foundation (post-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 190 | 0.21 | 0.20 | 0.20 | 0.20 | 0.05 | 0.05 | 0.03 | 0.03 | 0.11 | 0.11 |
| 180 | 0.84 | 0.80 | 0.83 | 0.78 | 0.24 | 0.23 | 0.17 | 0.16 | 0.50 | 0.48 |
| 175 | 1.50 | 1.40 | 1.48 | 1.39 | 0.55 | 0.54 | 0.38 | 0.37 | 0.96 | 0.91 |
| 170 | 2.58 | 2.40 | 2.56 | 2.37 | 1.08 | 1.02 | 0.80 | 0.75 | 1.78 | 1.65 |
| 160 | 6.86 | 6.19 | 6.81 | 6.15 | 3.64 | 3.34 | 2.83 | 2.63 | 5.16 | 4.76 |
| 150 | 18.66 | 16.43 | 18.44 | 16.22 | 10.87 | 9.60 | 8.87 | 8.09 | 15.26 | 13.44 |
| 140 | 79.05 | 70.80 | 69.42 | 62.68 | 40.07 | 35.16 | 30.94 | 27.57 | 57.60 | 51.15 |
| 130 | >90 | 86.09 | >90 | 86.03 | >90 | 85.97 | >90 | 85.80 | >90 | 86.01 |
| 120 | >90 | 86.09 | >90 | 86.11 | >90 | 86.11 | >90 | 86.11 | >90 | 86.11 |

Table F-278. Jacket foundation (post-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.21 | 0.20 | 0.20 | 0.20 | 0.05 | 0.05 | 0.03 | 0.03 | 0.11 | 0.11 |
| 175 | 0.42 | 0.39 | 0.41 | 0.38 | 0.12 | 0.12 | 0.08 | 0.08 | 0.23 | 0.22 |
| 170 | 0.84 | 0.80 | 0.83 | 0.78 | 0.24 | 0.23 | 0.17 | 0.16 | 0.50 | 0.48 |
| 160 | 2.58 | 2.40 | 2.56 | 2.37 | 1.08 | 1.02 | 0.80 | 0.75 | 1.78 | 1.65 |
| 150 | 6.86 | 6.19 | 6.81 | 6.15 | 3.64 | 3.34 | 2.83 | 2.63 | 5.16 | 4.76 |
| 140 | 18.66 | 16.43 | 18.44 | 16.22 | 10.87 | 9.60 | 8.87 | 8.09 | 15.26 | 13.44 |
| 130 | 79.05 | 70.80 | 69.42 | 62.68 | 40.07 | 35.16 | 30.94 | 27.57 | 57.60 | 51.15 |
| 120 | >90 | 86.09 | >90 | 86.03 | >90 | 85.97 | >90 | 85.80 | >90 | 86.01 |

Table F-279. Jacket foundation (post-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.15 | 0.14 | 0.15 | 0.14 | 0.03 | 0.03 | 0.03 | 0.03 | 0.09 | 0.09 |
| 175 | 0.30 | 0.29 | 0.29 | 0.28 | 0.09 | 0.09 | 0.05 | 0.05 | 0.16 | 0.16 |
| 170 | 0.62 | 0.60 | 0.61 | 0.59 | 0.17 | 0.17 | 0.13 | 0.12 | 0.36 | 0.35 |
| 160 | 2.08 | 1.92 | 2.04 | 1.90 | 0.84 | 0.80 | 0.58 | 0.57 | 1.40 | 1.32 |
| 150 | 5.68 | 5.15 | 5.63 | 5.12 | 2.84 | 2.64 | 2.30 | 2.08 | 4.25 | 3.93 |
| 140 | 15.31 | 13.41 | 15.16 | 13.28 | 8.65 | 7.85 | 7.34 | 6.45 | 12.32 | 10.83 |
| 130 | 54.81 | 48.35 | 51.26 | 45.12 | 28.84 | 25.67 | 23.57 | 20.67 | 42.02 | 36.94 |
| 120 | >90 | 86.04 | >90 | 85.95 | >90 | 85.51 | >90 | 85.05 | >90 | 85.85 |

Table F-280. Jacket foundation (post-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | - | - | - | - | - | - | - | - | - | - |
| 180 | 0.10 | 0.10 | 0.10 | 0.10 | 0.02 | 0.02 | 0.02 | 0.02 | 0.04 | 0.04 |
| 175 | 0.21 | 0.20 | 0.20 | 0.20 | 0.05 | 0.05 | 0.03 | 0.03 | 0.11 | 0.11 |
| 170 | 0.42 | 0.39 | 0.41 | 0.38 | 0.12 | 0.12 | 0.08 | 0.08 | 0.23 | 0.22 |
| 160 | 1.50 | 1.40 | 1.48 | 1.39 | 0.55 | 0.54 | 0.38 | 0.37 | 0.96 | 0.91 |
| 150 | 4.26 | 3.95 | 4.23 | 3.93 | 1.95 | 1.84 | 1.52 | 1.43 | 2.99 | 2.79 |
| 140 | 11.39 | 9.84 | 11.29 | 9.74 | 6.28 | 5.66 | 5.09 | 4.67 | 8.85 | 7.92 |
| 130 | 33.52 | 29.88 | 32.32 | 28.88 | 19.40 | 17.27 | 15.98 | 14.32 | 27.06 | 24.02 |
| 120 | >90 | 85.64 | >90 | 85.35 | 89.99 | 83.24 | 74.93 | 66.37 | >90 | 85.05 |

Table F-281. Jacket foundation (post-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 190 | 0.20 | 0.20 | 0.20 | 0.19 | 0.05 | 0.05 | 0.03 | 0.03 | 0.07 | 0.07 |
| 180 | 0.74 | 0.70 | 0.72 | 0.69 | 0.22 | 0.22 | 0.15 | 0.15 | 0.40 | 0.39 |
| 175 | 1.43 | 1.37 | 1.41 | 1.35 | 0.42 | 0.40 | 0.28 | 0.28 | 0.80 | 0.76 |
| 170 | 2.43 | 2.32 | 2.39 | 2.29 | 0.96 | 0.93 | 0.62 | 0.60 | 1.57 | 1.51 |
| 160 | 6.76 | 6.43 | 6.72 | 6.38 | 3.04 | 2.92 | 2.45 | 2.32 | 4.84 | 4.62 |
| 150 | 18.89 | 17.26 | 18.68 | 17.10 | 9.99 | 9.46 | 8.33 | 7.84 | 14.64 | 13.57 |
| 140 | 65.10 | 56.18 | 62.50 | 53.76 | 35.07 | 31.32 | 29.38 | 26.08 | 50.48 | 43.95 |
| 130 | >90 | 85.41 | >90 | 85.35 | >90 | 85.31 | >90 | 85.23 | >90 | 85.35 |
| 120 | >90 | 85.71 | >90 | 85.67 | >90 | 85.63 | >90 | 85.63 | >90 | 85.65 |

Table F-282. Jacket foundation (post-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.20 | 0.20 | 0.20 | 0.19 | 0.05 | 0.05 | 0.03 | 0.03 | 0.07 | 0.07 |
| 175 | 0.38 | 0.37 | 0.37 | 0.36 | 0.08 | 0.08 | 0.06 | 0.06 | 0.21 | 0.20 |
| 170 | 0.74 | 0.70 | 0.72 | 0.69 | 0.22 | 0.22 | 0.15 | 0.15 | 0.40 | 0.39 |
| 160 | 2.43 | 2.32 | 2.39 | 2.29 | 0.96 | 0.93 | 0.62 | 0.60 | 1.57 | 1.51 |
| 150 | 6.76 | 6.43 | 6.72 | 6.38 | 3.04 | 2.92 | 2.45 | 2.32 | 4.84 | 4.62 |
| 140 | 18.89 | 17.26 | 18.68 | 17.10 | 9.99 | 9.46 | 8.33 | 7.84 | 14.64 | 13.57 |
| 130 | 65.10 | 56.18 | 62.50 | 53.76 | 35.07 | 31.32 | 29.38 | 26.08 | 50.48 | 43.95 |
| 120 | >90 | 85.41 | >90 | 85.35 | >90 | 85.31 | >90 | 85.23 | >90 | 85.35 |

Table F-283. Jacket foundation (post-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.17 | 0.16 | 0.16 | 0.16 | 0.03 | 0.03 | 0.02 | 0.02 | 0.06 | 0.06 |
| 175 | 0.28 | 0.28 | 0.28 | 0.27 | 0.06 | 0.06 | 0.05 | 0.05 | 0.17 | 0.17 |
| 170 | 0.49 | 0.48 | 0.48 | 0.47 | 0.17 | 0.17 | 0.08 | 0.08 | 0.29 | 0.28 |
| 160 | 1.93 | 1.84 | 1.90 | 1.81 | 0.66 | 0.63 | 0.46 | 0.43 | 1.27 | 1.22 |
| 150 | 5.54 | 5.30 | 5.48 | 5.24 | 2.53 | 2.41 | 1.79 | 1.72 | 3.95 | 3.78 |
| 140 | 15.40 | 14.24 | 15.26 | 14.11 | 8.08 | 7.70 | 6.42 | 6.13 | 11.92 | 10.98 |
| 130 | 49.49 | 42.93 | 47.10 | 41.02 | 27.50 | 24.51 | 23.11 | 20.36 | 36.87 | 32.88 |
| 120 | >90 | 85.37 | >90 | 85.30 | >90 | 84.94 | >90 | 83.66 | >90 | 85.27 |

Table F-284. Jacket foundation (post-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | - | - | - | - | - | - | - | - | - | - |
| 180 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | 0.02 | 0.02 | 0.04 | 0.04 |
| 175 | 0.20 | 0.20 | 0.20 | 0.19 | 0.05 | 0.05 | 0.03 | 0.03 | 0.07 | 0.07 |
| 170 | 0.38 | 0.37 | 0.37 | 0.36 | 0.08 | 0.08 | 0.06 | 0.06 | 0.21 | 0.20 |
| 160 | 1.43 | 1.37 | 1.41 | 1.35 | 0.42 | 0.40 | 0.28 | 0.28 | 0.80 | 0.76 |
| 150 | 4.12 | 3.94 | 4.09 | 3.91 | 1.68 | 1.61 | 1.36 | 1.31 | 2.82 | 2.69 |
| 140 | 11.40 | 10.56 | 11.24 | 10.44 | 5.76 | 5.45 | 4.56 | 4.35 | 8.36 | 7.92 |
| 130 | 32.37 | 29.04 | 31.75 | 28.48 | 18.76 | 17.17 | 15.44 | 14.30 | 26.12 | 23.42 |
| 120 | >90 | 85.11 | >90 | 83.96 | 75.49 | 66.76 | 65.17 | 55.64 | 89.99 | 81.84 |

Table F-285. Jacket foundation (post-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 190 | 0.19 | 0.19 | 0.19 | 0.19 | 0.04 | 0.04 | 0.03 | 0.03 | 0.07 | 0.07 |
| 180 | 0.74 | 0.71 | 0.73 | 0.70 | 0.22 | 0.21 | 0.15 | 0.15 | 0.41 | 0.39 |
| 175 | 1.43 | 1.37 | 1.41 | 1.35 | 0.44 | 0.42 | 0.30 | 0.28 | 0.90 | 0.77 |
| 170 | 2.36 | 2.26 | 2.34 | 2.23 | 0.96 | 0.93 | 0.65 | 0.63 | 1.61 | 1.54 |
| 160 | 6.34 | 6.03 | 6.30 | 5.98 | 2.99 | 2.88 | 2.38 | 2.27 | 4.66 | 4.44 |
| 150 | 17.94 | 16.32 | 17.74 | 16.13 | 9.30 | 8.73 | 7.69 | 7.25 | 13.24 | 12.24 |
| 140 | >90 | 83.61 | 89.99 | 80.14 | 34.30 | 29.90 | 26.89 | 23.82 | 57.97 | 50.49 |
| 130 | >90 | 85.70 | >90 | 85.63 | >90 | 85.33 | >90 | 85.22 | >90 | 85.55 |
| 120 | >90 | 85.99 | >90 | 85.98 | >90 | 85.90 | >90 | 85.86 | >90 | 85.96 |

Table F-286. Jacket foundation (post-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.19 | 0.19 | 0.19 | 0.19 | 0.04 | 0.04 | 0.03 | 0.03 | 0.07 | 0.07 |
| 175 | 0.37 | 0.36 | 0.37 | 0.36 | 0.07 | 0.07 | 0.06 | 0.06 | 0.20 | 0.20 |
| 170 | 0.74 | 0.71 | 0.73 | 0.70 | 0.22 | 0.21 | 0.15 | 0.15 | 0.41 | 0.39 |
| 160 | 2.36 | 2.26 | 2.34 | 2.23 | 0.96 | 0.93 | 0.65 | 0.63 | 1.61 | 1.54 |
| 150 | 6.34 | 6.03 | 6.30 | 5.98 | 2.99 | 2.88 | 2.38 | 2.27 | 4.66 | 4.44 |
| 140 | 17.94 | 16.32 | 17.74 | 16.13 | 9.30 | 8.73 | 7.69 | 7.25 | 13.24 | 12.24 |
| 130 | >90 | 83.61 | 89.99 | 80.14 | 34.30 | 29.90 | 26.89 | 23.82 | 57.97 | 50.49 |
| 120 | >90 | 85.70 | >90 | 85.63 | >90 | 85.33 | >90 | 85.22 | >90 | 85.55 |

Table F-287. Jacket foundation (post-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.02 | 0.02 | 0.02 | 0.02 | - | - | - | - | - | - |
| 180 | 0.16 | 0.16 | 0.16 | 0.16 | 0.03 | 0.03 | 0.03 | 0.03 | 0.06 | 0.06 |
| 175 | 0.29 | 0.28 | 0.28 | 0.28 | 0.06 | 0.06 | 0.05 | 0.05 | 0.17 | 0.17 |
| 170 | 0.50 | 0.48 | 0.50 | 0.48 | 0.17 | 0.17 | 0.10 | 0.10 | 0.31 | 0.30 |
| 160 | 1.90 | 1.82 | 1.88 | 1.80 | 0.69 | 0.66 | 0.48 | 0.47 | 1.27 | 1.22 |
| 150 | 5.28 | 5.02 | 5.24 | 4.97 | 2.45 | 2.34 | 1.86 | 1.78 | 3.84 | 3.65 |
| 140 | 14.44 | 13.28 | 14.26 | 13.13 | 7.48 | 7.10 | 6.10 | 5.78 | 10.40 | 9.65 |
| 130 | 64.60 | 56.01 | 59.43 | 51.47 | 25.15 | 22.31 | 19.68 | 17.91 | 38.67 | 33.63 |
| 120 | >90 | 85.58 | >90 | 85.48 | >90 | 85.15 | >90 | 84.65 | >90 | 85.33 |

Table F-288. Jacket foundation (post-piled 4 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | - | - | - | - | - | - | - | - | - | - |
| 180 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | 0.02 | 0.02 | 0.04 | 0.04 |
| 175 | 0.19 | 0.19 | 0.19 | 0.19 | 0.04 | 0.04 | 0.03 | 0.03 | 0.07 | 0.07 |
| 170 | 0.37 | 0.36 | 0.37 | 0.36 | 0.07 | 0.07 | 0.06 | 0.06 | 0.20 | 0.20 |
| 160 | 1.43 | 1.37 | 1.41 | 1.35 | 0.44 | 0.42 | 0.30 | 0.28 | 0.90 | 0.77 |
| 150 | 4.00 | 3.82 | 3.96 | 3.79 | 1.78 | 1.70 | 1.34 | 1.28 | 2.73 | 2.61 |
| 140 | 10.22 | 9.49 | 10.10 | 9.41 | 5.40 | 5.12 | 4.34 | 4.12 | 7.76 | 7.33 |
| 130 | 34.89 | 30.46 | 33.63 | 29.52 | 16.65 | 15.30 | 13.67 | 12.68 | 24.46 | 21.76 |
| 120 | >90 | 85.32 | >90 | 85.25 | >90 | 82.41 | 69.81 | 61.33 | >90 | 84.97 |

## F.2.4.2. 4.25 m Difficult to Drive Jacket Foundation with an MHU-3500 Hammer

Table F-289. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.06 | 0.06 | 0.06 | 0.06 | - | - | - | - | 0.03 | 0.03 |
| 190 | 0.31 | 0.30 | 0.30 | 0.29 | 0.06 | 0.06 | 0.05 | 0.05 | 0.14 | 0.14 |
| 180 | 1.36 | 1.29 | 1.35 | 1.27 | 0.37 | 0.35 | 0.24 | 0.24 | 0.72 | 0.68 |
| 175 | 2.57 | 2.37 | 2.55 | 2.35 | 0.76 | 0.73 | 0.54 | 0.51 | 1.41 | 1.35 |
| 170 | 4.19 | 3.91 | 4.16 | 3.88 | 1.43 | 1.36 | 1.08 | 1.00 | 2.72 | 2.49 |
| 160 | 9.38 | 8.29 | 9.35 | 8.25 | 4.46 | 4.15 | 3.46 | 3.14 | 6.91 | 6.27 |
| 150 | 18.43 | 16.12 | 18.36 | 16.05 | 10.72 | 9.34 | 8.59 | 7.66 | 15.11 | 13.23 |
| 140 | 35.46 | 31.69 | 35.17 | 31.46 | 22.69 | 19.73 | 18.68 | 16.51 | 29.79 | 26.78 |
| 130 | 82.92 | 74.16 | 79.56 | 71.52 | 49.38 | 43.70 | 40.50 | 36.03 | 65.46 | 59.44 |
| 120 | >90 | 85.40 | >90 | 85.36 | >90 | 84.96 | >90 | 84.52 | >90 | 85.29 |

Table F-290. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.06 | 0.06 | - | - | - | - | 0.03 | 0.03 |
| 180 | 0.31 | 0.30 | 0.30 | 0.29 | 0.06 | 0.06 | 0.05 | 0.05 | 0.14 | 0.14 |
| 175 | 0.67 | 0.64 | 0.65 | 0.63 | 0.16 | 0.15 | 0.09 | 0.09 | 0.33 | 0.32 |
| 170 | 1.36 | 1.29 | 1.35 | 1.27 | 0.37 | 0.35 | 0.24 | 0.24 | 0.72 | 0.68 |
| 160 | 4.19 | 3.91 | 4.16 | 3.88 | 1.43 | 1.36 | 1.08 | 1.00 | 2.72 | 2.49 |
| 150 | 9.38 | 8.29 | 9.35 | 8.25 | 4.46 | 4.15 | 3.46 | 3.14 | 6.91 | 6.27 |
| 140 | 18.43 | 16.12 | 18.36 | 16.05 | 10.72 | 9.34 | 8.59 | 7.66 | 15.11 | 13.23 |
| 130 | 35.46 | 31.69 | 35.17 | 31.46 | 22.69 | 19.73 | 18.68 | 16.51 | 29.79 | 26.78 |
| 120 | 82.92 | 74.16 | 79.56 | 71.52 | 49.38 | 43.70 | 40.50 | 36.03 | 65.46 | 59.44 |

Table F-291. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.04 | 0.04 | 0.04 | 0.04 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.22 | 0.21 | 0.22 | 0.21 | 0.06 | 0.06 | 0.05 | 0.05 | 0.10 | 0.09 |
| 175 | 0.48 | 0.46 | 0.48 | 0.44 | 0.10 | 0.10 | 0.06 | 0.06 | 0.24 | 0.24 |
| 170 | 1.03 | 0.97 | 1.01 | 0.96 | 0.26 | 0.26 | 0.17 | 0.17 | 0.53 | 0.51 |
| 160 | 3.49 | 3.22 | 3.47 | 3.19 | 1.15 | 1.07 | 0.82 | 0.78 | 2.10 | 1.92 |
| 150 | 8.12 | 7.18 | 8.08 | 7.14 | 3.72 | 3.43 | 2.78 | 2.54 | 5.87 | 5.35 |
| 140 | 16.24 | 14.17 | 16.17 | 14.12 | 9.11 | 8.12 | 7.08 | 6.44 | 13.22 | 11.56 |
| 130 | 30.85 | 27.72 | 30.68 | 27.56 | 19.30 | 17.11 | 16.19 | 14.22 | 26.35 | 23.43 |
| 120 | 65.80 | 60.00 | 64.38 | 58.68 | 41.32 | 36.76 | 34.01 | 30.52 | 55.37 | 49.60 |

Table F-292. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | - | - |
| 180 | 0.13 | 0.13 | 0.13 | 0.13 | 0.04 | 0.04 | 0.03 | 0.03 | 0.06 | 0.06 |
| 175 | 0.31 | 0.30 | 0.30 | 0.29 | 0.06 | 0.06 | 0.05 | 0.05 | 0.14 | 0.14 |
| 170 | 0.67 | 0.64 | 0.65 | 0.63 | 0.16 | 0.15 | 0.09 | 0.09 | 0.33 | 0.32 |
| 160 | 2.57 | 2.37 | 2.55 | 2.35 | 0.76 | 0.73 | 0.54 | 0.51 | 1.41 | 1.35 |
| 150 | 6.37 | 5.75 | 6.34 | 5.72 | 2.72 | 2.47 | 1.91 | 1.78 | 4.48 | 4.17 |
| 140 | 13.42 | 11.71 | 13.38 | 11.66 | 6.91 | 6.31 | 5.50 | 5.02 | 10.44 | 9.14 |
| 130 | 25.83 | 22.85 | 25.72 | 22.72 | 15.71 | 13.80 | 13.01 | 11.41 | 21.22 | 18.44 |
| 120 | 52.18 | 46.25 | 51.48 | 45.61 | 32.11 | 29.02 | 27.40 | 24.40 | 43.52 | 38.66 |

Table F-293. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.06 | 0.06 | 0.06 | 0.06 | - | - | - | - | 0.03 | 0.03 |
| 190 | 0.30 | 0.29 | 0.30 | 0.29 | 0.06 | 0.06 | 0.05 | 0.05 | 0.13 | 0.13 |
| 180 | 1.38 | 1.30 | 1.36 | 1.29 | 0.37 | 0.36 | 0.24 | 0.24 | 0.73 | 0.70 |
| 175 | 2.68 | 2.45 | 2.66 | 2.42 | 0.78 | 0.74 | 0.56 | 0.52 | 1.46 | 1.39 |
| 170 | 4.47 | 4.16 | 4.44 | 4.13 | 1.50 | 1.42 | 1.09 | 1.02 | 2.88 | 2.63 |
| 160 | 11.35 | 9.88 | 11.28 | 9.81 | 5.11 | 4.69 | 3.89 | 3.57 | 8.32 | 7.47 |
| 150 | 28.24 | 25.79 | 27.84 | 25.45 | 14.66 | 13.25 | 11.34 | 10.14 | 21.80 | 19.60 |
| 140 | >90 | 84.99 | >90 | 84.55 | 52.72 | 46.36 | 37.60 | 33.57 | >90 | 80.70 |
| 130 | >90 | 86.09 | >90 | 86.06 | >90 | 85.99 | >90 | 85.95 | >90 | 86.04 |
| 120 | >90 | 86.08 | >90 | 86.08 | >90 | 86.09 | >90 | 86.10 | >90 | 86.09 |

Table F-294. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.06 | 0.06 | - | - | - | - | 0.03 | 0.03 |
| 180 | 0.30 | 0.29 | 0.30 | 0.29 | 0.06 | 0.06 | 0.05 | 0.05 | 0.13 | 0.13 |
| 175 | 0.67 | 0.64 | 0.67 | 0.64 | 0.15 | 0.15 | 0.08 | 0.08 | 0.34 | 0.33 |
| 170 | 1.38 | 1.30 | 1.36 | 1.29 | 0.37 | 0.36 | 0.24 | 0.24 | 0.73 | 0.70 |
| 160 | 4.47 | 4.16 | 4.44 | 4.13 | 1.50 | 1.42 | 1.09 | 1.02 | 2.88 | 2.63 |
| 150 | 11.35 | 9.88 | 11.28 | 9.81 | 5.11 | 4.69 | 3.89 | 3.57 | 8.32 | 7.47 |
| 140 | 28.24 | 25.79 | 27.84 | 25.45 | 14.66 | 13.25 | 11.34 | 10.14 | 21.80 | 19.60 |
| 130 | >90 | 84.99 | >90 | 84.55 | 52.72 | 46.36 | 37.60 | 33.57 | >90 | 80.70 |
| 120 | >90 | 86.09 | >90 | 86.06 | >90 | 85.99 | >90 | 85.95 | >90 | 86.04 |

Table F-295. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.04 | 0.04 | 0.04 | 0.04 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.22 | 0.21 | 0.21 | 0.20 | 0.06 | 0.06 | 0.05 | 0.05 | 0.09 | 0.09 |
| 175 | 0.48 | 0.46 | 0.47 | 0.45 | 0.10 | 0.10 | 0.06 | 0.06 | 0.24 | 0.23 |
| 170 | 1.04 | 0.98 | 1.02 | 0.96 | 0.27 | 0.26 | 0.16 | 0.16 | 0.54 | 0.51 |
| 160 | 3.73 | 3.42 | 3.71 | 3.39 | 1.16 | 1.10 | 0.84 | 0.79 | 2.22 | 2.03 |
| 150 | 9.44 | 8.39 | 9.40 | 8.35 | 4.16 | 3.83 | 3.04 | 2.77 | 6.80 | 6.14 |
| 140 | 23.19 | 20.85 | 22.93 | 20.59 | 11.94 | 10.69 | 9.05 | 8.25 | 17.87 | 16.08 |
| 130 | >90 | 82.24 | >90 | 78.74 | 37.62 | 33.49 | 28.70 | 26.02 | 65.76 | 56.76 |
| 120 | >90 | 86.07 | >90 | 86.01 | >90 | 85.79 | >90 | 85.36 | >90 | 85.98 |

Table F-296. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | - | - |
| 180 | 0.13 | 0.13 | 0.13 | 0.13 | 0.04 | 0.04 | 0.03 | 0.03 | 0.06 | 0.06 |
| 175 | 0.30 | 0.29 | 0.30 | 0.29 | 0.06 | 0.06 | 0.05 | 0.05 | 0.13 | 0.13 |
| 170 | 0.67 | 0.64 | 0.67 | 0.64 | 0.15 | 0.15 | 0.08 | 0.08 | 0.34 | 0.33 |
| 160 | 2.68 | 2.45 | 2.66 | 2.42 | 0.78 | 0.74 | 0.56 | 0.52 | 1.46 | 1.39 |
| 150 | 7.15 | 6.46 | 7.10 | 6.43 | 2.92 | 2.66 | 2.08 | 1.90 | 5.00 | 4.59 |
| 140 | 17.49 | 15.60 | 17.37 | 15.49 | 8.64 | 7.85 | 6.73 | 6.01 | 13.51 | 12.08 |
| 130 | 54.88 | 48.32 | 52.24 | 46.27 | 25.60 | 23.31 | 19.32 | 17.59 | 39.00 | 34.89 |
| 120 | >90 | 85.90 | >90 | 85.72 | >90 | 84.84 | >90 | 80.39 | >90 | 85.49 |

Table F-297. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.06 | 0.06 | 0.05 | 0.05 | - | - | - | - | 0.03 | 0.03 |
| 190 | 0.26 | 0.24 | 0.24 | 0.24 | 0.06 | 0.06 | 0.05 | 0.05 | 0.10 | 0.10 |
| 180 | 1.13 | 1.09 | 1.11 | 1.07 | 0.27 | 0.26 | 0.20 | 0.20 | 0.61 | 0.58 |
| 175 | 2.17 | 2.08 | 2.15 | 2.06 | 0.63 | 0.61 | 0.41 | 0.39 | 1.19 | 1.15 |
| 170 | 4.18 | 4.00 | 4.12 | 3.95 | 1.27 | 1.21 | 0.93 | 0.89 | 2.35 | 2.26 |
| 160 | 12.59 | 11.66 | 12.50 | 11.57 | 4.52 | 4.33 | 3.21 | 3.08 | 8.03 | 7.57 |
| 150 | 32.65 | 29.30 | 32.32 | 29.01 | 14.62 | 13.42 | 10.82 | 10.01 | 23.65 | 21.37 |
| 140 | 86.08 | 73.97 | 84.74 | 72.33 | 48.39 | 42.03 | 34.71 | 31.07 | 74.61 | 63.66 |
| 130 | >90 | 85.39 | >90 | 85.33 | >90 | 85.31 | >90 | 85.23 | >90 | 85.33 |
| 120 | >90 | 85.74 | >90 | 85.71 | >90 | 85.63 | >90 | 85.63 | >90 | 85.69 |

Table F-298. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.05 | 0.05 | - | - | - | - | 0.03 | 0.03 |
| 180 | 0.26 | 0.24 | 0.24 | 0.24 | 0.06 | 0.06 | 0.05 | 0.05 | 0.10 | 0.10 |
| 175 | 0.52 | 0.48 | 0.49 | 0.47 | 0.11 | 0.11 | 0.08 | 0.08 | 0.26 | 0.26 |
| 170 | 1.13 | 1.09 | 1.11 | 1.07 | 0.27 | 0.26 | 0.20 | 0.20 | 0.61 | 0.58 |
| 160 | 4.18 | 4.00 | 4.12 | 3.95 | 1.27 | 1.21 | 0.93 | 0.89 | 2.35 | 2.26 |
| 150 | 12.59 | 11.66 | 12.50 | 11.57 | 4.52 | 4.33 | 3.21 | 3.08 | 8.03 | 7.57 |
| 140 | 32.65 | 29.30 | 32.32 | 29.01 | 14.62 | 13.42 | 10.82 | 10.01 | 23.65 | 21.37 |
| 130 | 86.08 | 73.97 | 84.74 | 72.33 | 48.39 | 42.03 | 34.71 | 31.07 | 74.61 | 63.66 |
| 120 | >90 | 85.39 | >90 | 85.33 | >90 | 85.31 | >90 | 85.23 | >90 | 85.33 |

Table F-299. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.04 | 0.04 | 0.04 | 0.04 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.18 | 0.18 | 0.18 | 0.18 | 0.05 | 0.05 | 0.05 | 0.05 | 0.08 | 0.08 |
| 175 | 0.41 | 0.39 | 0.40 | 0.39 | 0.09 | 0.09 | 0.06 | 0.06 | 0.20 | 0.20 |
| 170 | 0.86 | 0.82 | 0.84 | 0.81 | 0.22 | 0.22 | 0.11 | 0.11 | 0.42 | 0.41 |
| 160 | 3.31 | 3.16 | 3.26 | 3.11 | 0.97 | 0.93 | 0.68 | 0.65 | 1.78 | 1.70 |
| 150 | 9.95 | 9.37 | 9.88 | 9.30 | 3.53 | 3.37 | 2.56 | 2.45 | 6.32 | 6.01 |
| 140 | 27.05 | 24.43 | 26.81 | 24.23 | 11.57 | 10.76 | 8.51 | 8.04 | 18.98 | 17.31 |
| 130 | 78.23 | 65.49 | 76.74 | 64.23 | 35.71 | 31.96 | 27.36 | 24.75 | 62.28 | 53.45 |
| 120 | >90 | 85.34 | >90 | 85.31 | >90 | 85.15 | >90 | 84.24 | >90 | 85.30 |

Table F-300. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | - | - |
| 180 | 0.09 | 0.09 | 0.09 | 0.09 | 0.04 | 0.04 | 0.03 | 0.03 | 0.06 | 0.06 |
| 175 | 0.26 | 0.24 | 0.24 | 0.24 | 0.06 | 0.06 | 0.05 | 0.05 | 0.10 | 0.10 |
| 170 | 0.52 | 0.48 | 0.49 | 0.47 | 0.11 | 0.11 | 0.08 | 0.08 | 0.26 | 0.26 |
| 160 | 2.17 | 2.08 | 2.15 | 2.06 | 0.63 | 0.61 | 0.41 | 0.39 | 1.19 | 1.15 |
| 150 | 7.30 | 6.91 | 7.24 | 6.85 | 2.43 | 2.31 | 1.73 | 1.64 | 4.47 | 4.27 |
| 140 | 19.77 | 18.09 | 19.66 | 17.98 | 8.17 | 7.71 | 6.00 | 5.73 | 14.11 | 12.98 |
| 130 | 61.07 | 52.19 | 60.01 | 51.24 | 25.46 | 23.05 | 19.15 | 17.45 | 40.79 | 35.97 |
| 120 | >90 | 85.29 | >90 | 85.25 | 86.52 | 76.92 | 72.22 | 63.77 | >90 | 85.06 |

Table F-301. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.06 | 0.06 | 0.05 | 0.05 | - | - | - | - | 0.03 | 0.03 |
| 190 | 0.26 | 0.25 | 0.26 | 0.25 | 0.06 | 0.06 | 0.05 | 0.05 | 0.10 | 0.10 |
| 180 | 1.14 | 1.10 | 1.12 | 1.08 | 0.26 | 0.25 | 0.20 | 0.19 | 0.62 | 0.60 |
| 175 | 2.19 | 2.10 | 2.16 | 2.07 | 0.65 | 0.62 | 0.42 | 0.41 | 1.22 | 1.16 |
| 170 | 4.01 | 3.82 | 3.97 | 3.78 | 1.29 | 1.23 | 0.94 | 0.90 | 2.27 | 2.18 |
| 160 | 12.33 | 11.51 | 12.22 | 11.39 | 4.26 | 4.06 | 3.05 | 2.92 | 7.41 | 7.07 |
| 150 | 48.05 | 41.46 | 46.59 | 40.26 | 13.75 | 12.81 | 9.76 | 9.30 | 25.97 | 23.41 |
| 140 | >90 | 85.37 | >90 | 85.35 | 75.53 | 66.29 | 43.49 | 37.98 | >90 | 85.18 |
| 130 | >90 | 85.89 | >90 | 85.87 | >90 | 85.67 | >90 | 85.54 | >90 | 85.82 |
| 120 | >90 | 86.12 | >90 | 86.10 | >90 | 86.04 | >90 | 86.00 | >90 | 86.09 |

Table F-302. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.05 | 0.05 | - | - | - | - | 0.03 | 0.03 |
| 180 | 0.26 | 0.25 | 0.26 | 0.25 | 0.06 | 0.06 | 0.05 | 0.05 | 0.10 | 0.10 |
| 175 | 0.58 | 0.56 | 0.56 | 0.50 | 0.11 | 0.11 | 0.08 | 0.08 | 0.26 | 0.25 |
| 170 | 1.14 | 1.10 | 1.12 | 1.08 | 0.26 | 0.25 | 0.20 | 0.19 | 0.62 | 0.60 |
| 160 | 4.01 | 3.82 | 3.97 | 3.78 | 1.29 | 1.23 | 0.94 | 0.90 | 2.27 | 2.18 |
| 150 | 12.33 | 11.51 | 12.22 | 11.39 | 4.26 | 4.06 | 3.05 | 2.92 | 7.41 | 7.07 |
| 140 | 48.05 | 41.46 | 46.59 | 40.26 | 13.75 | 12.81 | 9.76 | 9.30 | 25.97 | 23.41 |
| 130 | >90 | 85.37 | >90 | 85.35 | 75.53 | 66.29 | 43.49 | 37.98 | >90 | 85.18 |
| 120 | >90 | 85.89 | >90 | 85.87 | >90 | 85.67 | >90 | 85.54 | >90 | 85.82 |

Table F-303. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.04 | 0.04 | 0.04 | 0.04 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.19 | 0.19 | 0.18 | 0.18 | 0.06 | 0.06 | 0.05 | 0.05 | 0.08 | 0.08 |
| 175 | 0.41 | 0.40 | 0.41 | 0.40 | 0.09 | 0.09 | 0.06 | 0.06 | 0.19 | 0.19 |
| 170 | 0.87 | 0.82 | 0.84 | 0.80 | 0.22 | 0.21 | 0.11 | 0.11 | 0.42 | 0.41 |
| 160 | 3.04 | 2.90 | 2.98 | 2.86 | 0.98 | 0.94 | 0.69 | 0.66 | 1.74 | 1.68 |
| 150 | 9.61 | 9.12 | 9.52 | 9.04 | 3.34 | 3.19 | 2.47 | 2.35 | 5.92 | 5.62 |
| 140 | 32.98 | 29.29 | 32.39 | 28.80 | 10.79 | 10.01 | 7.94 | 7.46 | 19.55 | 17.89 |
| 130 | >90 | 85.29 | >90 | 85.26 | 48.43 | 42.10 | 29.25 | 26.14 | >90 | 84.59 |
| 120 | >90 | 85.84 | >90 | 85.81 | >90 | 85.55 | >90 | 85.33 | >90 | 85.73 |

Table F-304. Jacket foundation (pre-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | - | - |
| 180 | 0.09 | 0.09 | 0.09 | 0.09 | 0.04 | 0.04 | 0.03 | 0.03 | 0.06 | 0.06 |
| 175 | 0.26 | 0.25 | 0.26 | 0.25 | 0.06 | 0.06 | 0.05 | 0.05 | 0.10 | 0.10 |
| 170 | 0.58 | 0.56 | 0.56 | 0.50 | 0.11 | 0.11 | 0.08 | 0.08 | 0.26 | 0.25 |
| 160 | 2.19 | 2.10 | 2.16 | 2.07 | 0.65 | 0.62 | 0.42 | 0.41 | 1.22 | 1.16 |
| 150 | 6.88 | 6.53 | 6.82 | 6.47 | 2.29 | 2.19 | 1.76 | 1.68 | 4.18 | 4.00 |
| 140 | 21.99 | 19.87 | 21.70 | 19.61 | 7.52 | 7.15 | 5.61 | 5.36 | 13.59 | 12.63 |
| 130 | >90 | 84.74 | >90 | 84.64 | 27.09 | 24.36 | 18.70 | 17.16 | 67.74 | 59.07 |
| 120 | >90 | 85.71 | >90 | 85.67 | >90 | 85.24 | >90 | 84.62 | >90 | 85.58 |

Table F-305. Jacket foundation (post-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | - | - | 0.05 | 0.05 |
| 190 | 0.41 | 0.39 | 0.40 | 0.39 | 0.07 | 0.07 | 0.06 | 0.06 | 0.18 | 0.18 |
| 180 | 1.75 | 1.65 | 1.73 | 1.63 | 0.48 | 0.46 | 0.35 | 0.34 | 0.94 | 0.89 |
| 175 | 3.11 | 2.87 | 3.08 | 2.84 | 1.00 | 0.93 | 0.74 | 0.69 | 1.84 | 1.73 |
| 170 | 4.99 | 4.58 | 4.95 | 4.56 | 1.84 | 1.72 | 1.35 | 1.28 | 3.36 | 3.08 |
| 160 | 10.89 | 9.38 | 10.83 | 9.35 | 5.39 | 4.92 | 4.16 | 3.88 | 8.28 | 7.38 |
| 150 | 20.92 | 18.19 | 20.79 | 18.11 | 12.68 | 11.09 | 9.97 | 8.91 | 17.32 | 15.17 |
| 140 | 41.32 | 36.63 | 40.89 | 36.29 | 26.29 | 23.36 | 21.83 | 18.89 | 34.25 | 30.79 |
| 130 | >90 | 83.58 | >90 | 83.05 | 58.58 | 52.70 | 48.87 | 43.09 | 82.80 | 73.79 |
| 120 | >90 | 85.53 | >90 | 85.49 | >90 | 85.25 | >90 | 85.03 | >90 | 85.39 |

Table F-306. Jacket foundation (post-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | - | - | 0.05 | 0.05 |
| 180 | 0.41 | 0.39 | 0.40 | 0.39 | 0.07 | 0.07 | 0.06 | 0.06 | 0.18 | 0.18 |
| 175 | 0.89 | 0.85 | 0.88 | 0.84 | 0.22 | 0.21 | 0.15 | 0.14 | 0.43 | 0.42 |
| 170 | 1.75 | 1.65 | 1.73 | 1.63 | 0.48 | 0.46 | 0.35 | 0.34 | 0.94 | 0.89 |
| 160 | 4.99 | 4.58 | 4.95 | 4.56 | 1.84 | 1.72 | 1.35 | 1.28 | 3.36 | 3.08 |
| 150 | 10.89 | 9.38 | 10.83 | 9.35 | 5.39 | 4.92 | 4.16 | 3.88 | 8.28 | 7.38 |
| 140 | 20.92 | 18.19 | 20.79 | 18.11 | 12.68 | 11.09 | 9.97 | 8.91 | 17.32 | 15.17 |
| 130 | 41.32 | 36.63 | 40.89 | 36.29 | 26.29 | 23.36 | 21.83 | 18.89 | 34.25 | 30.79 |
| 120 | >90 | 83.58 | >90 | 83.05 | 58.58 | 52.70 | 48.87 | 43.09 | 82.80 | 73.79 |

Table F-307. Jacket foundation (post-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.06 | 0.06 | - | - | - | - | 0.03 | 0.03 |
| 180 | 0.31 | 0.30 | 0.30 | 0.29 | 0.06 | 0.06 | 0.05 | 0.05 | 0.14 | 0.14 |
| 175 | 0.67 | 0.64 | 0.65 | 0.63 | 0.16 | 0.15 | 0.09 | 0.09 | 0.33 | 0.32 |
| 170 | 1.36 | 1.29 | 1.35 | 1.27 | 0.37 | 0.35 | 0.24 | 0.24 | 0.72 | 0.68 |
| 160 | 4.19 | 3.91 | 4.16 | 3.88 | 1.43 | 1.36 | 1.08 | 1.00 | 2.72 | 2.49 |
| 150 | 9.38 | 8.29 | 9.35 | 8.25 | 4.46 | 4.15 | 3.46 | 3.14 | 6.91 | 6.27 |
| 140 | 18.43 | 16.12 | 18.36 | 16.04 | 10.72 | 9.34 | 8.59 | 7.66 | 15.11 | 13.23 |
| 130 | 35.46 | 31.68 | 35.17 | 31.45 | 22.69 | 19.73 | 18.68 | 16.50 | 29.79 | 26.78 |
| 120 | 82.92 | 74.16 | 79.56 | 71.51 | 49.38 | 43.70 | 40.50 | 36.03 | 65.46 | 59.44 |

Table F-308. Jacket foundation (post-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L01 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.17 | 0.17 | 0.17 | 0.17 | 0.05 | 0.05 | 0.04 | 0.04 | 0.07 | 0.07 |
| 175 | 0.41 | 0.39 | 0.40 | 0.39 | 0.07 | 0.07 | 0.06 | 0.06 | 0.18 | 0.18 |
| 170 | 0.89 | 0.85 | 0.88 | 0.84 | 0.22 | 0.21 | 0.15 | 0.14 | 0.43 | 0.42 |
| 160 | 3.11 | 2.87 | 3.08 | 2.84 | 1.00 | 0.93 | 0.74 | 0.69 | 1.84 | 1.73 |
| 150 | 7.47 | 6.63 | 7.43 | 6.60 | 3.36 | 3.04 | 2.50 | 2.27 | 5.39 | 4.93 |
| 140 | 15.24 | 13.30 | 15.17 | 13.24 | 8.38 | 7.48 | 6.52 | 5.94 | 12.35 | 10.72 |
| 130 | 29.03 | 25.96 | 28.89 | 25.82 | 18.11 | 15.94 | 15.03 | 13.22 | 24.74 | 21.74 |
| 120 | 60.46 | 54.90 | 59.45 | 53.85 | 37.89 | 33.85 | 31.48 | 28.27 | 51.28 | 45.52 |

Table F-309. Jacket foundation (post-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | - | - | 0.05 | 0.05 |
| 190 | 0.42 | 0.40 | 0.41 | 0.40 | 0.07 | 0.07 | 0.06 | 0.06 | 0.18 | 0.18 |
| 180 | 1.78 | 1.68 | 1.76 | 1.66 | 0.50 | 0.48 | 0.35 | 0.34 | 0.96 | 0.91 |
| 175 | 3.31 | 3.03 | 3.27 | 3.00 | 1.00 | 0.94 | 0.74 | 0.71 | 1.92 | 1.79 |
| 170 | 5.45 | 4.97 | 5.42 | 4.94 | 1.94 | 1.82 | 1.40 | 1.32 | 3.66 | 3.36 |
| 160 | 13.55 | 11.99 | 13.47 | 11.91 | 6.45 | 5.76 | 4.77 | 4.41 | 9.89 | 8.92 |
| 150 | 35.25 | 31.79 | 34.59 | 31.22 | 17.97 | 16.27 | 14.10 | 12.78 | 27.22 | 24.86 |
| 140 | >90 | 85.36 | >90 | 85.25 | 77.94 | 67.11 | 53.36 | 47.20 | >90 | 84.85 |
| 130 | >90 | 86.10 | >90 | 86.08 | >90 | 86.06 | >90 | 86.03 | >90 | 86.07 |
| 120 | >90 | 86.16 | >90 | 86.07 | >90 | 86.07 | >90 | 86.08 | >90 | 86.07 |

Table F-310. Jacket foundation (post-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | - | - | 0.05 | 0.05 |
| 180 | 0.42 | 0.40 | 0.41 | 0.40 | 0.07 | 0.07 | 0.06 | 0.06 | 0.18 | 0.18 |
| 175 | 0.89 | 0.85 | 0.89 | 0.84 | 0.22 | 0.21 | 0.14 | 0.14 | 0.44 | 0.43 |
| 170 | 1.78 | 1.68 | 1.76 | 1.66 | 0.50 | 0.48 | 0.35 | 0.34 | 0.96 | 0.91 |
| 160 | 5.45 | 4.97 | 5.42 | 4.94 | 1.94 | 1.82 | 1.40 | 1.32 | 3.66 | 3.36 |
| 150 | 13.55 | 11.99 | 13.47 | 11.91 | 6.45 | 5.76 | 4.77 | 4.41 | 9.89 | 8.92 |
| 140 | 35.25 | 31.79 | 34.59 | 31.22 | 17.97 | 16.27 | 14.10 | 12.78 | 27.22 | 24.86 |
| 130 | >90 | 85.36 | >90 | 85.25 | 77.94 | 67.11 | 53.36 | 47.20 | >90 | 84.85 |
| 120 | >90 | 86.10 | >90 | 86.08 | >90 | 86.06 | >90 | 86.03 | >90 | 86.07 |

Table F-311. Jacket foundation (post-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.06 | 0.06 | - | - | - | - | 0.03 | 0.03 |
| 180 | 0.30 | 0.29 | 0.30 | 0.29 | 0.06 | 0.06 | 0.05 | 0.05 | 0.13 | 0.13 |
| 175 | 0.67 | 0.64 | 0.67 | 0.64 | 0.15 | 0.15 | 0.08 | 0.08 | 0.34 | 0.33 |
| 170 | 1.38 | 1.30 | 1.36 | 1.29 | 0.37 | 0.36 | 0.24 | 0.24 | 0.73 | 0.70 |
| 160 | 4.47 | 4.16 | 4.44 | 4.13 | 1.50 | 1.42 | 1.09 | 1.02 | 2.88 | 2.63 |
| 150 | 11.35 | 9.88 | 11.28 | 9.81 | 5.11 | 4.69 | 3.89 | 3.57 | 8.31 | 7.47 |
| 140 | 28.24 | 25.79 | 27.84 | 25.45 | 14.66 | 13.24 | 11.34 | 10.14 | 21.80 | 19.61 |
| 130 | >90 | 84.99 | >90 | 84.55 | 52.72 | 46.37 | 37.60 | 33.56 | >90 | 80.70 |
| 120 | >90 | 86.09 | >90 | 86.06 | >90 | 85.99 | >90 | 85.95 | >90 | 86.04 |

Table F-312. Jacket foundation (post-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L01 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.17 | 0.16 | 0.17 | 0.16 | 0.05 | 0.05 | 0.04 | 0.04 | 0.07 | 0.07 |
| 175 | 0.42 | 0.40 | 0.41 | 0.40 | 0.07 | 0.07 | 0.06 | 0.06 | 0.18 | 0.18 |
| 170 | 0.89 | 0.85 | 0.89 | 0.84 | 0.22 | 0.21 | 0.14 | 0.14 | 0.44 | 0.43 |
| 160 | 3.31 | 3.03 | 3.27 | 3.00 | 1.00 | 0.94 | 0.74 | 0.71 | 1.92 | 1.79 |
| 150 | 8.73 | 7.74 | 8.68 | 7.69 | 3.73 | 3.42 | 2.74 | 2.49 | 6.19 | 5.57 |
| 140 | 20.76 | 18.48 | 20.52 | 18.32 | 10.55 | 9.46 | 8.12 | 7.44 | 16.33 | 14.62 |
| 130 | 82.70 | 70.58 | 76.68 | 65.68 | 32.96 | 29.58 | 25.14 | 22.93 | 54.06 | 47.43 |
| 120 | >90 | 86.04 | >90 | 85.97 | >90 | 85.49 | >90 | 84.88 | >90 | 85.88 |

Table F-313. Jacket foundation (post-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | - | - | 0.05 | 0.05 |
| 190 | 0.37 | 0.36 | 0.32 | 0.31 | 0.07 | 0.07 | 0.06 | 0.06 | 0.17 | 0.17 |
| 180 | 1.51 | 1.45 | 1.49 | 1.43 | 0.39 | 0.37 | 0.26 | 0.26 | 0.79 | 0.75 |
| 175 | 2.82 | 2.70 | 2.79 | 2.67 | 0.83 | 0.79 | 0.60 | 0.57 | 1.56 | 1.49 |
| 170 | 5.31 | 5.05 | 5.26 | 5.00 | 1.61 | 1.53 | 1.22 | 1.16 | 2.94 | 2.83 |
| 160 | 15.25 | 14.01 | 15.13 | 13.91 | 5.70 | 5.44 | 4.25 | 4.06 | 9.84 | 9.31 |
| 150 | 40.82 | 35.96 | 40.14 | 35.44 | 18.13 | 16.52 | 13.85 | 12.70 | 28.99 | 26.16 |
| 140 | 89.99 | 82.90 | 89.99 | 81.03 | 64.69 | 55.98 | 47.02 | 41.07 | 85.39 | 74.03 |
| 130 | >90 | 85.53 | >90 | 85.48 | >90 | 85.35 | >90 | 85.33 | >90 | 85.39 |
| 120 | >90 | 85.83 | >90 | 85.80 | >90 | 85.70 | >90 | 85.66 | >90 | 85.75 |

Table F-314. Jacket foundation (post-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | - | - | 0.05 | 0.05 |
| 180 | 0.37 | 0.36 | 0.32 | 0.31 | 0.07 | 0.07 | 0.06 | 0.06 | 0.17 | 0.17 |
| 175 | 0.74 | 0.72 | 0.74 | 0.71 | 0.18 | 0.18 | 0.10 | 0.09 | 0.37 | 0.35 |
| 170 | 1.51 | 1.45 | 1.49 | 1.43 | 0.39 | 0.37 | 0.26 | 0.26 | 0.79 | 0.75 |
| 160 | 5.31 | 5.05 | 5.26 | 5.00 | 1.61 | 1.53 | 1.22 | 1.16 | 2.94 | 2.83 |
| 150 | 15.25 | 14.01 | 15.13 | 13.91 | 5.70 | 5.44 | 4.25 | 4.06 | 9.84 | 9.31 |
| 140 | 40.82 | 35.96 | 40.14 | 35.44 | 18.13 | 16.52 | 13.85 | 12.70 | 28.99 | 26.16 |
| 130 | 89.99 | 82.90 | 89.99 | 81.03 | 64.69 | 55.98 | 47.02 | 41.07 | 85.39 | 74.03 |
| 120 | >90 | 85.53 | >90 | 85.48 | >90 | 85.35 | >90 | 85.33 | >90 | 85.39 |

Table F-315. Jacket foundation (post-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.05 | 0.05 | - | - | - | - | 0.03 | 0.03 |
| 180 | 0.26 | 0.24 | 0.24 | 0.24 | 0.06 | 0.06 | 0.05 | 0.05 | 0.10 | 0.10 |
| 175 | 0.52 | 0.48 | 0.49 | 0.47 | 0.11 | 0.11 | 0.08 | 0.08 | 0.26 | 0.26 |
| 170 | 1.13 | 1.09 | 1.11 | 1.07 | 0.27 | 0.26 | 0.20 | 0.20 | 0.61 | 0.58 |
| 160 | 4.18 | 4.00 | 4.12 | 3.95 | 1.27 | 1.21 | 0.93 | 0.89 | 2.35 | 2.26 |
| 150 | 12.59 | 11.66 | 12.50 | 11.57 | 4.52 | 4.33 | 3.21 | 3.08 | 8.03 | 7.57 |
| 140 | 32.65 | 29.30 | 32.32 | 29.01 | 14.62 | 13.42 | 10.82 | 10.01 | 23.65 | 21.37 |
| 130 | 86.08 | 73.97 | 84.74 | 72.33 | 48.39 | 42.03 | 34.71 | 31.07 | 74.61 | 63.66 |
| 120 | >90 | 85.39 | >90 | 85.33 | >90 | 85.31 | >90 | 85.23 | >90 | 85.33 |

Table F-316. Jacket foundation (post-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during summer at location L02 at 15 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.14 | 0.13 | 0.13 | 0.13 | 0.05 | 0.05 | 0.04 | 0.04 | 0.07 | 0.07 |
| 175 | 0.37 | 0.36 | 0.32 | 0.31 | 0.07 | 0.07 | 0.06 | 0.06 | 0.17 | 0.17 |
| 170 | 0.74 | 0.72 | 0.74 | 0.71 | 0.18 | 0.18 | 0.10 | 0.09 | 0.37 | 0.35 |
| 160 | 2.82 | 2.70 | 2.79 | 2.67 | 0.83 | 0.79 | 0.60 | 0.57 | 1.56 | 1.49 |
| 150 | 9.12 | 8.58 | 9.04 | 8.51 | 3.00 | 2.87 | 2.28 | 2.16 | 5.62 | 5.35 |
| 140 | 24.66 | 22.29 | 24.44 | 22.09 | 10.08 | 9.48 | 7.50 | 7.15 | 17.25 | 15.75 |
| 130 | 71.38 | 60.97 | 69.45 | 59.93 | 31.76 | 28.53 | 24.47 | 22.12 | 55.16 | 47.44 |
| 120 | >90 | 85.33 | >90 | 85.30 | >90 | 84.64 | 89.99 | 81.10 | >90 | 85.27 |

Table F-317. Jacket foundation (post-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 0 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | - | - | 0.05 | 0.05 |
| 190 | 0.38 | 0.37 | 0.37 | 0.36 | 0.07 | 0.07 | 0.06 | 0.06 | 0.17 | 0.16 |
| 180 | 1.51 | 1.45 | 1.49 | 1.43 | 0.40 | 0.39 | 0.26 | 0.24 | 0.78 | 0.74 |
| 175 | 2.76 | 2.65 | 2.75 | 2.63 | 0.84 | 0.80 | 0.62 | 0.59 | 1.57 | 1.50 |
| 170 | 4.98 | 4.74 | 4.94 | 4.70 | 1.64 | 1.57 | 1.24 | 1.18 | 2.85 | 2.73 |
| 160 | 15.51 | 14.32 | 15.36 | 14.19 | 5.36 | 5.12 | 3.99 | 3.81 | 9.38 | 8.88 |
| 150 | 74.14 | 64.61 | 70.61 | 61.49 | 17.75 | 16.31 | 12.84 | 12.00 | 35.95 | 31.65 |
| 140 | >90 | 85.56 | >90 | 85.52 | >90 | 84.32 | 66.70 | 58.64 | >90 | 85.32 |
| 130 | >90 | 85.96 | >90 | 85.93 | >90 | 85.80 | >90 | 85.70 | >90 | 85.89 |
| 120 | >90 | 86.14 | >90 | 86.13 | >90 | 86.11 | >90 | 86.10 | >90 | 86.12 |

Table F-318. Jacket foundation (post-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 10 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.06 | 0.06 | 0.02 | 0.02 | - | - | 0.05 | 0.05 |
| 180 | 0.38 | 0.37 | 0.37 | 0.36 | 0.07 | 0.07 | 0.06 | 0.06 | 0.17 | 0.16 |
| 175 | 0.74 | 0.71 | 0.73 | 0.70 | 0.18 | 0.18 | 0.10 | 0.09 | 0.38 | 0.37 |
| 170 | 1.51 | 1.45 | 1.49 | 1.43 | 0.40 | 0.39 | 0.26 | 0.24 | 0.78 | 0.74 |
| 160 | 4.98 | 4.74 | 4.94 | 4.70 | 1.64 | 1.57 | 1.24 | 1.18 | 2.85 | 2.73 |
| 150 | 15.51 | 14.32 | 15.36 | 14.19 | 5.36 | 5.12 | 3.99 | 3.81 | 9.38 | 8.88 |
| 140 | 74.14 | 64.61 | 70.61 | 61.49 | 17.75 | 16.31 | 12.84 | 12.00 | 35.95 | 31.65 |
| 130 | >90 | 85.56 | >90 | 85.52 | >90 | 84.32 | 66.70 | 58.64 | >90 | 85.32 |
| 120 | >90 | 85.96 | >90 | 85.93 | >90 | 85.80 | >90 | 85.70 | >90 | 85.89 |

Table F-319. Jacket foundation (post-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 12 dB.

| Level (dB re 1µPa²) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.06 | 0.06 | 0.05 | 0.05 | - | - | - | - | 0.03 | 0.03 |
| 180 | 0.26 | 0.25 | 0.26 | 0.25 | 0.06 | 0.06 | 0.05 | 0.05 | 0.10 | 0.10 |
| 175 | 0.58 | 0.56 | 0.56 | 0.50 | 0.11 | 0.11 | 0.08 | 0.08 | 0.26 | 0.25 |
| 170 | 1.14 | 1.10 | 1.12 | 1.08 | 0.26 | 0.25 | 0.20 | 0.19 | 0.62 | 0.60 |
| 160 | 4.01 | 3.82 | 3.97 | 3.78 | 1.29 | 1.23 | 0.94 | 0.90 | 2.27 | 2.18 |
| 150 | 12.33 | 11.50 | 12.22 | 11.39 | 4.26 | 4.06 | 3.05 | 2.92 | 7.41 | 7.07 |
| 140 | 48.05 | 41.46 | 46.59 | 40.26 | 13.75 | 12.81 | 9.76 | 9.30 | 25.97 | 23.41 |
| 130 | >90 | 85.37 | >90 | 85.35 | 75.53 | 66.29 | 43.49 | 37.97 | >90 | 85.18 |
| 120 | >90 | 85.89 | >90 | 85.87 | >90 | 85.67 | >90 | 85.54 | >90 | 85.82 |

Table F-320. Jacket foundation (post-piled 4.25 m difficult-to-drive jacket with an MHU 3500S hammer, 3500 kJ max energy level) acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) for each of the flat and frequency weighted SPL categories (Finneran et al. 2017, NMFS 2018) during winter at location L02 at 15 dB.

| Level (dB re 1µPa$^2$) | FLAT $R_{max}$ | FLAT $R_{95\%}$ | LFC $R_{max}$ | LFC $R_{95\%}$ | MFC $R_{max}$ | MFC $R_{95\%}$ | HFC $R_{max}$ | HFC $R_{95\%}$ | PPW $R_{max}$ | PPW $R_{95\%}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | - | - | - | - | - | - | - | - | - | - |
| 190 | 0.03 | 0.03 | 0.03 | 0.03 | - | - | - | - | 0.02 | 0.02 |
| 180 | 0.14 | 0.14 | 0.13 | 0.13 | 0.05 | 0.05 | 0.04 | 0.04 | 0.07 | 0.07 |
| 175 | 0.38 | 0.37 | 0.37 | 0.36 | 0.07 | 0.07 | 0.06 | 0.06 | 0.17 | 0.16 |
| 170 | 0.74 | 0.71 | 0.73 | 0.70 | 0.18 | 0.18 | 0.10 | 0.09 | 0.38 | 0.37 |
| 160 | 2.76 | 2.65 | 2.75 | 2.63 | 0.84 | 0.80 | 0.62 | 0.59 | 1.57 | 1.50 |
| 150 | 8.67 | 8.26 | 8.56 | 8.17 | 2.91 | 2.79 | 2.14 | 2.04 | 5.33 | 5.04 |
| 140 | 28.51 | 25.53 | 28.09 | 25.19 | 9.45 | 8.97 | 6.94 | 6.59 | 17.41 | 15.98 |
| 130 | >90 | 85.21 | >90 | 85.13 | 39.15 | 34.29 | 25.02 | 22.59 | >90 | 84.00 |
| 120 | >90 | 85.80 | >90 | 85.77 | >90 | 85.48 | >90 | 85.20 | >90 | 85.68 |

## F.3. Impact Pile Driving Per Pile SEL Acoustic Ranges with Attenuation

### F.3.1. Monopile Foundation (Typical)

#### F.3.1.1. 14 m Typical Monopile with an MHU 5500 Hammer

Table F-321. Monopile (14 m typical monopile, MHU 5500 hammer, summer) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa$^2$·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 7.77 | 3.99 | 3.45 | 2.68 |
| MF | 185 | - | - | - | - |
| HF | 155 | 0.32 | 0.08 | 0.03 | 0.02 |
| MF | 185 | 1.81 | 0.58 | 0.40 | 0.28 |
| TUW | 204 | 2.62 | 0.93 | 0.72 | 0.47 |

Table F-322. Monopile (14 m typical monopile, MHU 5500 hammer, winter) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa$^2$·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 9.07 | 4.31 | 3.72 | 2.84 |
| MF | 185 | - | - | - | - |
| HF | 155 | 0.33 | 0.08 | 0.03 | 0.02 |
| MF | 185 | 1.91 | 0.61 | 0.42 | 0.28 |
| TUW | 204 | 2.77 | 0.96 | 0.76 | 0.50 |

Table F-323. Monopile (14 m typical monopile, MHU 5500 hammer, summer) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 10.77 | 5.73 | 4.99 | 3.97 |
| MF | 185 | - | - | - | - |
| HF | 155 | 0.36 | 0.05 | 0.03 | - |
| MF | 185 | 2.61 | 0.65 | 0.56 | 0.34 |
| TUW | 204 | 3.87 | 1.27 | 0.94 | 0.61 |

Table F-324. Monopile (14 m typical monopile, MHU 5500 hammer, winter) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 12.22 | 6.11 | 5.29 | 4.20 |
| MF | 185 | - | - | - | - |
| HF | 155 | 0.36 | 0.05 | 0.03 | 0.02 |
| MF | 185 | 2.73 | 0.67 | 0.58 | 0.32 |
| TUW | 204 | 4.11 | 1.32 | 0.97 | 0.62 |

## F.3.2. Monopile Foundation (Difficult-to-drive)

### F.3.2.1. 14 m Difficult to Drive Monopile with an MHU-6600 Hammer

Table F-325. Monopile (14 m difficult to drive, MHU-6600 hammer, summer) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 9.06 | 4.75 | 4.15 | 3.34 |
| MF | 185 | - | - | - | - |
| HF | 155 | 0.43 | 0.09 | 0.08 | 0.03 |
| MF | 185 | 2.35 | 0.80 | 0.62 | 0.38 |
| TUW | 204 | 3.28 | 1.27 | 0.98 | 0.68 |

Table F-326. Monopile (14 m difficult to drive, MHU-6600 hammer, winter) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 11.21 | 5.25 | 4.51 | 3.60 |
| MF | 185 | - | - | - | - |
| HF | 155 | 0.45 | 0.11 | 0.09 | 0.03 |
| MF | 185 | 2.49 | 0.84 | 0.64 | 0.40 |
| TUW | 204 | 3.54 | 1.34 | 1.05 | 0.72 |

Table F-327. Monopile (14 m difficult to drive, MHU-6600 hammer, summer) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 12.54 | 6.69 | 5.90 | 4.78 |
| MF | 185 | - | - | - | - |
| HF | 155 | 0.58 | 0.12 | 0.08 | 0.03 |
| MF | 185 | 3.31 | 1.01 | 0.72 | 0.52 |
| TUW | 204 | 4.70 | 1.73 | 1.33 | 0.89 |

Table F-328. Monopile (14 m difficult to drive, MHU-6600 hammer, winter) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 14.35 | 7.22 | 6.29 | 5.08 |
| MF | 185 | - | - | - | - |
| HF | 155 | 0.58 | 0.12 | 0.06 | 0.03 |
| MF | 185 | 3.55 | 1.07 | 0.72 | 0.53 |
| TUW | 204 | 4.99 | 1.81 | 1.39 | 0.91 |

## F.3.3. Jacket Foundation (Typical)

### F.3.3.1. 4 m Diameter Pin Pile, 4 Legs

Table F-329. Jacket with 4 legs (summer, pre-piled 4 m diameter typical, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 11.78 | 5.49 | 4.74 | 3.79 |
| MF | 185 | 0.06 | - | - | - |
| HF | 155 | 1.94 | 0.68 | 0.48 | 0.31 |
| PPW | 185 | 2.84 | 0.94 | 0.74 | 0.47 |

Table F-330. Jacket with 4 legs (winter, pre-piled 4 m diameter typical, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 15.03 | 5.99 | 5.09 | 4.01 |
| MF | 185 | 0.07 | - | - | - |
| HF | 155 | 2.06 | 0.70 | 0.54 | 0.37 |
| PPW | 185 | 3.00 | 0.98 | 0.76 | 0.49 |

Table F-331. Jacket with 4 legs (summer, pre-piled 4 m diameter typical, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 17.19 | 7.18 | 6.04 | 4.64 |
| MF | 185 | 0.06 | - | - | - |
| HF | 155 | 2.39 | 0.74 | 0.51 | 0.34 |
| PPW | 185 | 3.33 | 0.95 | 0.67 | 0.47 |

Table F-332. Jacket with 4 legs (winter, pre-piled 4 m diameter typical, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 21.94 | 7.57 | 6.28 | 4.76 |
| MF | 185 | 0.06 | - | - | - |
| HF | 155 | 2.35 | 0.80 | 0.54 | 0.34 |
| PPW | 185 | 3.47 | 0.98 | 0.68 | 0.48 |

Table F-333. Jacket with 4 legs (summer, post-piled 4 m diameter typical, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 13.59 | 6.36 | 5.49 | 4.40 |
| MF | 185 | 0.09 | - | - | - |
| HF | 155 | 2.35 | 0.82 | 0.68 | 0.44 |
| PPW | 185 | 3.53 | 1.23 | 0.94 | 0.66 |

Table F-334. Jacket with 4 legs (winter, post-piled 4 m diameter typical, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 18.25 | 7.11 | 5.99 | 4.70 |
| MF | 185 | 0.09 | - | - | - |
| HF | 155 | 2.46 | 0.90 | 0.70 | 0.48 |
| PPW | 185 | 3.70 | 1.28 | 0.98 | 0.67 |

Table F-335. Jacket with 4 legs (summer, post-piled 4 m diameter typical, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 20.87 | 8.53 | 7.18 | 5.55 |
| MF | 185 | 0.08 | - | - | - |
| HF | 155 | 2.81 | 0.92 | 0.74 | 0.47 |
| PPW | 185 | 4.14 | 1.30 | 0.95 | 0.59 |

Table F-336. Jacket with 4 legs (winter, post-piled 4 m diameter typical, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 28.73 | 9.09 | 7.57 | 5.73 |
| MF | 185 | 0.09 | - | - | - |
| HF | 155 | 2.77 | 0.96 | 0.80 | 0.48 |
| PPW | 185 | 4.24 | 1.32 | 0.98 | 0.60 |

## F.3.3.2. 4 m Diameter Pin Pile, 8 Legs

Table F-337. Jacket with 8 legs (summer, pre-piled 4 m diameter typical, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 14.60 | 6.86 | 5.92 | 4.74 |
| MF | 185 | 0.10 | - | - | - |
| HF | 155 | 2.54 | 0.95 | 0.74 | 0.48 |
| PPW | 185 | 3.83 | 1.40 | 1.08 | 0.74 |

Table F-338. Jacket with 8 legs (winter, pre-piled 4 m diameter typical, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 20.72 | 7.78 | 6.50 | 5.10 |
| MF | 185 | 0.10 | 0.02 | - | - |
| HF | 155 | 2.66 | 1.03 | 0.77 | 0.54 |
| PPW | 185 | 4.04 | 1.44 | 1.14 | 0.76 |

Table F-339. Jacket with 8 legs (summer, pre-piled 4 m diameter typical, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 23.16 | 9.20 | 7.85 | 6.04 |
| MF | 185 | 0.09 | - | - | - |
| HF | 155 | 3.10 | 1.05 | 0.79 | 0.51 |
| PPW | 185 | 4.56 | 1.46 | 1.12 | 0.67 |

Table F-340. Jacket with 8 legs (winter, pre-piled 4 m diameter typical, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 33.61 | 10.03 | 8.34 | 6.28 |
| MF | 185 | 0.09 | 0.02 | - | - |
| HF | 155 | 3.02 | 1.08 | 0.88 | 0.54 |
| PPW | 185 | 4.67 | 1.51 | 1.15 | 0.68 |

Table F-341. Jacket with 8 legs (summer, post-piled 4 m diameter typical, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 16.88 | 8.03 | 6.86 | 5.49 |
| MF | 185 | 0.13 | 0.02 | - | - |
| HF | 155 | 2.89 | 1.20 | 0.95 | 0.68 |
| PPW | 185 | 4.48 | 1.71 | 1.40 | 0.94 |

Table F-342. Jacket with 8 legs (winter, post-piled 4 m diameter typical, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 26.33 | 9.17 | 7.78 | 6.00 |
| MF | 185 | 0.14 | 0.02 | 0.02 | - |
| HF | 155 | 3.08 | 1.26 | 1.03 | 0.70 |
| PPW | 185 | 4.77 | 1.79 | 1.44 | 0.98 |

Table F-343. Jacket with 8 legs (summer, post-piled 4 m diameter typical, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 28.11 | 11.18 | 9.20 | 7.19 |
| MF | 185 | 0.12 | 0.02 | - | - |
| HF | 155 | 3.72 | 1.38 | 1.05 | 0.74 |
| PPW | 185 | 5.46 | 1.85 | 1.46 | 0.96 |

Table F-344. Jacket with 8 legs (winter, post-piled 4 m diameter typical, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 49.03 | 12.48 | 10.03 | 7.58 |
| MF | 185 | 0.13 | 0.02 | 0.02 | - |
| HF | 155 | 3.66 | 1.43 | 1.08 | 0.80 |
| PPW | 185 | 5.63 | 1.92 | 1.51 | 0.98 |

## F.3.3.3. 4.25 m Diameter Pin Pile, 4 Legs

Table F-345. Jacket with 4 legs (summer, pre-piled 4.25 m diameter typical, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 12.87 | 6.29 | 5.46 | 4.41 |
| MF | 185 | 0.06 | - | - | - |
| HF | 155 | 1.63 | 0.51 | 0.41 | 0.25 |
| PPW | 185 | 3.32 | 1.20 | 0.93 | 0.64 |

Table F-346. Jacket with 4 legs (winter, pre-piled 4.25 m diameter typical, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 18.87 | 7.42 | 6.23 | 4.87 |
| MF | 185 | 0.07 | - | - | - |
| HF | 155 | 1.78 | 0.58 | 0.45 | 0.30 |
| PPW | 185 | 3.65 | 1.26 | 0.96 | 0.67 |

Table F-347. Jacket with 4 legs (summer, pre-piled 4.25 m diameter typical, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 21.22 | 8.68 | 7.31 | 5.65 |
| MF | 185 | 0.06 | - | - | - |
| HF | 155 | 1.87 | 0.50 | 0.36 | 0.28 |
| PPW | 185 | 4.09 | 1.29 | 0.95 | 0.60 |

Table F-348. Jacket with 4 legs (winter, pre-piled 4.25 m diameter typical, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 29.72 | 9.26 | 7.76 | 5.89 |
| MF | 185 | 0.06 | - | - | - |
| HF | 155 | 1.98 | 0.55 | 0.45 | 0.28 |
| PPW | 185 | 4.22 | 1.35 | 1.00 | 0.61 |

Table F-349. Jacket with 4 legs (summer, post-piled 4.25 m diameter typical, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 14.71 | 7.28 | 6.29 | 5.09 |
| MF | 185 | 0.08 | - | - | - |
| HF | 155 | 1.93 | 0.67 | 0.51 | 0.33 |
| PPW | 185 | 3.91 | 1.50 | 1.20 | 0.84 |

Table F-350. Jacket with 4 legs (winter, post-piled 4.25 m diameter typical, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 24.07 | 8.79 | 7.42 | 5.74 |
| MF | 185 | 0.09 | - | - | - |
| HF | 155 | 2.15 | 0.74 | 0.58 | 0.36 |
| PPW | 185 | 4.29 | 1.59 | 1.26 | 0.87 |

Table F-351. Jacket with 4 legs (summer, post-piled 4.25 m diameter typical, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 25.78 | 10.30 | 8.68 | 6.68 |
| MF | 185 | 0.08 | - | - | - |
| HF | 155 | 2.35 | 0.74 | 0.50 | 0.32 |
| PPW | 185 | 4.89 | 1.68 | 1.29 | 0.82 |

Table F-352. Jacket with 4 legs (winter, post-piled 4.25 m diameter typical, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 42.07 | 11.51 | 9.26 | 7.06 |
| MF | 185 | 0.09 | - | - | - |
| HF | 155 | 2.43 | 0.81 | 0.56 | 0.37 |
| PPW | 185 | 5.07 | 1.76 | 1.35 | 0.88 |

## F.3.3.4. 4.25 m Diameter Pin Pile, 8 Legs

Table F-353. Jacket with 8 legs (summer, pre-piled 4.25 m diameter typical, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 15.74 | 7.84 | 6.75 | 5.47 |
| MF | 185 | 0.09 | - | - | - |
| HF | 155 | 2.15 | 0.77 | 0.58 | 0.41 |
| PPW | 185 | 4.20 | 1.67 | 1.34 | 0.93 |

Table F-354. Jacket with 8 legs (winter, pre-piled 4.25 m diameter typical, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 26.91 | 9.56 | 8.10 | 6.24 |
| MF | 185 | 0.09 | - | - | - |
| HF | 155 | 2.36 | 0.83 | 0.65 | 0.45 |
| PPW | 185 | 4.66 | 1.77 | 1.42 | 0.96 |

Table F-355. Jacket with 8 legs (summer, pre-piled 4.25 m diameter typical, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 28.46 | 11.39 | 9.34 | 7.32 |
| MF | 185 | 0.09 | - | - | - |
| HF | 155 | 2.55 | 0.83 | 0.67 | 0.36 |
| PPW | 185 | 5.34 | 1.88 | 1.48 | 0.96 |

Table F-356. Jacket with 8 legs (winter, pre-piled 4.25 m diameter typical, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 51.52 | 12.74 | 10.30 | 7.77 |
| MF | 185 | 0.09 | - | - | - |
| HF | 155 | 2.64 | 0.92 | 0.68 | 0.45 |
| PPW | 185 | 5.57 | 1.96 | 1.54 | 1.01 |

Table F-357. Jacket with 8 legs (summer, post-piled 4.25 m diameter typical, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 17.85 | 8.93 | 7.84 | 6.29 |
| MF | 185 | 0.12 | 0.02 | - | - |
| HF | 155 | 2.52 | 0.96 | 0.77 | 0.51 |
| PPW | 185 | 4.84 | 2.06 | 1.67 | 1.20 |

Table F-358. Jacket with 8 legs (winter, post-piled 4.25 m diameter typical, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 34.44 | 11.78 | 9.56 | 7.43 |
| MF | 185 | 0.13 | 0.02 | - | - |
| HF | 155 | 2.72 | 1.07 | 0.83 | 0.58 |
| PPW | 185 | 5.49 | 2.24 | 1.77 | 1.26 |

Table F-359. Jacket with 8 legs (summer, post-piled 4.25 m diameter typical, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 35.24 | 13.52 | 11.39 | 8.68 |
| MF | 185 | 0.11 | 0.02 | - | - |
| HF | 155 | 3.00 | 1.01 | 0.83 | 0.50 |
| PPW | 185 | 6.35 | 2.43 | 1.88 | 1.29 |

Table F-360. Jacket with 8 legs (winter, post-piled 4.25 m diameter typical, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 78.64 | 15.66 | 12.74 | 9.27 |
| MF | 185 | 0.12 | 0.02 | - | - |
| HF | 155 | 3.16 | 1.16 | 0.92 | 0.56 |
| PPW | 185 | 6.63 | 2.53 | 1.96 | 1.35 |

## F.3.4. Jacket Foundation (Difficult-to-drive)

### F.3.4.1. 4 m Diameter Pin Pile, 4 Legs

Table F-361. Jacket with 4 legs (summer, pre-piled 4 m diameter difficult-to-drive, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 12.10 | 5.76 | 5.00 | 4.03 |
| MF | 185 | 0.08 | - | - | - |
| HF | 155 | 2.12 | 0.73 | 0.54 | 0.41 |
| PPW | 185 | 3.11 | 1.09 | 0.86 | 0.57 |

Table F-362. Jacket with 4 legs (winter, pre-piled 4 m diameter difficult-to-drive, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 15.75 | 6.35 | 5.43 | 4.30 |
| MF | 185 | 0.09 | - | - | - |
| HF | 155 | 2.24 | 0.77 | 0.62 | 0.42 |
| PPW | 185 | 3.32 | 1.15 | 0.89 | 0.59 |

Table F-363. Jacket with 4 legs (summer, pre-piled 4 m diameter difficult-to-drive, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 17.95 | 7.81 | 6.58 | 5.15 |
| MF | 185 | 0.07 | - | - | - |
| HF | 155 | 2.56 | 0.78 | 0.71 | 0.37 |
| PPW | 185 | 3.81 | 1.17 | 0.86 | 0.55 |

Table F-364. Jacket with 4 legs (winter, pre-piled 4 m diameter difficult-to-drive, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 24.58 | 8.40 | 6.97 | 5.35 |
| MF | 185 | 0.07 | - | - | - |
| HF | 155 | 2.54 | 0.88 | 0.65 | 0.44 |
| PPW | 185 | 3.94 | 1.19 | 0.89 | 0.56 |

Table F-365. Jacket with 4 legs (summer, post-piled 4 m diameter difficult-to-drive, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 13.93 | 6.63 | 5.76 | 4.66 |
| MF | 185 | 0.10 | - | - | - |
| HF | 155 | 2.50 | 0.94 | 0.73 | 0.47 |
| PPW | 185 | 3.75 | 1.40 | 1.09 | 0.75 |

Table F-366. Jacket with 4 legs (winter, post-piled 4 m diameter difficult-to-drive, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 19.10 | 7.55 | 6.35 | 5.02 |
| MF | 185 | 0.10 | - | - | - |
| HF | 155 | 2.63 | 1.03 | 0.77 | 0.54 |
| PPW | 185 | 3.97 | 1.46 | 1.15 | 0.77 |

Table F-367. Jacket with 4 legs (summer, post-piled 4 m diameter difficult-to-drive, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 21.99 | 9.10 | 7.81 | 6.08 |
| MF | 185 | 0.09 | - | - | - |
| HF | 155 | 3.04 | 1.03 | 0.78 | 0.50 |
| PPW | 185 | 4.59 | 1.51 | 1.17 | 0.71 |

Table F-368. Jacket with 4 legs (winter, post-piled 4 m diameter difficult-to-drive, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 32.72 | 10.07 | 8.40 | 6.38 |
| MF | 185 | 0.09 | - | - | - |
| HF | 155 | 2.98 | 1.07 | 0.88 | 0.53 |
| PPW | 185 | 4.73 | 1.56 | 1.19 | 0.71 |

## F.3.4.2. 4 m Diameter Pin Pile, 8 Legs

Table F-369. Jacket with 8 legs (summer, pre-piled 4 m diameter difficult-to-drive, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 14.97 | 7.19 | 6.18 | 5.00 |
| MF | 185 | 0.11 | 0.02 | - | - |
| HF | 155 | 2.68 | 1.07 | 0.80 | 0.54 |
| PPW | 185 | 4.03 | 1.55 | 1.24 | 0.86 |

Table F-370. Jacket with 8 legs (winter, pre-piled 4 m diameter difficult-to-drive, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 21.79 | 8.21 | 6.91 | 5.43 |
| MF | 185 | 0.13 | 0.02 | - | - |
| HF | 155 | 2.79 | 1.13 | 0.90 | 0.62 |
| PPW | 185 | 4.30 | 1.62 | 1.29 | 0.89 |

Table F-371. Jacket with 8 legs (summer, pre-piled 4 m diameter difficult-to-drive, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 24.22 | 9.89 | 8.47 | 6.58 |
| MF | 185 | 0.10 | 0.02 | - | - |
| HF | 155 | 3.38 | 1.22 | 0.92 | 0.71 |
| PPW | 185 | 4.99 | 1.74 | 1.34 | 0.86 |

Table F-372. Jacket with 8 legs (winter, pre-piled 4 m diameter difficult-to-drive, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 38.97 | 11.27 | 9.14 | 6.98 |
| MF | 185 | 0.11 | 0.02 | - | - |
| HF | 155 | 3.31 | 1.21 | 0.96 | 0.65 |
| PPW | 185 | 5.18 | 1.79 | 1.38 | 0.89 |

Table F-373. Jacket with 8 legs (summer, post-piled 4 m diameter difficult-to-drive, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 17.22 | 8.32 | 7.19 | 5.77 |
| MF | 185 | 0.15 | 0.02 | 0.02 | - |
| HF | 155 | 3.09 | 1.31 | 1.07 | 0.73 |
| PPW | 185 | 4.68 | 1.88 | 1.55 | 1.09 |

Table F-374. Jacket with 8 legs (winter, post-piled 4 m diameter difficult-to-drive, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 27.47 | 9.67 | 8.21 | 6.35 |
| MF | 185 | 0.17 | 0.03 | 0.02 | - |
| HF | 155 | 3.30 | 1.41 | 1.13 | 0.77 |
| PPW | 185 | 5.04 | 2.00 | 1.62 | 1.15 |

Table F-375. Jacket with 8 legs (summer, post-piled 4 m diameter difficult-to-drive, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 29.31 | 11.93 | 9.89 | 7.82 |
| MF | 185 | 0.15 | 0.02 | 0.02 | - |
| HF | 155 | 3.97 | 1.49 | 1.22 | 0.78 |
| PPW | 185 | 5.94 | 2.24 | 1.74 | 1.17 |

Table F-376. Jacket with 8 legs (winter, post-piled 4 m diameter difficult-to-drive, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 57.92 | 13.74 | 11.27 | 8.41 |
| MF | 185 | 0.16 | 0.03 | 0.02 | - |
| HF | 155 | 3.92 | 1.54 | 1.21 | 0.88 |
| PPW | 185 | 6.20 | 2.32 | 1.79 | 1.19 |

## F.3.4.3. 4.25 m Diameter Pin Pile, 4 Legs

Table F-377. Jacket with 4 legs (summer, pre-piled 4.25 m difficult-to-drive diameter, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 13.55 | 6.69 | 5.84 | 4.73 |
| MF | 185 | 0.07 | - | - | - |
| HF | 155 | 1.75 | 0.56 | 0.46 | 0.29 |
| PPW | 185 | 3.63 | 1.35 | 1.07 | 0.74 |

Table F-378. Jacket with 4 legs (winter, pre-piled 4.25 m difficult-to-drive diameter, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 20.78 | 8.03 | 6.73 | 5.27 |
| MF | 185 | 0.08 | - | - | - |
| HF | 155 | 1.89 | 0.64 | 0.50 | 0.32 |
| PPW | 185 | 3.97 | 1.43 | 1.13 | 0.77 |

Table F-379. Jacket with 4 legs (summer, pre-piled 4.25 m difficult-to-drive diameter, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 22.75 | 9.28 | 7.97 | 6.17 |
| MF | 185 | 0.06 | - | - | - |
| HF | 155 | 2.11 | 0.67 | 0.43 | 0.30 |
| PPW | 185 | 4.49 | 1.52 | 1.15 | 0.70 |

Table F-380. Jacket with 4 legs (winter, pre-piled 4.25 m difficult-to-drive diameter, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 33.21 | 10.15 | 8.47 | 6.43 |
| MF | 185 | 0.07 | - | - | - |
| HF | 155 | 2.16 | 0.64 | 0.48 | 0.29 |
| PPW | 185 | 4.65 | 1.57 | 1.19 | 0.69 |

Table F-381. Jacket with 4 legs (summer, post-piled 4.25 m diameter difficult-to-drive, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 15.47 | 7.76 | 6.69 | 5.44 |
| MF | 185 | 0.09 | - | - | - |
| HF | 155 | 2.10 | 0.75 | 0.56 | 0.40 |
| PPW | 185 | 4.20 | 1.68 | 1.35 | 0.94 |

Table F-382. Jacket with 4 legs (winter, post-piled 4.25 m diameter difficult-to-drive, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 26.01 | 9.43 | 8.03 | 6.20 |
| MF | 185 | 0.09 | - | - | - |
| HF | 155 | 2.32 | 0.81 | 0.64 | 0.45 |
| PPW | 185 | 4.66 | 1.78 | 1.43 | 0.97 |

Table F-383. Jacket with 4 legs (summer, post-piled 4.25 m diameter difficult-to-drive, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 27.43 | 11.24 | 9.28 | 7.32 |
| MF | 185 | 0.09 | - | - | - |
| HF | 155 | 2.52 | 0.82 | 0.67 | 0.36 |
| PPW | 185 | 5.35 | 1.91 | 1.52 | 0.98 |

Table F-384. Jacket with 4 legs (winter, post-piled 4.25 m diameter difficult-to-drive, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 48.35 | 12.52 | 10.15 | 7.73 |
| MF | 185 | 0.09 | - | - | - |
| HF | 155 | 2.59 | 0.88 | 0.64 | 0.43 |
| PPW | 185 | 5.56 | 2.00 | 1.57 | 1.03 |

## F.3.4.4. 4.25 m Diameter Pin Pile, 8 Legs

Table F-385. Jacket with 8 legs (summer, pre-piled 4.25 m diameter difficult-to-drive, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 16.54 | 8.30 | 7.23 | 5.84 |
| MF | 185 | 0.10 | - | - | - |
| HF | 155 | 2.31 | 0.85 | 0.66 | 0.46 |
| PPW | 185 | 4.50 | 1.85 | 1.52 | 1.07 |

Table F-386. Jacket with 8 legs (winter, pre-piled 4.25 m diameter difficult-to-drive, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 29.21 | 10.49 | 8.71 | 6.74 |
| MF | 185 | 0.11 | - | - | - |
| HF | 155 | 2.51 | 0.93 | 0.73 | 0.50 |
| PPW | 185 | 5.05 | 1.99 | 1.61 | 1.13 |

Table F-387. Jacket with 8 legs (summer, pre-piled 4.25 m diameter difficult-to-drive, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 30.31 | 12.25 | 10.21 | 7.98 |
| MF | 185 | 0.10 | - | - | - |
| HF | 155 | 2.75 | 0.91 | 0.73 | 0.43 |
| PPW | 185 | 5.84 | 2.19 | 1.71 | 1.15 |

Table F-388. Jacket with 8 legs (winter, pre-piled 4.25 m diameter difficult-to-drive, MHU 3500S) foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 59.34 | 13.82 | 11.35 | 8.48 |
| MF | 185 | 0.11 | - | - | - |
| HF | 155 | 2.80 | 1.02 | 0.78 | 0.48 |
| PPW | 185 | 6.07 | 2.28 | 1.78 | 1.19 |

Table F-389. Jacket with 8 legs (summer, post-piled 4.25 m diameter difficult-to-drive, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 18.63 | 9.43 | 8.30 | 6.70 |
| MF | 185 | 0.13 | 0.02 | - | - |
| HF | 155 | 2.66 | 1.06 | 0.85 | 0.56 |
| PPW | 185 | 5.17 | 2.33 | 1.85 | 1.35 |

Table F-390. Jacket with 8 legs (winter, post-piled 4.25 m diameter difficult-to-drive, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L01.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 37.88 | 12.69 | 10.49 | 8.03 |
| MF | 185 | 0.14 | 0.03 | - | - |
| HF | 155 | 2.85 | 1.17 | 0.93 | 0.64 |
| PPW | 185 | 5.95 | 2.49 | 1.99 | 1.43 |

Table F-391. Jacket with 8 legs (summer, post-piled 4.25 m diameter difficult-to-drive, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 37.78 | 14.45 | 12.25 | 9.29 |
| MF | 185 | 0.13 | 0.02 | - | - |
| HF | 155 | 3.31 | 1.21 | 0.91 | 0.67 |
| PPW | 185 | 6.87 | 2.71 | 2.19 | 1.52 |

Table F-392. Jacket with 8 legs (winter, post-piled 4.25 m diameter difficult-to-drive, MHU 3500S foundation SEL acoustic ranges ($R_{95\%}$ in km) with attenuation (Finneran et al. 2017, NMFS 2018) for location L02.

| Hearing group | Threshold (dB re 1 µPa²·s) | Attenuation level 0 dB | Attenuation level 10 dB | Attenuation level 12 dB | Attenuation level 15 dB |
|---|---|---|---|---|---|
| LF | 183 | 83.63 | 17.01 | 13.82 | 10.17 |
| MF | 185 | 0.15 | 0.03 | - | - |
| HF | 155 | 3.40 | 1.32 | 1.02 | 0.64 |
| PPW | 185 | 7.24 | 2.79 | 2.28 | 1.58 |

# F.4. Fish and Sea Turtle Acoustic Distances to Threshold

## F.4.1. Monopile Foundation (Typical)

### F.4.1.1. 14 m Typical Monopile with an MHU 5500 Hammer

Table F-393. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.09 | 0.17 | 0.30 | 0.32 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 9.79 | 12.33 | 13.01 | 14.99 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.09 | 0.17 | 0.30 | 0.32 |
| Fish < 2 g | $L_p$ [b] | 150 | 9.79 | 12.33 | 13.01 | 14.99 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | 0.03 | 0.07 | 0.09 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.09 | 0.15 | 0.18 | 0.31 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.09 | 0.15 | 0.18 | 0.31 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 1.74 | 2.27 | 2.65 | 3.13 |

Table F-394. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 9.70 |
| Fish < 2 g | $L_E$ [a] | 183 | 12.44 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.95 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 3.53 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 3.53 |
| Sea turtles | $L_E$ [d] | 204 | 3.24 |

Table F-395. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.05 | 0.06 | 0.06 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.64 | 6.85 | 7.44 | 8.54 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.05 | 0.06 | 0.06 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.64 | 6.85 | 7.44 | 8.54 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.03 | 0.05 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.03 | 0.05 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.52 | 0.74 | 0.98 | 1.16 |

Table F-396. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 5.32 |
| Fish < 2 g | $L_E$ [a] | 183 | 6.83 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.22 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.39 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.39 |
| Sea turtles | $L_E$ [d] | 204 | 1.25 |

Table F-397. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.03 | 0.04 | 0.05 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 4.99 | 6.06 | 6.57 | 7.63 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.03 | 0.04 | 0.05 |
| Fish < 2 g | $L_p$ [b] | 150 | 4.99 | 6.06 | 6.57 | 7.63 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.02 | 0.03 | 0.04 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.02 | 0.03 | 0.04 |
| Sea turtles | $L_{pk}$[d] | 232 | - | - | - | - |
| Sea turtles | $L_p$[e] | 175 | 0.34 | 0.60 | 0.76 | 0.92 |

Table F-398. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 4.67 |
| Fish < 2 g | $L_E$ [a] | 183 | 6.05 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.16 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.09 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.09 |
| Sea turtles | $L_E$[d] | 204 | 0.95 |

Table F-399. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.03 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 4.11 | 4.99 | 5.48 | 6.34 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.03 |
| Fish < 2 g | $L_p$ [b] | 150 | 4.11 | 4.99 | 5.48 | 6.34 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.03 |
| Sea turtles | $L_{pk}$[d] | 232 | - | - | - | - |
| Sea turtles | $L_p$[e] | 175 | 0.25 | 0.36 | 0.52 | 0.64 |

Table F-400. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 3.81 |
| Fish < 2 g | $L_E$ [a] | 183 | 4.99 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 0.75 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 0.75 |
| Sea turtles | $L_E$ [d] | 204 | 0.67 |

Table F-401. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa²) and SPL (dB re 1 μPa) thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.09 | 0.17 | 0.30 | 0.33 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 11.36 | 15.17 | 16.22 | 19.33 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.09 | 0.17 | 0.30 | 0.33 |
| Fish < 2 g | $L_p$ [b] | 150 | 11.36 | 15.17 | 16.22 | 19.33 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | 0.03 | 0.07 | 0.09 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.09 | 0.15 | 0.27 | 0.31 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.09 | 0.15 | 0.27 | 0.31 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 1.79 | 2.39 | 2.77 | 3.38 |

Table F-402. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 11.93 |
| Fish < 2 g | $L_E$ [a] | 183 | 15.62 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.01 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 3.79 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 3.79 |
| Sea turtles | $L_E$ [d] | 204 | 3.49 |

Table F-403. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.05 | 0.06 | 0.06 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 6.07 | 7.85 | 8.50 | 9.94 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.05 | 0.06 | 0.06 |
| Fish < 2 g | $L_p$ [b] | 150 | 6.07 | 7.85 | 8.50 | 9.94 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.03 | 0.05 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.03 | 0.05 | 0.06 |
| Sea turtles | $L_{pk}$[d] | 232 | - | - | - | - |
| Sea turtles | $L_p$[e] | 175 | 0.53 | 0.78 | 1.03 | 1.23 |

Table F-404. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 5.89 |
| Fish < 2 g | $L_E$ [a] | 183 | 7.82 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.23 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.46 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.46 |
| Sea turtles | $L_E$[d] | 204 | 1.30 |

Table F-405. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.03 | 0.04 | 0.05 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.32 | 6.80 | 7.48 | 8.70 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.03 | 0.04 | 0.05 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.32 | 6.80 | 7.48 | 8.70 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.02 | 0.03 | 0.04 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.02 | 0.03 | 0.04 |
| Sea turtles | $L_{pk}$[d] | 232 | - | - | - | - |
| Sea turtles | $L_p$[e] | 175 | 0.35 | 0.62 | 0.79 | 0.94 |

Table F-406. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 5.09 |
| Fish < 2 g | $L_E$ [a] | 183 | 6.76 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.16 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.17 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.17 |
| Sea turtles | $L_E$ [d] | 204 | 1.01 |

Table F-407. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.03 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 4.33 | 5.52 | 6.09 | 7.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.03 |
| Fish < 2 g | $L_p$ [b] | 150 | 4.33 | 5.52 | 6.09 | 7.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.25 | 0.37 | 0.54 | 0.66 |

Table F-408. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 4.08 |
| Fish < 2 g | $L_E$ [a] | 183 | 5.47 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 0.80 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 0.80 |
| Sea turtles | $L_E$ [d] | 204 | 0.70 |

Table F-409. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.13 | 0.20 | 0.32 | 0.51 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 13.56 | 18.77 | 20.68 | 22.88 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.13 | 0.20 | 0.32 | 0.51 |
| Fish < 2 g | $L_p$ [b] | 150 | 13.56 | 18.77 | 20.68 | 22.88 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | 0.02 | 0.11 | 0.13 | 0.14 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.12 | 0.19 | 0.27 | 0.37 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.12 | 0.19 | 0.27 | 0.37 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 2.26 | 3.15 | 3.72 | 4.19 |

Table F-410. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 14.65 |
| Fish < 2 g | $L_E$ [a] | 183 | 18.43 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.32 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 5.07 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 5.07 |
| Sea turtles | $L_E$ [d] | 204 | 4.71 |

Table F-411. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.07 | 0.09 | 0.10 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 7.22 | 9.50 | 10.81 | 12.01 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.07 | 0.09 | 0.10 |
| Fish < 2 g | $L_p$ [b] | 150 | 7.22 | 9.50 | 10.81 | 12.01 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.02 | 0.08 | 0.09 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.02 | 0.08 | 0.09 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.56 | 1.06 | 1.33 | 1.61 |

Table F-412. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 7.74 |
| Fish < 2 g | $L_E$ [a] | 183 | 9.95 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.30 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.92 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.92 |
| Sea turtles | $L_E$ [d] | 204 | 1.72 |

Table F-413. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.02 | 0.06 | 0.08 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 6.35 | 8.44 | 9.22 | 10.48 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.02 | 0.06 | 0.08 |
| Fish < 2 g | $L_p$ [b] | 150 | 6.35 | 8.44 | 9.22 | 10.48 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.47 | 0.74 | 1.01 | 1.25 |

Table F-414. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 6.72 |
| Fish < 2 g | $L_E$ [a] | 183 | 8.78 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.18 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.54 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.54 |
| Sea turtles | $L_E$ [d] | 204 | 1.32 |

Table F-415. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.18 | 6.86 | 7.53 | 8.60 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.18 | 6.86 | 7.53 | 8.60 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.28 | 0.53 | 0.66 | 0.88 |

Table F-416. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 5.47 |
| Fish < 2 g | $L_E$ [a] | 183 | 7.22 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.14 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 0.99 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 0.99 |
| Sea turtles | $L_E$ [d] | 204 | 0.88 |

Table F-417. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.13 | 0.22 | 0.34 | 0.50 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 16.01 | 25.01 | 27.98 | 32.76 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.13 | 0.22 | 0.34 | 0.50 |
| Fish < 2 g | $L_p$ [b] | 150 | 16.01 | 25.01 | 27.98 | 32.76 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | 0.02 | 0.11 | 0.13 | 0.14 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.12 | 0.20 | 0.28 | 0.38 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.12 | 0.20 | 0.28 | 0.38 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 2.34 | 3.32 | 3.89 | 4.38 |

Table F-418. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 17.31 |
| Fish < 2 g | $L_E$ [a] | 183 | 24.41 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.38 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 5.39 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 5.39 |
| Sea turtles | $L_E$ [d] | 204 | 4.99 |

Table F-419. Monopile pile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.06 | 0.09 | 0.10 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 7.62 | 11.01 | 12.38 | 13.69 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.06 | 0.09 | 0.10 |
| Fish < 2 g | $L_p$ [b] | 150 | 7.62 | 11.01 | 12.38 | 13.69 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.02 | 0.08 | 0.09 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.02 | 0.08 | 0.09 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.57 | 1.11 | 1.38 | 1.66 |

Table F-420. Monopile pile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 8.41 |
| Fish < 2 g | $L_E$ [a] | 183 | 11.33 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.29 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.04 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.04 |
| Sea turtles | $L_E$ [d] | 204 | 1.79 |

Table F-421. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.02 | 0.06 | 0.08 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 6.35 | 8.44 | 9.22 | 10.48 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.02 | 0.06 | 0.08 |
| Fish < 2 g | $L_p$ [b] | 150 | 6.35 | 8.44 | 9.22 | 10.48 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.47 | 0.74 | 1.01 | 1.25 |

Table F-422. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 6.72 |
| Fish < 2 g | $L_E$ [a] | 183 | 8.78 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.18 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.54 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.54 |
| Sea turtles | $L_E$ [d] | 204 | 1.32 |

Table F-423. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 800 kJ | Hammer energy 2500 kJ | Hammer energy 3500 kJ | Hammer energy 4400 kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.38 | 7.41 | 8.30 | 9.21 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.38 | 7.41 | 8.30 | 9.21 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.27 | 0.54 | 0.68 | 0.90 |

Table F-424. Monopile foundation (14 m typical monopile with an MHU 5500 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 5.82 |
| Fish < 2 g | $L_E$ [a] | 183 | 7.84 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.14 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.04 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.04 |
| Sea turtles | $L_E$ [d] | 204 | 0.91 |

## F.4.2. Monopile Foundation (Difficult-to-drive)

### F.4.2.1. 14 m Difficult to Drive Monopile with an MHU-6600 Hammer

Table F-425. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 2500 kJ | Hammer energy 4000 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.18 | 0.31 | 0.41 | 0.42 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 11.90 | 14.71 | 15.30 | 16.69 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.18 | 0.31 | 0.41 | 0.42 |
| Fish < 2 g | $L_p$ [b] | 150 | 11.90 | 14.71 | 15.30 | 16.69 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | 0.07 | 0.09 | 0.11 | 0.12 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.16 | 0.28 | 0.32 | 0.34 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.16 | 0.28 | 0.32 | 0.34 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 2.27 | 2.92 | 3.51 | 3.77 |

Table F-426. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 11.54 |
| Fish < 2 g | $L_E$ [a] | 183 | 14.33 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.32 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 4.26 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 4.26 |
| Sea turtles | $L_E$ [d] | 204 | 3.98 |

Table F-427 Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 2500 kJ | Hammer energy 4000 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.05 | 0.07 | 0.08 | 0.08 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 6.62 | 8.42 | 8.94 | 9.59 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.05 | 0.07 | 0.08 | 0.08 |
| Fish < 2 g | $L_p$ [b] | 150 | 6.62 | 8.42 | 8.94 | 9.59 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.03 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.04 | 0.06 | 0.07 | 0.07 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.04 | 0.06 | 0.07 | 0.07 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.76 | 1.04 | 1.45 | 1.46 |

Table F-428 Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 6.28 |
| Fish < 2 g | $L_E$ [a] | 183 | 8.06 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.36 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.79 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.79 |
| Sea turtles | $L_E$ [d] | 204 | 1.63 |

Table F-429. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 2500 kJ | Hammer energy 4000 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.03 | 0.05 | 0.06 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 5.89 | 7.50 | 8.07 | 8.59 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.03 | 0.05 | 0.06 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 5.89 | 7.50 | 8.07 | 8.59 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.03 | 0.04 | 0.06 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.03 | 0.04 | 0.06 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.60 | 0.84 | 1.17 | 1.17 |

Table F-430. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 5.54 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 7.13 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.24 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.47 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.47 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.32 |

Table F-431. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 2500 kJ | Hammer energy 4000 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.03 | 0.04 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.86 | 6.20 | 6.75 | 7.23 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.03 | 0.04 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.86 | 6.20 | 6.75 | 7.23 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.02 | 0.03 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.02 | 0.03 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.37 | 0.58 | 0.79 | 0.84 |

Table F-432. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 4.56 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 5.91 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.13 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.02 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.02 |
| Sea turtles | $L_{E}$ [d] | 204 | 0.92 |

Table F-433. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 2500 kJ | Hammer energy 4000 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.18 | 0.31 | 0.40 | 0.41 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 14.72 | 18.46 | 20.03 | 22.92 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.18 | 0.31 | 0.40 | 0.41 |
| Fish < 2 g | $L_p$ [b] | 150 | 14.72 | 18.46 | 20.03 | 22.92 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | 0.07 | 0.09 | 0.11 | 0.12 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.16 | 0.29 | 0.33 | 0.34 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.16 | 0.29 | 0.33 | 0.34 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 2.38 | 3.20 | 3.78 | 4.04 |

Table F-434. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 14.22 |
| Fish < 2 g | $L_E$ [a] | 183 | 18.49 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.39 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 4.61 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 4.61 |
| Sea turtles | $L_E$ [d] | 204 | 4.27 |

Table F-435. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 2500 kJ | Hammer energy 4000 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.05 | 0.07 | 0.09 | 0.08 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 7.59 | 9.71 | 10.59 | 11.61 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.05 | 0.07 | 0.09 | 0.08 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 7.59 | 9.71 | 10.59 | 11.61 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.03 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.03 | 0.06 | 0.07 | 0.07 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.03 | 0.06 | 0.07 | 0.07 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.80 | 1.11 | 1.51 | 1.52 |

Table F-436. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 7.09 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 9.25 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.37 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.88 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.88 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.71 |

Table F-437. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 2500 kJ | Hammer energy 4000 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.03 | 0.05 | 0.06 | 0.06 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 6.58 | 8.56 | 9.17 | 10.01 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.03 | 0.05 | 0.06 | 0.06 |
| Fish < 2 g | $L_p$ [b] | 150 | 6.58 | 8.56 | 9.17 | 10.01 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.02 | 0.03 | 0.06 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.02 | 0.03 | 0.06 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.63 | 0.88 | 1.22 | 1.23 |

Table F-438. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 6.15 |
| Fish < 2 g | $L_E$ [a] | 183 | 8.16 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.26 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.54 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.54 |
| Sea turtles | $L_E$ [d] | 204 | 1.39 |

Table F-439. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 2500 kJ | Hammer energy 4000 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.03 | 0.03 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 5.36 | 6.98 | 7.65 | 8.22 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.03 | 0.03 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 5.36 | 6.98 | 7.65 | 8.22 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.03 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.03 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.39 | 0.60 | 0.84 | 0.88 |

Table F-440. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 4.95 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 6.58 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.14 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.09 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.09 |
| Sea turtles | $L_{E}$ [d] | 204 | 0.95 |

Table F-441. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 2500 kJ | Hammer energy 4000 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.25 | 0.38 | 0.56 | 0.57 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 18.32 | 23.36 | 25.36 | 25.98 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.25 | 0.38 | 0.56 | 0.57 |
| Fish < 2 g | $L_p$ [b] | 150 | 18.32 | 23.36 | 25.36 | 25.98 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | 0.11 | 0.14 | 0.16 | 0.17 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.18 | 0.30 | 0.52 | 0.54 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.18 | 0.30 | 0.52 | 0.54 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 3.06 | 4.05 | 4.65 | 4.80 |

Table F-442. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 16.99 |
| Fish < 2 g | $L_E$ [a] | 183 | 22.27 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.80 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 6.05 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 6.05 |
| Sea turtles | $L_E$ [d] | 204 | 5.64 |

Table F-443. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 2500 kJ | Hammer energy 4000 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.06 | 0.10 | 0.13 | 0.13 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 9.23 | 12.06 | 13.31 | 13.51 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.06 | 0.10 | 0.13 | 0.13 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 9.23 | 12.06 | 13.31 | 13.51 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.02 | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.03 | 0.09 | 0.11 | 0.11 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.03 | 0.09 | 0.11 | 0.11 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 1.03 | 1.52 | 1.89 | 2.00 |

Table F-444. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 9.01 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 11.89 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.39 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.56 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.56 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.30 |

Table F-445. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 2500 kJ | Hammer energy 4000 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.02 | 0.08 | 0.10 | 0.10 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 8.21 | 10.35 | 11.76 | 11.97 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.02 | 0.08 | 0.10 | 0.10 |
| Fish < 2 g | $L_p$ [b] | 150 | 8.21 | 10.35 | 11.76 | 11.97 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.03 | 0.09 | 0.09 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.03 | 0.09 | 0.09 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.73 | 1.18 | 1.53 | 1.60 |

Table F-446. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 7.98 |
| Fish < 2 g | $L_E$ [a] | 183 | 10.35 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.31 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.03 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.03 |
| Sea turtles | $L_E$ [d] | 204 | 1.80 |

Table F-447. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 2500 kJ | Hammer energy 4000 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.02 | 0.03 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 6.65 | 8.42 | 9.31 | 9.62 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.02 | 0.03 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 6.65 | 8.42 | 9.31 | 9.62 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.50 | 0.73 | 1.01 | 1.11 |

Table F-448. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 6.47 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 8.50 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.17 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.41 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.41 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.22 |

Table F-449. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 2500 kJ | Hammer energy 4000 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.23 | 0.38 | 0.55 | 0.57 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 24.64 | 31.39 | 38.08 | 41.18 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.23 | 0.38 | 0.55 | 0.57 |
| Fish < 2 g | $L_p$ [b] | 150 | 24.64 | 31.39 | 38.08 | 41.18 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | 0.11 | 0.14 | 0.17 | 0.18 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.19 | 0.31 | 0.50 | 0.53 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.19 | 0.31 | 0.50 | 0.53 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 3.22 | 4.26 | 4.91 | 5.06 |

Table F-450. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 21.39 |
| Fish < 2 g | $L_E$ [a] | 183 | 30.25 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.88 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 6.46 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 6.46 |
| Sea turtles | $L_E$ [d] | 204 | 6.01 |

Table F-451. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 2500 kJ | Hammer energy 4000 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.06 | 0.10 | 0.13 | 0.13 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 10.54 | 13.97 | 15.47 | 15.74 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.06 | 0.10 | 0.13 | 0.13 |
| Fish < 2 g | $L_p$ [b] | 150 | 10.54 | 13.97 | 15.47 | 15.74 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.02 | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.03 | 0.09 | 0.11 | 0.11 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.03 | 0.09 | 0.11 | 0.11 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 1.08 | 1.57 | 1.94 | 2.08 |

Table F-452. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 9.96 |
| Fish < 2 g | $L_E$ [a] | 183 | 13.47 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.41 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.67 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.67 |
| Sea turtles | $L_E$ [d] | 204 | 2.41 |

Table F-453. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 2500 kJ | Hammer energy 4000 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.02 | 0.08 | 0.09 | 0.10 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 8.91 | 11.94 | 13.35 | 13.60 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.02 | 0.08 | 0.09 | 0.10 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 8.91 | 11.94 | 13.35 | 13.60 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.03 | 0.09 | 0.09 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.03 | 0.09 | 0.09 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.74 | 1.22 | 1.59 | 1.64 |

Table F-454. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 8.67 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 11.73 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.31 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.14 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.14 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.88 |

Table F-455. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges (Rmax in km) to fish and sea turtle PK (dB re 1 µPa2) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 2500 kJ | Hammer energy 4000 kJ | Hammer energy 6600 (a) kJ | Hammer energy 6600 (b) kJ |
|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.02 | 0.03 | 0.04 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 7.22 | 9.11 | 10.60 | 10.86 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.02 | 0.03 | 0.04 |
| Fish < 2 g | $L_p$ [b] | 150 | 7.22 | 9.11 | 10.60 | 10.86 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.51 | 0.74 | 1.06 | 1.15 |

Table F-456. Monopile foundation (14 m difficult to drive monopile with an MHU-6600 hammer) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 6.96 |
| Fish < 2 g | $L_E$ [a] | 183 | 9.22 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.17 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.47 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.47 |
| Sea turtles | $L_E$ [d] | 204 | 1.27 |

# F.4.3. Jacket Foundation (Typical)

## F.4.3.1. 4 m Diameter Pin Pile, 4 Legs

Table F-457. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.05 | 0.09 | 0.11 | 0.13 | 0.17 | 0.28 | 0.09 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 4.58 | 7.06 | 8.30 | 9.30 | 9.63 | 13.38 | 11.50 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.05 | 0.09 | 0.11 | 0.13 | 0.17 | 0.28 | 0.09 |
| Fish < 2 g | $L_p$ [b] | 150 | 4.58 | 7.06 | 8.30 | 9.30 | 9.63 | 13.38 | 11.50 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.09 | 0.11 | 0.12 | 0.13 | 0.23 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.09 | 0.11 | 0.12 | 0.13 | 0.23 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.34 | 0.84 | 1.15 | 1.43 | 1.69 | 2.21 | 1.15 |

Table F-458. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 12.39 |
| Fish < 2 g | $L_E$ [a] | 183 | 16.03 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.13 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 4.07 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 4.07 |
| Sea turtles | $L_E$ [d] | 204 | 3.78 |

Table F-459. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.15 | 3.66 | 4.33 | 4.89 | 5.23 | 7.10 | 5.15 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.15 | 3.66 | 4.33 | 4.89 | 5.23 | 7.10 | 5.15 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.07 | 0.17 | 0.28 | 0.39 | 0.51 | 0.65 | 0.29 |

Table F-460. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 6.20 |
| Fish < 2 g | $L_E$ [a] | 183 | 8.19 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.27 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.59 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.59 |
| Sea turtles | $L_E$ [d] | 204 | 1.43 |

Table F-461. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.05 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.76 | 3.09 | 3.79 | 4.30 | 4.65 | 6.19 | 4.38 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.05 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.76 | 3.09 | 3.79 | 4.30 | 4.65 | 6.19 | 4.38 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.06 | 0.12 | 0.18 | 0.30 | 0.37 | 0.48 | 0.23 |

Table F-462. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 5.40 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 7.14 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.19 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.27 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.27 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.13 |

Table F-463. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.30 | 2.43 | 2.93 | 3.49 | 3.87 | 5.07 | 3.35 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.30 | 2.43 | 2.93 | 3.49 | 3.87 | 5.07 | 3.35 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.03 | 0.09 | 0.11 | 0.16 | 0.21 | 0.28 | 0.15 |

Table F-464. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 4.37 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 5.79 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.12 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 0.88 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 0.88 |
| Sea turtles | $L_{E}$ [d] | 204 | 0.77 |

Table F-465. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.04 | 0.09 | 0.12 | 0.13 | 0.17 | 0.26 | 0.09 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.96 | 8.15 | 9.79 | 11.65 | 11.98 | 18.05 | 13.44 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.04 | 0.09 | 0.12 | 0.13 | 0.17 | 0.26 | 0.09 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.96 | 8.15 | 9.79 | 11.65 | 11.98 | 18.05 | 13.44 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.09 | 0.11 | 0.12 | 0.13 | 0.19 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.09 | 0.11 | 0.12 | 0.13 | 0.19 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.35 | 0.88 | 1.19 | 1.48 | 1.77 | 2.33 | 1.14 |

Table F-466. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 16.01 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 23.75 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 1.16 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 4.32 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 4.32 |
| Sea turtles | $L_{E}$ [d] | 204 | 4.00 |

Table F-467. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.26 | 3.90 | 4.70 | 5.34 | 5.74 | 8.34 | 5.17 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.26 | 3.90 | 4.70 | 5.34 | 5.74 | 8.34 | 5.17 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.07 | 0.17 | 0.28 | 0.40 | 0.53 | 0.66 | 0.29 |

Table F-468. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 6.92 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 9.45 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.28 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.64 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.64 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.47 |

Table F-469. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.83 | 3.32 | 4.05 | 4.63 | 5.01 | 7.17 | 4.32 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 1.83 | 3.32 | 4.05 | 4.63 | 5.01 | 7.17 | 4.32 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.06 | 0.12 | 0.18 | 0.30 | 0.37 | 0.48 | 0.23 |

Table F-470. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 5.91 |
| Fish < 2 g | $L_E$ [a] | 183 | 8.14 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.19 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.31 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.31 |
| Sea turtles | $L_E$ [d] | 204 | 1.16 |

Table F-471. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.35 | 2.56 | 3.14 | 3.73 | 4.12 | 5.67 | 3.26 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.35 | 2.56 | 3.14 | 3.73 | 4.12 | 5.67 | 3.26 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.02 | 0.09 | 0.11 | 0.16 | 0.21 | 0.29 | 0.14 |

Table F-472. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 4.67 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 6.38 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.12 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 0.90 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 0.90 |
| Sea turtles | $L_{E}$ [d] | 204 | 0.78 |

Table F-473. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.02 | 0.13 | 0.15 | 0.15 | 0.15 | 0.15 | 0.06 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 6.01 | 8.56 | 10.58 | 13.74 | 18.50 | 26.94 | 14.29 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.02 | 0.13 | 0.15 | 0.15 | 0.15 | 0.15 | 0.06 |
| Fish < 2 g | $L_p$ [b] | 150 | 6.01 | 8.56 | 10.58 | 13.74 | 18.50 | 26.94 | 14.29 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.02 | 0.08 | 0.08 | 0.09 | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.12 | 0.14 | 0.14 | 0.13 | 0.14 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.12 | 0.14 | 0.14 | 0.13 | 0.14 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.47 | 1.13 | 1.58 | 1.77 | 1.86 | 2.12 | 1.11 |

Table F-474. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 20.45 |
| Fish < 2 g | $L_E$ [a] | 183 | 28.97 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.20 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 5.30 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 5.30 |
| Sea turtles | $L_E$ [d] | 204 | 4.83 |

Table F-475. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa²) and SPL (dB re 1 μPa) thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.97 | 4.76 | 5.90 | 7.11 | 8.48 | 11.38 | 5.32 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.06 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.97 | 4.76 | 5.90 | 7.11 | 8.48 | 11.38 | 5.32 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.11 | 0.19 | 0.32 | 0.45 | 0.47 | 0.50 | 0.28 |

Table F-476. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 8.92 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 12.61 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.26 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.78 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.78 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.57 |

Table F-477. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.53 | 4.19 | 5.21 | 6.09 | 7.13 | 9.26 | 4.39 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.53 | 4.19 | 5.21 | 6.09 | 7.13 | 9.26 | 4.39 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.07 | 0.17 | 0.19 | 0.30 | 0.30 | 0.38 | 0.21 |

Table F-478. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 7.56 |
| Fish < 2 g | $L_E$ [a] | 183 | 10.63 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.18 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.39 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.39 |
| Sea turtles | $L_E$ [d] | 204 | 1.20 |

Table F-479. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.82 | 3.30 | 4.24 | 4.82 | 5.37 | 7.06 | 3.14 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.82 | 3.30 | 4.24 | 4.82 | 5.37 | 7.06 | 3.14 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.02 | 0.13 | 0.15 | 0.15 | 0.17 | 0.23 | 0.17 |

Table F-480. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 5.80 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 8.25 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.12 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 0.88 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 0.88 |
| Sea turtles | $L_{E}$ [d] | 204 | 0.76 |

Table F-481. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.02 | 0.13 | 0.16 | 0.16 | 0.15 | 0.15 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 6.32 | 9.12 | 12.03 | 17.56 | 26.55 | 44.16 | 13.33 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.02 | 0.13 | 0.16 | 0.16 | 0.15 | 0.15 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 6.32 | 9.12 | 12.03 | 17.56 | 26.55 | 44.16 | 13.33 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.02 | 0.07 | 0.09 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.12 | 0.14 | 0.14 | 0.14 | 0.14 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.12 | 0.14 | 0.14 | 0.14 | 0.14 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.47 | 1.18 | 1.62 | 1.78 | 1.85 | 2.12 | 1.11 |

Table F-482. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 27.76 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 52.85 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 1.22 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 5.49 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 5.49 |
| Sea turtles | $L_{E}$ [d] | 204 | 4.99 |

Table F-483. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.11 | 4.98 | 6.24 | 7.81 | 9.41 | 12.63 | 5.03 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.06 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 3.11 | 4.98 | 6.24 | 7.81 | 9.41 | 12.63 | 5.03 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.11 | 0.20 | 0.31 | 0.46 | 0.47 | 0.51 | 0.28 |

Table F-484. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 9.59 |
| Fish < 2 g | $L_E$ [a] | 183 | 14.42 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.24 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.81 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.81 |
| Sea turtles | $L_E$ [d] | 204 | 1.59 |

Table F-485. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.61 | 4.38 | 5.48 | 6.52 | 7.86 | 9.89 | 4.17 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.61 | 4.38 | 5.48 | 6.52 | 7.86 | 9.89 | 4.17 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.06 | 0.17 | 0.19 | 0.28 | 0.28 | 0.39 | 0.20 |

Table F-486. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 8.07 |
| Fish < 2 g | $L_E$ [a] | 183 | 11.92 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.17 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.41 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.41 |
| Sea turtles | $L_E$ [d] | 204 | 1.22 |

Table F-487. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.88 | 3.49 | 4.43 | 4.96 | 5.78 | 7.18 | 3.02 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.88 | 3.49 | 4.43 | 4.96 | 5.78 | 7.18 | 3.02 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | - | 0.13 | 0.15 | 0.15 | 0.16 | 0.22 | 0.16 |

Table F-488. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 6.04 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 8.83 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.12 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 0.89 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 0.89 |
| Sea turtles | $L_{E}$ [d] | 204 | 0.77 |

Table F-489. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.06 | 0.11 | 0.13 | 0.17 | 0.29 | 0.32 | 0.12 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.19 | 8.06 | 9.32 | 10.79 | 11.11 | 15.01 | 13.33 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.06 | 0.11 | 0.13 | 0.17 | 0.29 | 0.32 | 0.12 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.19 | 8.06 | 9.32 | 10.79 | 11.11 | 15.01 | 13.33 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.06 | 0.07 | 0.09 | 0.09 | 0.10 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.06 | 0.11 | 0.12 | 0.13 | 0.26 | 0.30 | 0.10 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.06 | 0.11 | 0.12 | 0.13 | 0.26 | 0.30 | 0.10 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.45 | 1.04 | 1.42 | 1.73 | 2.05 | 2.66 | 1.45 |

Table F-490. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 14.08 |
| Fish < 2 g | $L_E$ [a] | 183 | 18.10 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.43 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 4.69 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 4.69 |
| Sea turtles | $L_E$ [d] | 204 | 4.37 |

Table F-491. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.07 | 0.08 | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.56 | 4.18 | 4.95 | 5.56 | 5.91 | 8.10 | 6.06 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.07 | 0.08 | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.56 | 4.18 | 4.95 | 5.56 | 5.91 | 8.10 | 6.06 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.06 | 0.06 | 0.06 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.06 | 0.06 | 0.06 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.09 | 0.26 | 0.40 | 0.53 | 0.68 | 0.86 | 0.40 |

Table F-492. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 7.14 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 9.26 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.37 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.93 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.93 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.76 |

Table F-493. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.15 | 3.66 | 4.33 | 4.89 | 5.23 | 7.10 | 5.15 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.15 | 3.66 | 4.33 | 4.89 | 5.23 | 7.10 | 5.15 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.07 | 0.17 | 0.28 | 0.39 | 0.51 | 0.65 | 0.29 |

Table F-494. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 6.20 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 8.19 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.27 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.59 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.59 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.43 |

Table F-495. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.60 | 2.82 | 3.51 | 4.03 | 4.37 | 5.80 | 4.03 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 1.60 | 2.82 | 3.51 | 4.03 | 4.37 | 5.80 | 4.03 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.05 | 0.11 | 0.15 | 0.24 | 0.34 | 0.42 | 0.20 |

Table F-496. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 5.04 |
| Fish < 2 g | $L_E$ [a] | 183 | 6.63 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.16 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.13 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.13 |
| Sea turtles | $L_E$ [d] | 204 | 0.98 |

Table F-497. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.06 | 0.11 | 0.13 | 0.18 | 0.28 | 0.31 | 0.12 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 5.71 | 9.35 | 11.57 | 13.63 | 13.88 | 22.10 | 16.47 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.06 | 0.11 | 0.13 | 0.18 | 0.28 | 0.31 | 0.12 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 5.71 | 9.35 | 11.57 | 13.63 | 13.88 | 22.10 | 16.47 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.06 | 0.07 | 0.09 | 0.09 | 0.11 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.06 | 0.11 | 0.13 | 0.13 | 0.20 | 0.29 | 0.10 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.06 | 0.11 | 0.13 | 0.13 | 0.20 | 0.29 | 0.10 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.46 | 1.09 | 1.48 | 1.80 | 2.17 | 2.81 | 1.41 |

Table F-498. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 19.00 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 29.21 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 1.47 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 5.05 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 5.05 |
| Sea turtles | $L_{E}$ [d] | 204 | 4.68 |

Table F-499. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.04 | 0.06 | 0.07 | 0.08 | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.66 | 4.50 | 5.45 | 6.17 | 6.58 | 9.59 | 6.21 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.04 | 0.06 | 0.07 | 0.08 | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.66 | 4.50 | 5.45 | 6.17 | 6.58 | 9.59 | 6.21 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.06 | 0.06 | 0.06 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.06 | 0.06 | 0.06 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.09 | 0.26 | 0.43 | 0.56 | 0.71 | 0.87 | 0.40 |

Table F-500. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 8.14 |
| Fish < 2 g | $L_E$ [a] | 183 | 11.41 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.37 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.03 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.03 |
| Sea turtles | $L_E$ [d] | 204 | 1.82 |

Table F-501. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.26 | 3.90 | 4.70 | 5.34 | 5.74 | 8.34 | 5.17 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.26 | 3.90 | 4.70 | 5.34 | 5.74 | 8.34 | 5.17 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.07 | 0.17 | 0.28 | 0.40 | 0.53 | 0.66 | 0.29 |

Table F-502. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 6.92 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 9.45 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.28 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.64 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.64 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.47 |

Table F-503. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.67 | 3.00 | 3.76 | 4.31 | 4.70 | 6.60 | 3.96 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.67 | 3.00 | 3.76 | 4.31 | 4.70 | 6.60 | 3.96 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.05 | 0.11 | 0.14 | 0.26 | 0.34 | 0.42 | 0.20 |

Table F-504. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 5.46 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 7.52 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.15 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.16 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.16 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.02 |

Table F-505. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.05 | 0.16 | 0.17 | 0.17 | 0.17 | 0.28 | 0.10 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 6.72 | 9.62 | 12.01 | 15.42 | 22.16 | 31.96 | 17.31 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.05 | 0.16 | 0.17 | 0.17 | 0.17 | 0.28 | 0.10 |
| Fish < 2 g | $L_p$ [b] | 150 | 6.72 | 9.62 | 12.01 | 15.42 | 22.16 | 31.96 | 17.31 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.09 | 0.10 | 0.09 | 0.10 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.03 | 0.14 | 0.17 | 0.16 | 0.16 | 0.22 | 0.07 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.03 | 0.14 | 0.17 | 0.16 | 0.16 | 0.22 | 0.07 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.59 | 1.47 | 1.94 | 2.30 | 2.32 | 2.76 | 1.37 |

Table F-506. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 24.45 |
| Fish < 2 g | $L_E$ [a] | 183 | 34.98 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.57 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 6.33 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 6.33 |
| Sea turtles | $L_E$ [d] | 204 | 5.80 |

Table F-507. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.07 | 0.07 | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.61 | 5.37 | 6.60 | 8.27 | 9.85 | 13.65 | 6.45 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.07 | 0.07 | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.61 | 5.37 | 6.60 | 8.27 | 9.85 | 13.65 | 6.45 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.14 | 0.34 | 0.47 | 0.56 | 0.58 | 0.75 | 0.37 |

Table F-508. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 10.63 |
| Fish < 2 g | $L_E$ [a] | 183 | 14.76 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.33 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.29 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.29 |
| Sea turtles | $L_E$ [d] | 204 | 2.01 |

Table F-509. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.97 | 4.76 | 5.90 | 7.11 | 8.48 | 11.38 | 5.32 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.06 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.97 | 4.76 | 5.90 | 7.11 | 8.48 | 11.38 | 5.32 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.11 | 0.19 | 0.32 | 0.45 | 0.47 | 0.50 | 0.28 |

Table F-510. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 8.92 |
| Fish < 2 g | $L_E$ [a] | 183 | 12.61 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.26 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.78 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.78 |
| Sea turtles | $L_E$ [d] | 204 | 1.57 |

Table F-511. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.02 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.29 | 3.92 | 4.87 | 5.65 | 6.51 | 8.55 | 3.95 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.02 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.29 | 3.92 | 4.87 | 5.65 | 6.51 | 8.55 | 3.95 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$[d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$[e] | 175 | 0.04 | 0.16 | 0.17 | 0.24 | 0.26 | 0.30 | 0.20 |

Table F-512. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 6.91 |
| Fish < 2 g | $L_E$ [a] | 183 | 9.59 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.16 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.20 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.20 |
| Sea turtles | $L_E$ [d] | 204 | 1.03 |

Table F-513. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.05 | 0.16 | 0.18 | 0.18 | 0.18 | 0.27 | 0.09 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 7.15 | 10.75 | 13.49 | 21.79 | 33.70 | 70.23 | 16.36 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.05 | 0.16 | 0.18 | 0.18 | 0.18 | 0.27 | 0.09 |
| Fish < 2 g | $L_p$ [b] | 150 | 7.15 | 10.75 | 13.49 | 21.79 | 33.70 | 70.23 | 16.36 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.07 | 0.10 | 0.10 | 0.10 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.03 | 0.15 | 0.17 | 0.17 | 0.16 | 0.23 | 0.07 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.03 | 0.15 | 0.17 | 0.17 | 0.16 | 0.23 | 0.07 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.60 | 1.53 | 1.99 | 2.32 | 2.35 | 2.66 | 1.38 |

Table F-514. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 36.66 |
| Fish < 2 g | $L_E$ [a] | 183 | 79.28 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.59 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 6.63 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 6.63 |
| Sea turtles | $L_E$ [d] | 204 | 6.04 |

Table F-515. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.04 | 0.07 | 0.08 | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.75 | 5.63 | 7.08 | 9.03 | 11.82 | 15.61 | 6.04 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.04 | 0.07 | 0.08 | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.75 | 5.63 | 7.08 | 9.03 | 11.82 | 15.61 | 6.04 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.14 | 0.33 | 0.48 | 0.57 | 0.58 | 0.76 | 0.37 |

Table F-516. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 11.92 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 17.48 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.33 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.34 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.34 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.05 |

Table F-517. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.11 | 4.98 | 6.24 | 7.81 | 9.41 | 12.63 | 5.03 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.06 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 3.11 | 4.98 | 6.24 | 7.81 | 9.41 | 12.63 | 5.03 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.11 | 0.20 | 0.31 | 0.46 | 0.47 | 0.51 | 0.28 |

Table F-518. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 9.59 |
| Fish < 2 g | $L_E$ [a] | 183 | 14.42 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.24 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.81 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.81 |
| Sea turtles | $L_E$ [d] | 204 | 1.59 |

Table F-519. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.02 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.38 | 4.10 | 5.11 | 5.99 | 7.10 | 8.92 | 3.84 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.02 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.38 | 4.10 | 5.11 | 5.99 | 7.10 | 8.92 | 3.84 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.03 | 0.16 | 0.17 | 0.18 | 0.25 | 0.31 | 0.19 |

Table F-520. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 7.33 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 10.76 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.16 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.22 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.22 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.05 |

### F.4.3.2. 4 m Diameter Pin Pile, 8 Legs

Table F-521. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.05 | 0.09 | 0.11 | 0.13 | 0.17 | 0.28 | 0.09 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 4.58 | 7.06 | 8.30 | 9.30 | 9.63 | 13.38 | 11.50 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.05 | 0.09 | 0.11 | 0.13 | 0.17 | 0.28 | 0.09 |
| Fish < 2 g | $L_p$ [b] | 150 | 4.58 | 7.06 | 8.30 | 9.30 | 9.63 | 13.38 | 11.50 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.09 | 0.11 | 0.12 | 0.13 | 0.23 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.09 | 0.11 | 0.12 | 0.13 | 0.23 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.34 | 0.84 | 1.15 | 1.43 | 1.69 | 2.21 | 1.15 |

Table F-522. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 15.03 |
| Fish < 2 g | $L_E$ [a] | 183 | 19.41 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.59 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 5.04 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 5.04 |
| Sea turtles | $L_E$ [d] | 204 | 4.70 |

Table F-523. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.15 | 3.66 | 4.33 | 4.89 | 5.23 | 7.10 | 5.15 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.15 | 3.66 | 4.33 | 4.89 | 5.23 | 7.10 | 5.15 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.07 | 0.17 | 0.28 | 0.39 | 0.51 | 0.65 | 0.29 |

Table F-524. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 7.67 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 9.98 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.44 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.19 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.19 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.94 |

Table F-525. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.76 | 3.09 | 3.79 | 4.30 | 4.65 | 6.19 | 4.38 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 1.76 | 3.09 | 3.79 | 4.30 | 4.65 | 6.19 | 4.38 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.06 | 0.12 | 0.18 | 0.30 | 0.37 | 0.48 | 0.23 |

Table F-526. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 6.63 |
| Fish < 2 g | $L_E$ [a] | 183 | 8.72 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.32 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.76 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.76 |
| Sea turtles | $L_E$ [d] | 204 | 1.59 |

Table F-527. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.30 | 2.43 | 2.93 | 3.49 | 3.87 | 5.07 | 3.35 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.30 | 2.43 | 2.93 | 3.49 | 3.87 | 5.07 | 3.35 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.03 | 0.09 | 0.11 | 0.16 | 0.21 | 0.28 | 0.15 |

Table F-528. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 5.40 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 7.14 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.19 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.27 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.27 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.13 |

Table F-529. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.04 | 0.09 | 0.12 | 0.13 | 0.17 | 0.26 | 0.09 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.96 | 8.15 | 9.79 | 11.65 | 11.98 | 18.05 | 13.44 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.04 | 0.09 | 0.12 | 0.13 | 0.17 | 0.26 | 0.09 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.96 | 8.15 | 9.79 | 11.65 | 11.98 | 18.05 | 13.44 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.09 | 0.11 | 0.12 | 0.13 | 0.19 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.09 | 0.11 | 0.12 | 0.13 | 0.19 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.35 | 0.88 | 1.19 | 1.48 | 1.77 | 2.33 | 1.14 |

Table F-530. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 21.41 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 32.84 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 1.64 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 5.46 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 5.46 |
| Sea turtles | $L_{E}$ [d] | 204 | 5.06 |

Table F-531. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.26 | 3.90 | 4.70 | 5.34 | 5.74 | 8.34 | 5.17 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.26 | 3.90 | 4.70 | 5.34 | 5.74 | 8.34 | 5.17 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.07 | 0.17 | 0.28 | 0.40 | 0.53 | 0.66 | 0.29 |

Table F-532. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 8.78 |
| Fish < 2 g | $L_E$ [a] | 183 | 12.42 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.45 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.29 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.29 |
| Sea turtles | $L_E$ [d] | 204 | 2.03 |

Table F-533. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.05 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.83 | 3.32 | 4.05 | 4.63 | 5.01 | 7.17 | 4.32 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.05 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.83 | 3.32 | 4.05 | 4.63 | 5.01 | 7.17 | 4.32 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.06 | 0.12 | 0.18 | 0.30 | 0.37 | 0.48 | 0.23 |

Table F-534. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 7.53 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 10.42 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.32 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.82 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.82 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.64 |

Table F-535. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.35 | 2.56 | 3.14 | 3.73 | 4.12 | 5.67 | 3.26 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.35 | 2.56 | 3.14 | 3.73 | 4.12 | 5.67 | 3.26 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.02 | 0.09 | 0.11 | 0.16 | 0.21 | 0.29 | 0.14 |

Table F-536. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 5.91 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 8.15 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.19 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.31 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.31 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.17 |

Table F-537. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.02 | 0.13 | 0.15 | 0.15 | 0.15 | 0.15 | 0.06 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 6.01 | 8.56 | 10.58 | 13.74 | 18.50 | 26.94 | 14.29 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.02 | 0.13 | 0.15 | 0.15 | 0.15 | 0.15 | 0.06 |
| Fish < 2 g | $L_p$ [b] | 150 | 6.01 | 8.56 | 10.58 | 13.74 | 18.50 | 26.94 | 14.29 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.02 | 0.08 | 0.08 | 0.09 | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.12 | 0.14 | 0.14 | 0.13 | 0.14 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.12 | 0.14 | 0.14 | 0.13 | 0.14 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.47 | 1.13 | 1.58 | 1.77 | 1.86 | 2.12 | 1.11 |

Table F-538. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 26.60 |
| Fish < 2 g | $L_E$ [a] | 183 | 39.06 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.78 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 6.91 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 6.91 |
| Sea turtles | $L_E$ [d] | 204 | 6.34 |

Table F-539. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.97 | 4.76 | 5.90 | 7.11 | 8.48 | 11.38 | 5.32 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.06 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.97 | 4.76 | 5.90 | 7.11 | 8.48 | 11.38 | 5.32 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.11 | 0.19 | 0.32 | 0.45 | 0.47 | 0.50 | 0.28 |

Table F-540. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 11.64 |
| Fish < 2 g | $L_E$ [a] | 183 | 16.00 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.43 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.56 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.56 |
| Sea turtles | $L_E$ [d] | 204 | 2.29 |

Table F-541. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.53 | 4.19 | 5.21 | 6.09 | 7.13 | 9.26 | 4.39 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.53 | 4.19 | 5.21 | 6.09 | 7.13 | 9.26 | 4.39 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.07 | 0.17 | 0.19 | 0.30 | 0.30 | 0.38 | 0.21 |

Table F-542. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 9.60 |
| Fish < 2 g | $L_E$ [a] | 183 | 13.65 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.29 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.02 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.02 |
| Sea turtles | $L_E$ [d] | 204 | 1.78 |

Table F-543. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.82 | 3.30 | 4.24 | 4.82 | 5.37 | 7.06 | 3.14 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.82 | 3.30 | 4.24 | 4.82 | 5.37 | 7.06 | 3.14 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.02 | 0.13 | 0.15 | 0.15 | 0.17 | 0.23 | 0.17 |

Table F-544. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 7.57 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 10.64 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.18 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.39 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.39 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.20 |

Table F-545. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.02 | 0.13 | 0.16 | 0.16 | 0.15 | 0.15 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 6.32 | 9.12 | 12.03 | 17.56 | 26.55 | 44.16 | 13.33 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.02 | 0.13 | 0.16 | 0.16 | 0.15 | 0.15 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 6.32 | 9.12 | 12.03 | 17.56 | 26.55 | 44.16 | 13.33 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.02 | 0.07 | 0.09 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.12 | 0.14 | 0.14 | 0.14 | 0.14 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.12 | 0.14 | 0.14 | 0.14 | 0.14 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.47 | 1.18 | 1.62 | 1.78 | 1.85 | 2.12 | 1.11 |

Table F-546. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 43.88 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 84.02 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 1.81 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 7.34 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 7.34 |
| Sea turtles | $L_{E}$ [d] | 204 | 6.63 |

Table F-547. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.11 | 4.98 | 6.24 | 7.81 | 9.41 | 12.63 | 5.03 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.06 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.11 | 4.98 | 6.24 | 7.81 | 9.41 | 12.63 | 5.03 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.11 | 0.20 | 0.31 | 0.46 | 0.47 | 0.51 | 0.28 |

Table F-548. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 13.11 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 19.37 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.44 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.61 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.61 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.34 |

Table F-549. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.05 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.61 | 4.38 | 5.48 | 6.52 | 7.86 | 9.89 | 4.17 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.05 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.61 | 4.38 | 5.48 | 6.52 | 7.86 | 9.89 | 4.17 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.06 | 0.17 | 0.19 | 0.28 | 0.28 | 0.39 | 0.20 |

Table F-550. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 10.77 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 15.92 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.28 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.05 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.05 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.81 |

Table F-551. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.88 | 3.49 | 4.43 | 4.96 | 5.78 | 7.18 | 3.02 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.88 | 3.49 | 4.43 | 4.96 | 5.78 | 7.18 | 3.02 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | - | 0.13 | 0.15 | 0.15 | 0.16 | 0.22 | 0.16 |

Table F-552. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 8.08 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 11.93 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.17 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.41 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.41 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.22 |

Table F-553. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.06 | 0.11 | 0.13 | 0.17 | 0.29 | 0.32 | 0.12 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 5.19 | 8.06 | 9.32 | 10.79 | 11.11 | 15.01 | 13.33 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.06 | 0.11 | 0.13 | 0.17 | 0.29 | 0.32 | 0.12 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 5.19 | 8.06 | 9.32 | 10.79 | 11.11 | 15.01 | 13.33 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.06 | 0.07 | 0.09 | 0.09 | 0.10 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.06 | 0.11 | 0.12 | 0.13 | 0.26 | 0.30 | 0.10 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.06 | 0.11 | 0.12 | 0.13 | 0.26 | 0.30 | 0.10 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.45 | 1.04 | 1.42 | 1.73 | 2.05 | 2.66 | 1.45 |

Table F-554. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 17.09 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 22.75 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 1.94 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 5.80 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 5.80 |
| Sea turtles | $L_{E}$ [d] | 204 | 5.40 |

Table F-555. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.07 | 0.08 | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.56 | 4.18 | 4.95 | 5.56 | 5.91 | 8.10 | 6.06 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.07 | 0.08 | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.56 | 4.18 | 4.95 | 5.56 | 5.91 | 8.10 | 6.06 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.06 | 0.06 | 0.06 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.06 | 0.06 | 0.06 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.09 | 0.26 | 0.40 | 0.53 | 0.68 | 0.86 | 0.40 |

Table F-556. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 8.72 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 11.60 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.59 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.64 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.64 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.43 |

Table F-557. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.15 | 3.66 | 4.33 | 4.89 | 5.23 | 7.10 | 5.15 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.15 | 3.66 | 4.33 | 4.89 | 5.23 | 7.10 | 5.15 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.07 | 0.17 | 0.28 | 0.39 | 0.51 | 0.65 | 0.29 |

Table F-558. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 7.66 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 9.98 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.44 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.19 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.19 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.94 |

Table F-559. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.60 | 2.82 | 3.51 | 4.03 | 4.37 | 5.80 | 4.03 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 1.60 | 2.82 | 3.51 | 4.03 | 4.37 | 5.80 | 4.03 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.05 | 0.11 | 0.15 | 0.24 | 0.34 | 0.42 | 0.20 |

Table F-560. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 6.20 |
| Fish < 2 g | $L_E$ [a] | 183 | 8.19 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.27 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.59 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.59 |
| Sea turtles | $L_E$ [d] | 204 | 1.43 |

Table F-561. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.06 | 0.11 | 0.13 | 0.18 | 0.28 | 0.31 | 0.12 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.71 | 9.35 | 11.57 | 13.63 | 13.88 | 22.10 | 16.47 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.06 | 0.11 | 0.13 | 0.18 | 0.28 | 0.31 | 0.12 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.71 | 9.35 | 11.57 | 13.63 | 13.88 | 22.10 | 16.47 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.06 | 0.07 | 0.09 | 0.09 | 0.11 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.06 | 0.11 | 0.13 | 0.13 | 0.20 | 0.29 | 0.10 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.06 | 0.11 | 0.13 | 0.13 | 0.20 | 0.29 | 0.10 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.46 | 1.09 | 1.48 | 1.80 | 2.17 | 2.81 | 1.41 |

Table F-562. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 26.26 |
| Fish < 2 g | $L_E$ [a] | 183 | 42.89 |
| Fish without swim bladder | $L_E$ [c] | 216 | 2.03 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 6.38 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 6.38 |
| Sea turtles | $L_E$ [d] | 204 | 5.91 |

Table F-563. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.04 | 0.06 | 0.07 | 0.08 | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.66 | 4.50 | 5.45 | 6.17 | 6.58 | 9.59 | 6.21 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.04 | 0.06 | 0.07 | 0.08 | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.66 | 4.50 | 5.45 | 6.17 | 6.58 | 9.59 | 6.21 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.06 | 0.06 | 0.06 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.06 | 0.06 | 0.06 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.09 | 0.26 | 0.43 | 0.56 | 0.71 | 0.87 | 0.40 |

Table F-564. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 10.42 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 14.69 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.60 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.74 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.74 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.52 |

Table F-565. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.26 | 3.90 | 4.70 | 5.34 | 5.74 | 8.34 | 5.17 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.04 | 0.06 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.26 | 3.90 | 4.70 | 5.34 | 5.74 | 8.34 | 5.17 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.07 | 0.17 | 0.28 | 0.40 | 0.53 | 0.66 | 0.29 |

Table F-566. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 8.78 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 12.42 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.45 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.29 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.29 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.03 |

Table F-567. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.67 | 3.00 | 3.76 | 4.31 | 4.70 | 6.60 | 3.96 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.67 | 3.00 | 3.76 | 4.31 | 4.70 | 6.60 | 3.96 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.05 | 0.11 | 0.14 | 0.26 | 0.34 | 0.42 | 0.20 |

Table F-568. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 6.92 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 9.46 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.28 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.64 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.64 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.47 |

Table F-569. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.05 | 0.16 | 0.17 | 0.17 | 0.17 | 0.28 | 0.10 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 6.72 | 9.62 | 12.01 | 15.42 | 22.16 | 31.96 | 17.31 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.05 | 0.16 | 0.17 | 0.17 | 0.17 | 0.28 | 0.10 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 6.72 | 9.62 | 12.01 | 15.42 | 22.16 | 31.96 | 17.31 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.09 | 0.10 | 0.09 | 0.10 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.03 | 0.14 | 0.17 | 0.16 | 0.16 | 0.22 | 0.07 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.03 | 0.14 | 0.17 | 0.16 | 0.16 | 0.22 | 0.07 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.59 | 1.47 | 1.94 | 2.30 | 2.32 | 2.76 | 1.37 |

Table F-570. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 31.75 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 49.57 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 2.29 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 8.25 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 8.25 |
| Sea turtles | $L_{E}$ [d] | 204 | 7.57 |

Table F-571. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.07 | 0.07 | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.61 | 5.37 | 6.60 | 8.27 | 9.85 | 13.65 | 6.45 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.07 | 0.07 | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.61 | 5.37 | 6.60 | 8.27 | 9.85 | 13.65 | 6.45 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.14 | 0.34 | 0.47 | 0.56 | 0.58 | 0.75 | 0.37 |

Table F-572. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 13.65 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 18.54 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.55 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 3.18 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 3.18 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.83 |

Table F-573. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.97 | 4.76 | 5.90 | 7.11 | 8.48 | 11.38 | 5.32 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.06 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.97 | 4.76 | 5.90 | 7.11 | 8.48 | 11.38 | 5.32 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.11 | 0.19 | 0.32 | 0.45 | 0.47 | 0.50 | 0.28 |

Table F-574. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 11.64 |
| Fish < 2 g | $L_E$ [a] | 183 | 16.00 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.43 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.56 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.56 |
| Sea turtles | $L_E$ [d] | 204 | 2.29 |

Table F-575. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.02 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.29 | 3.92 | 4.87 | 5.65 | 6.51 | 8.55 | 3.95 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.02 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.29 | 3.92 | 4.87 | 5.65 | 6.51 | 8.55 | 3.95 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.04 | 0.16 | 0.17 | 0.24 | 0.26 | 0.30 | 0.20 |

Table F-576. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 8.92 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 12.62 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.26 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.78 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.78 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.57 |

Table F-577. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.05 | 0.16 | 0.18 | 0.18 | 0.18 | 0.27 | 0.09 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 7.15 | 10.75 | 13.49 | 21.79 | 33.70 | 70.23 | 16.36 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.05 | 0.16 | 0.18 | 0.18 | 0.18 | 0.27 | 0.09 |
| Fish < 2 g | $L_p$ [b] | 150 | 7.15 | 10.75 | 13.49 | 21.79 | 33.70 | 70.23 | 16.36 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.07 | 0.10 | 0.10 | 0.10 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.03 | 0.15 | 0.17 | 0.17 | 0.16 | 0.23 | 0.07 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.03 | 0.15 | 0.17 | 0.17 | 0.16 | 0.23 | 0.07 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.60 | 1.53 | 1.99 | 2.32 | 2.35 | 2.66 | 1.38 |

Table F-578. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 64.44 |
| Fish < 2 g | $L_E$ [a] | 183 | 84.90 |
| Fish without swim bladder | $L_E$ [c] | 216 | 2.34 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 8.84 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 8.84 |
| Sea turtles | $L_E$ [d] | 204 | 8.08 |

Table F-579. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.04 | 0.07 | 0.08 | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.75 | 5.63 | 7.08 | 9.03 | 11.82 | 15.61 | 6.04 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.04 | 0.07 | 0.08 | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.75 | 5.63 | 7.08 | 9.03 | 11.82 | 15.61 | 6.04 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.14 | 0.33 | 0.48 | 0.57 | 0.58 | 0.76 | 0.37 |

Table F-580. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 15.92 |
| Fish < 2 g | $L_E$ [a] | 183 | 24.70 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.56 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 3.30 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 3.30 |
| Sea turtles | $L_E$ [d] | 204 | 2.87 |

Table F-581. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.06 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.11 | 4.98 | 6.24 | 7.81 | 9.41 | 12.63 | 5.03 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.06 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 3.11 | 4.98 | 6.24 | 7.81 | 9.41 | 12.63 | 5.03 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.11 | 0.20 | 0.31 | 0.46 | 0.47 | 0.51 | 0.28 |

Table F-582. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 13.11 |
| Fish < 2 g | $L_E$ [a] | 183 | 19.37 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.44 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.61 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.61 |
| Sea turtles | $L_E$ [d] | 204 | 2.34 |

Table F-583. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 600 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.02 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.38 | 4.10 | 5.11 | 5.99 | 7.10 | 8.92 | 3.84 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.02 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.38 | 4.10 | 5.11 | 5.99 | 7.10 | 8.92 | 3.84 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.03 | 0.16 | 0.17 | 0.18 | 0.25 | 0.31 | 0.19 |

Table F-584. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 9.60 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 14.43 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.24 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.81 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.86 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.59 |

### F.4.3.3. 4.25 m Diameter Pin Pile, 4 Legs

Table F-585. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.06 | 0.09 | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 4.84 | 6.99 | 8.74 | 9.87 | 10.93 | 11.04 | 13.35 | 16.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.06 | 0.09 | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 |
| Fish < 2 g | $L_p$ [b] | 150 | 4.84 | 6.99 | 8.74 | 9.87 | 10.93 | 11.04 | 13.35 | 16.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.06 | 0.07 | 0.09 | 0.09 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.05 | 0.08 | 0.11 | 0.13 | 0.15 | 0.19 | 0.29 | 0.15 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.05 | 0.08 | 0.11 | 0.13 | 0.15 | 0.19 | 0.29 | 0.15 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.38 | 0.82 | 1.27 | 1.54 | 1.72 | 1.94 | 2.43 | 2.37 |

Table F-586. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 14.38 |
| Fish < 2 g | $L_E$ [a] | 183 | 18.20 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.52 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 4.95 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 4.95 |
| Sea turtles | $L_E$ [d] | 204 | 4.61 |

Table F-587. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.06 | 0.06 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.33 | 3.62 | 4.62 | 5.22 | 5.62 | 5.83 | 7.22 | 8.29 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.06 | 0.06 | 0.07 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.33 | 3.62 | 4.62 | 5.22 | 5.62 | 5.83 | 7.22 | 8.29 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.05 | 0.06 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.05 | 0.06 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.08 | 0.17 | 0.32 | 0.42 | 0.54 | 0.66 | 0.77 | 0.64 |

Table F-588. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 7.49 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 9.62 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.39 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.09 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.09 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.86 |

Table F-589. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.05 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.89 | 3.04 | 4.03 | 4.59 | 4.92 | 5.14 | 6.34 | 7.18 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.05 | 0.06 | 0.04 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.89 | 3.04 | 4.03 | 4.59 | 4.92 | 5.14 | 6.34 | 7.18 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.05 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.06 | 0.11 | 0.21 | 0.32 | 0.38 | 0.48 | 0.58 | 0.46 |

Table F-590. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 6.50 |
| Fish < 2 g | $L_E$ [a] | 183 | 8.52 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.29 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.69 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.69 |
| Sea turtles | $L_E$ [d] | 204 | 1.52 |

Table F-591. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.42 | 2.40 | 3.17 | 3.75 | 4.05 | 4.26 | 5.24 | 5.75 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.42 | 2.40 | 3.17 | 3.75 | 4.05 | 4.26 | 5.24 | 5.75 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.04 | 0.09 | 0.12 | 0.18 | 0.25 | 0.32 | 0.37 | 0.30 |

Table F-592. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 5.30 |
| Fish < 2 g | $L_E$ [a] | 183 | 6.98 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.16 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.20 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.20 |
| Sea turtles | $L_E$ [d] | 204 | 1.05 |

Table F-593. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.06 | 0.09 | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.27 | 8.08 | 10.48 | 12.27 | 13.79 | 13.77 | 17.80 | 25.79 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.06 | 0.09 | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.27 | 8.08 | 10.48 | 12.27 | 13.79 | 13.77 | 17.80 | 25.79 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.06 | 0.08 | 0.09 | 0.09 | 0.10 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.04 | 0.09 | 0.12 | 0.13 | 0.14 | 0.19 | 0.28 | 0.18 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.04 | 0.09 | 0.12 | 0.13 | 0.14 | 0.19 | 0.28 | 0.18 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.40 | 0.85 | 1.32 | 1.61 | 1.80 | 2.07 | 2.54 | 2.45 |

Table F-594. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 21.12 |
| Fish < 2 g | $L_E$ [a] | 183 | 31.75 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.58 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 5.45 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 5.45 |
| Sea turtles | $L_E$ [d] | 204 | 5.04 |

Table F-595. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.44 | 3.87 | 5.03 | 5.78 | 6.27 | 6.46 | 8.44 | 9.88 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.44 | 3.87 | 5.03 | 5.78 | 6.27 | 6.46 | 8.44 | 9.88 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.08 | 0.17 | 0.32 | 0.44 | 0.57 | 0.69 | 0.79 | 0.64 |

Table F-596. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 8.78 |
| Fish < 2 g | $L_E$ [a] | 183 | 12.39 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.40 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.21 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.21 |
| Sea turtles | $L_E$ [d] | 204 | 1.95 |

Table F-597. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.04 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.98 | 3.26 | 4.34 | 4.98 | 5.39 | 5.63 | 7.28 | 8.39 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.04 | 0.06 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.98 | 3.26 | 4.34 | 4.98 | 5.39 | 5.63 | 7.28 | 8.39 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.05 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.06 | 0.12 | 0.23 | 0.34 | 0.39 | 0.50 | 0.59 | 0.46 |

Table F-598. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 7.52 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 10.41 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.29 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.76 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.76 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.58 |

Table F-599. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.48 | 2.52 | 3.42 | 4.01 | 4.33 | 4.58 | 5.83 | 6.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.48 | 2.52 | 3.42 | 4.01 | 4.33 | 4.58 | 5.83 | 6.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.04 | 0.09 | 0.12 | 0.18 | 0.26 | 0.32 | 0.37 | 0.29 |

Table F-600. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 5.91 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 8.15 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.16 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.24 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.24 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.08 |

Table F-601. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.03 | 0.13 | 0.17 | 0.18 | 0.17 | 0.17 | 0.25 | 0.15 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 6.31 | 8.70 | 10.69 | 11.98 | 15.33 | 20.20 | 27.61 | 29.30 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.03 | 0.13 | 0.17 | 0.18 | 0.17 | 0.17 | 0.25 | 0.15 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 6.31 | 8.70 | 10.69 | 11.98 | 15.33 | 20.20 | 27.61 | 29.30 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.03 | 0.09 | 0.09 | 0.10 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.12 | 0.16 | 0.17 | 0.16 | 0.16 | 0.17 | 0.13 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.12 | 0.16 | 0.17 | 0.16 | 0.16 | 0.17 | 0.13 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.52 | 1.08 | 1.75 | 2.24 | 2.17 | 2.32 | 2.50 | 2.08 |

Table F-602. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 25.89 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 37.50 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 1.69 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 6.70 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 6.70 |
| Sea turtles | $L_{E}$ [d] | 204 | 6.15 |

Table F-603. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.07 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.24 | 4.77 | 5.79 | 6.79 | 7.94 | 9.42 | 12.13 | 11.66 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.07 | 0.06 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.24 | 4.77 | 5.79 | 6.79 | 7.94 | 9.42 | 12.13 | 11.66 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.12 | 0.18 | 0.46 | 0.57 | 0.53 | 0.60 | 0.68 | 0.48 |

Table F-604. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 11.34 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 15.61 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.37 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.46 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.46 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.15 |

Table F-605. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.02 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.70 | 4.17 | 5.14 | 6.08 | 6.90 | 8.12 | 10.00 | 9.37 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.02 | 0.06 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.70 | 4.17 | 5.14 | 6.08 | 6.90 | 8.12 | 10.00 | 9.37 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.05 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.09 | 0.16 | 0.31 | 0.36 | 0.43 | 0.46 | 0.45 | 0.39 |

Table F-606. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 9.35 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 13.33 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.26 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.89 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.89 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.69 |

Table F-607. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.98 | 3.27 | 4.25 | 5.09 | 5.53 | 6.27 | 7.60 | 6.91 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.98 | 3.27 | 4.25 | 5.09 | 5.53 | 6.27 | 7.60 | 6.91 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.02 | 0.13 | 0.17 | 0.19 | 0.17 | 0.26 | 0.27 | 0.24 |

Table F-608. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 7.35 |
| Fish < 2 g | $L_E$ [a] | 183 | 10.31 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.15 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.30 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.30 |
| Sea turtles | $L_E$ [d] | 204 | 1.11 |

Table F-609. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.03 | 0.14 | 0.18 | 0.19 | 0.18 | 0.18 | 0.25 | 0.15 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 6.65 | 9.26 | 11.83 | 13.32 | 20.05 | 30.50 | 50.59 | 41.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.03 | 0.14 | 0.18 | 0.19 | 0.18 | 0.18 | 0.25 | 0.15 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 6.65 | 9.26 | 11.83 | 13.32 | 20.05 | 30.50 | 50.59 | 41.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.03 | 0.09 | 0.10 | 0.10 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.12 | 0.17 | 0.18 | 0.17 | 0.16 | 0.16 | 0.13 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.12 | 0.17 | 0.18 | 0.17 | 0.16 | 0.16 | 0.13 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.53 | 1.13 | 1.81 | 2.31 | 2.32 | 2.33 | 2.42 | 2.10 |

Table F-610. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 41.04 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 83.42 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 1.74 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 7.13 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 7.13 |
| Sea turtles | $L_{E}$ [d] | 204 | 6.46 |

Table F-611. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.03 | 0.07 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.38 | 4.99 | 6.06 | 7.29 | 8.80 | 11.30 | 13.73 | 11.50 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.03 | 0.07 | 0.06 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.38 | 4.99 | 6.06 | 7.29 | 8.80 | 11.30 | 13.73 | 11.50 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.05 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.05 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.12 | 0.19 | 0.46 | 0.57 | 0.57 | 0.61 | 0.68 | 0.56 |

Table F-612. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 12.68 |
| Fish < 2 g | $L_E$ [a] | 183 | 18.56 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.38 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.53 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.53 |
| Sea turtles | $L_E$ [d] | 204 | 2.26 |

Table F-613. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.02 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.78 | 4.36 | 5.38 | 6.43 | 7.65 | 9.17 | 11.12 | 9.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.02 | 0.06 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.78 | 4.36 | 5.38 | 6.43 | 7.65 | 9.17 | 11.12 | 9.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.05 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.09 | 0.17 | 0.30 | 0.34 | 0.46 | 0.47 | 0.46 | 0.40 |

Table F-614. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 10.38 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 15.36 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.26 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.96 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.96 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.74 |

Table F-615. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.07 | 3.43 | 4.43 | 5.35 | 6.05 | 6.80 | 8.06 | 6.53 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.07 | 3.43 | 4.43 | 5.35 | 6.05 | 6.80 | 8.06 | 6.53 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.02 | 0.13 | 0.18 | 0.20 | 0.22 | 0.25 | 0.26 | 0.25 |

Table F-616. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 7.85 |
| Fish < 2 g | $L_E$ [a] | 183 | 11.54 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.16 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.34 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.34 |
| Sea turtles | $L_E$ [d] | 204 | 1.15 |

Table F-617. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.07 | 0.11 | 0.13 | 0.20 | 0.28 | 0.32 | 0.35 | 0.30 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.48 | 7.98 | 9.84 | 11.36 | 12.40 | 12.50 | 14.89 | 18.19 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.07 | 0.11 | 0.13 | 0.20 | 0.28 | 0.32 | 0.35 | 0.30 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.48 | 7.98 | 9.84 | 11.36 | 12.40 | 12.50 | 14.89 | 18.19 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.06 | 0.07 | 0.09 | 0.11 | 0.11 | 0.12 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.06 | 0.10 | 0.13 | 0.17 | 0.25 | 0.30 | 0.33 | 0.27 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.06 | 0.10 | 0.13 | 0.17 | 0.25 | 0.30 | 0.33 | 0.27 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.51 | 1.00 | 1.57 | 1.86 | 2.10 | 2.39 | 2.83 | 2.87 |

Table F-618. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 16.25 |
| Fish < 2 g | $L_E$ [a] | 183 | 21.10 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.86 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 5.69 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 5.69 |
| Sea turtles | $L_E$ [d] | 204 | 5.30 |

Table F-619. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.06 | 0.07 | 0.07 | 0.08 | 0.09 | 0.06 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.71 | 4.15 | 5.27 | 5.96 | 6.39 | 6.57 | 8.18 | 9.38 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.06 | 0.07 | 0.07 | 0.08 | 0.09 | 0.06 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.71 | 4.15 | 5.27 | 5.96 | 6.39 | 6.57 | 8.18 | 9.38 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.05 | 0.06 | 0.06 | 0.07 | 0.08 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.05 | 0.06 | 0.06 | 0.07 | 0.08 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.09 | 0.26 | 0.46 | 0.58 | 0.71 | 0.84 | 0.97 | 0.85 |

Table F-620. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 8.52 |
| Fish < 2 g | $L_E$ [a] | 183 | 11.19 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.53 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.57 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.57 |
| Sea turtles | $L_E$ [d] | 204 | 2.35 |

Table F-621. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.06 | 0.06 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.33 | 3.62 | 4.62 | 5.22 | 5.61 | 5.83 | 7.22 | 8.29 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.06 | 0.06 | 0.07 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.33 | 3.62 | 4.62 | 5.22 | 5.61 | 5.83 | 7.22 | 8.29 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.05 | 0.06 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.05 | 0.06 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.08 | 0.17 | 0.32 | 0.42 | 0.54 | 0.66 | 0.77 | 0.64 |

Table F-622. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 7.49 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 9.62 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.39 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.09 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.09 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.86 |

Table F-623. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.74 | 2.78 | 3.76 | 4.29 | 4.61 | 4.83 | 5.97 | 6.63 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.74 | 2.78 | 3.76 | 4.29 | 4.61 | 4.83 | 5.97 | 6.63 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.03 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.03 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.06 | 0.11 | 0.18 | 0.26 | 0.34 | 0.42 | 0.48 | 0.39 |

Table F-624. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 6.09 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 8.00 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.24 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.52 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.52 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.35 |

Table F-625. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.07 | 0.11 | 0.14 | 0.20 | 0.27 | 0.32 | 0.34 | 0.28 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 6.07 | 9.26 | 12.24 | 14.22 | 16.08 | 16.05 | 21.40 | 31.78 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.07 | 0.11 | 0.14 | 0.20 | 0.27 | 0.32 | 0.34 | 0.28 |
| Fish < 2 g | $L_p$ [b] | 150 | 6.07 | 9.26 | 12.24 | 14.22 | 16.08 | 16.05 | 21.40 | 31.78 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.05 | 0.08 | 0.09 | 0.11 | 0.11 | 0.12 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.06 | 0.11 | 0.13 | 0.18 | 0.20 | 0.30 | 0.32 | 0.26 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.06 | 0.11 | 0.13 | 0.18 | 0.20 | 0.30 | 0.32 | 0.26 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.54 | 1.05 | 1.63 | 1.95 | 2.22 | 2.50 | 3.05 | 3.03 |

Table F-626. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 25.77 |
| Fish < 2 g | $L_E$ [a] | 183 | 40.66 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.95 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 6.38 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 6.38 |
| Sea turtles | $L_E$ [d] | 204 | 5.91 |

Table F-627. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.82 | 4.46 | 5.83 | 6.68 | 7.35 | 7.51 | 9.69 | 11.99 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.82 | 4.46 | 5.83 | 6.68 | 7.35 | 7.51 | 9.69 | 11.99 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.07 | 0.08 | 0.09 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.07 | 0.08 | 0.09 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.11 | 0.26 | 0.46 | 0.62 | 0.74 | 0.88 | 0.99 | 0.85 |

Table F-628. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 10.41 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 14.63 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.55 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.69 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.69 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.46 |

Table F-629. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.44 | 3.87 | 5.03 | 5.78 | 6.27 | 6.46 | 8.44 | 9.88 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.44 | 3.87 | 5.03 | 5.78 | 6.27 | 6.46 | 8.44 | 9.88 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.08 | 0.17 | 0.32 | 0.44 | 0.57 | 0.69 | 0.79 | 0.64 |

Table F-630. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 8.78 |
| Fish < 2 g | $L_E$ [a] | 183 | 12.39 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.40 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.21 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.21 |
| Sea turtles | $L_E$ [d] | 204 | 1.95 |

Table F-631. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.80 | 2.94 | 4.03 | 4.63 | 5.01 | 5.25 | 6.72 | 7.74 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.80 | 2.94 | 4.03 | 4.63 | 5.01 | 5.25 | 6.72 | 7.74 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.02 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.02 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.06 | 0.11 | 0.18 | 0.27 | 0.35 | 0.44 | 0.49 | 0.40 |

Table F-632. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 6.92 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 9.46 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.24 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.58 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.58 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.40 |

Table F-633. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.09 | 0.16 | 0.19 | 0.34 | 0.32 | 0.32 | 0.38 | 0.23 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 7.08 | 9.71 | 12.22 | 13.27 | 17.34 | 23.65 | 32.49 | 35.96 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.09 | 0.16 | 0.19 | 0.34 | 0.32 | 0.32 | 0.38 | 0.23 |
| Fish < 2 g | $L_p$ [b] | 150 | 7.08 | 9.71 | 12.22 | 13.27 | 17.34 | 23.65 | 32.49 | 35.96 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.02 | 0.10 | 0.13 | 0.12 | 0.12 | 0.12 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.05 | 0.15 | 0.18 | 0.20 | 0.28 | 0.30 | 0.28 | 0.17 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.05 | 0.15 | 0.18 | 0.20 | 0.28 | 0.30 | 0.28 | 0.17 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.64 | 1.42 | 2.14 | 2.68 | 2.71 | 2.79 | 3.21 | 2.70 |

Table F-634. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 30.78 |
| Fish < 2 g | $L_E$ [a] | 183 | 47.56 |
| Fish without swim bladder | $L_E$ [c] | 216 | 2.15 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 8.03 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 8.03 |
| Sea turtles | $L_E$ [d] | 204 | 7.35 |

Table F-635. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.05 | 0.09 | 0.09 | 0.09 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.85 | 5.40 | 6.47 | 7.63 | 8.94 | 11.33 | 14.31 | 14.01 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.05 | 0.09 | 0.09 | 0.09 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.85 | 5.40 | 6.47 | 7.63 | 8.94 | 11.33 | 14.31 | 14.01 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.08 | 0.08 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.08 | 0.08 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.15 | 0.32 | 0.58 | 0.72 | 0.80 | 0.81 | 0.82 | 0.72 |

Table F-636. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 13.33 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 18.09 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.52 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 3.05 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 3.05 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.72 |

Table F-637. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.07 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.24 | 4.77 | 5.78 | 6.79 | 7.94 | 9.42 | 12.13 | 11.66 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.07 | 0.06 | 0.05 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.24 | 4.77 | 5.78 | 6.79 | 7.94 | 9.42 | 12.13 | 11.66 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.12 | 0.18 | 0.46 | 0.57 | 0.53 | 0.60 | 0.68 | 0.48 |

Table F-638. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 11.34 |
| Fish < 2 g | $L_E$ [a] | 183 | 15.61 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.37 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.46 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.46 |
| Sea turtles | $L_E$ [d] | 204 | 2.15 |

Table F-639. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.48 | 3.89 | 4.83 | 5.75 | 6.42 | 7.45 | 9.12 | 8.58 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.48 | 3.89 | 4.83 | 5.75 | 6.42 | 7.45 | 9.12 | 8.58 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.03 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.03 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.06 | 0.15 | 0.19 | 0.32 | 0.31 | 0.39 | 0.41 | 0.36 |

Table F-640. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 8.71 |
| Fish < 2 g | $L_E$ [a] | 183 | 12.31 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.20 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.69 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.69 |
| Sea turtles | $L_E$ [d] | 204 | 1.48 |

Table F-641. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.07 | 0.17 | 0.20 | 0.32 | 0.32 | 0.32 | 0.38 | 0.23 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 7.54 | 10.99 | 13.45 | 15.38 | 24.19 | 43.03 | 80.70 | 64.62 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.07 | 0.17 | 0.20 | 0.32 | 0.32 | 0.32 | 0.38 | 0.23 |
| Fish < 2 g | $L_p$ [b] | 150 | 7.54 | 10.99 | 13.45 | 15.38 | 24.19 | 43.03 | 80.70 | 64.62 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.02 | 0.10 | 0.13 | 0.13 | 0.12 | 0.12 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.05 | 0.15 | 0.19 | 0.20 | 0.28 | 0.28 | 0.28 | 0.17 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.05 | 0.15 | 0.19 | 0.20 | 0.28 | 0.28 | 0.28 | 0.17 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.66 | 1.47 | 2.25 | 2.78 | 2.83 | 2.84 | 3.11 | 2.65 |

Table F-642. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 59.81 |
| Fish < 2 g | $L_E$ [a] | 183 | 84.81 |
| Fish without swim bladder | $L_E$ [c] | 216 | 2.26 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 8.61 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 8.61 |
| Sea turtles | $L_E$ [d] | 204 | 7.85 |

Table F-643. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.05 | 0.09 | 0.09 | 0.09 | 0.06 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.99 | 5.67 | 6.84 | 8.24 | 10.25 | 13.62 | 16.86 | 14.32 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.05 | 0.09 | 0.09 | 0.09 | 0.06 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.99 | 5.67 | 6.84 | 8.24 | 10.25 | 13.62 | 16.86 | 14.32 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.03 | 0.07 | 0.09 | 0.08 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.03 | 0.07 | 0.09 | 0.08 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.15 | 0.32 | 0.60 | 0.74 | 0.88 | 0.82 | 0.84 | 0.71 |

Table F-644. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 15.36 |
| Fish < 2 g | $L_E$ [a] | 183 | 23.74 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.53 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 3.16 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 3.16 |
| Sea turtles | $L_E$ [d] | 204 | 2.80 |

Table F-645. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.03 | 0.07 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.38 | 4.99 | 6.06 | 7.29 | 8.80 | 11.29 | 13.73 | 11.51 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.03 | 0.07 | 0.06 | 0.05 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.38 | 4.99 | 6.06 | 7.29 | 8.80 | 11.29 | 13.73 | 11.51 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.05 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.05 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.12 | 0.19 | 0.46 | 0.57 | 0.57 | 0.61 | 0.68 | 0.56 |

Table F-646. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 12.68 |
| Fish < 2 g | $L_E$ [a] | 183 | 18.56 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.38 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.53 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.53 |
| Sea turtles | $L_E$ [d] | 204 | 2.26 |

Table F-647. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.57 | 4.05 | 5.05 | 6.07 | 7.09 | 8.40 | 9.82 | 8.26 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.57 | 4.05 | 5.05 | 6.07 | 7.09 | 8.40 | 9.82 | 8.26 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.02 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.02 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.05 | 0.16 | 0.20 | 0.31 | 0.39 | 0.40 | 0.41 | 0.37 |

Table F-648. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 9.33 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 13.94 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.20 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.74 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.74 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.53 |

## F.4.3.4. 4.25 m Diameter Pin Pile, 8 Legs

Table F-649. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.06 | 0.09 | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.84 | 6.99 | 8.74 | 9.87 | 10.93 | 11.04 | 13.35 | 16.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.06 | 0.09 | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.84 | 6.99 | 8.74 | 9.87 | 10.93 | 11.04 | 13.35 | 16.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.06 | 0.07 | 0.09 | 0.09 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.05 | 0.08 | 0.11 | 0.13 | 0.15 | 0.19 | 0.29 | 0.15 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.05 | 0.08 | 0.11 | 0.13 | 0.15 | 0.19 | 0.29 | 0.15 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.38 | 0.82 | 1.27 | 1.54 | 1.72 | 1.94 | 2.43 | 2.37 |

Table F-650. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 17.25 |
| Fish < 2 g | $L_E$ [a] | 183 | 22.65 |
| Fish without swim bladder | $L_E$ [c] | 216 | 2.10 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 6.09 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 6.09 |
| Sea turtles | $L_E$ [d] | 204 | 5.69 |

Table F-651. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.06 | 0.06 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.33 | 3.62 | 4.62 | 5.22 | 5.62 | 5.83 | 7.22 | 8.29 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.06 | 0.06 | 0.07 | 0.05 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.33 | 3.62 | 4.62 | 5.22 | 5.62 | 5.83 | 7.22 | 8.29 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.05 | 0.06 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.05 | 0.06 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.08 | 0.17 | 0.32 | 0.42 | 0.54 | 0.66 | 0.77 | 0.64 |

Table F-652. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 9.03 |
| Fish < 2 g | $L_E$ [a] | 183 | 11.94 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.62 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.78 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.78 |
| Sea turtles | $L_E$ [d] | 204 | 2.57 |

Table F-653. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.05 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.89 | 3.04 | 4.03 | 4.59 | 4.92 | 5.14 | 6.34 | 7.18 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.04 | 0.05 | 0.06 | 0.04 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.89 | 3.04 | 4.03 | 4.59 | 4.92 | 5.14 | 6.34 | 7.18 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.05 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.06 | 0.11 | 0.21 | 0.32 | 0.38 | 0.48 | 0.58 | 0.46 |

Table F-654. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 8.01 |
| Fish < 2 g | $L_E$ [a] | 183 | 10.43 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.45 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.35 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.35 |
| Sea turtles | $L_E$ [d] | 204 | 2.10 |

Table F-655. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.42 | 2.40 | 3.17 | 3.75 | 4.05 | 4.26 | 5.24 | 5.75 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.42 | 2.40 | 3.17 | 3.75 | 4.05 | 4.26 | 5.24 | 5.75 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.04 | 0.09 | 0.12 | 0.18 | 0.25 | 0.32 | 0.37 | 0.30 |

Table F-656. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 6.50 |
| Fish < 2 g | $L_E$ [a] | 183 | 8.52 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.29 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.69 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.69 |
| Sea turtles | $L_E$ [d] | 204 | 1.52 |

Table F-657. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.06 | 0.09 | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.27 | 8.08 | 10.48 | 12.27 | 13.79 | 13.77 | 17.80 | 25.79 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.06 | 0.09 | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.27 | 8.08 | 10.48 | 12.27 | 13.79 | 13.77 | 17.80 | 25.79 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.06 | 0.08 | 0.09 | 0.09 | 0.10 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.04 | 0.09 | 0.12 | 0.13 | 0.14 | 0.19 | 0.28 | 0.18 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.04 | 0.09 | 0.12 | 0.13 | 0.14 | 0.19 | 0.28 | 0.18 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.40 | 0.85 | 1.32 | 1.61 | 1.80 | 2.07 | 2.54 | 2.45 |

Table F-658. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 28.53 |
| Fish < 2 g | $L_E$ [a] | 183 | 46.86 |
| Fish without swim bladder | $L_E$ [c] | 216 | 2.22 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 6.92 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 6.92 |
| Sea turtles | $L_E$ [d] | 204 | 6.38 |

Table F-659. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.44 | 3.87 | 5.03 | 5.78 | 6.27 | 6.46 | 8.44 | 9.88 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.44 | 3.87 | 5.03 | 5.78 | 6.27 | 6.46 | 8.44 | 9.88 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.08 | 0.17 | 0.32 | 0.44 | 0.57 | 0.69 | 0.79 | 0.64 |

Table F-660. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 11.41 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 15.96 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.64 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.95 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.95 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.69 |

Table F-661. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.04 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.98 | 3.26 | 4.34 | 4.98 | 5.39 | 5.63 | 7.28 | 8.39 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.04 | 0.06 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.98 | 3.26 | 4.34 | 4.98 | 5.39 | 5.63 | 7.28 | 8.39 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.05 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.06 | 0.12 | 0.23 | 0.34 | 0.39 | 0.50 | 0.59 | 0.46 |

Table F-662. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 9.47 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 13.47 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.46 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.47 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.47 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.22 |

Table F-663. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.48 | 2.52 | 3.42 | 4.01 | 4.33 | 4.58 | 5.83 | 6.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.48 | 2.52 | 3.42 | 4.01 | 4.33 | 4.58 | 5.83 | 6.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.04 | 0.09 | 0.12 | 0.18 | 0.26 | 0.32 | 0.37 | 0.29 |

Table F-664. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 7.53 |
| Fish < 2 g | $L_E$ [a] | 183 | 10.42 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.29 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.76 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.76 |
| Sea turtles | $L_E$ [d] | 204 | 1.58 |

Table F-665. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.03 | 0.13 | 0.17 | 0.18 | 0.17 | 0.17 | 0.25 | 0.15 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 6.31 | 8.70 | 10.69 | 11.98 | 15.33 | 20.20 | 27.61 | 29.30 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.03 | 0.13 | 0.17 | 0.18 | 0.17 | 0.17 | 0.25 | 0.15 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 6.31 | 8.70 | 10.69 | 11.98 | 15.33 | 20.20 | 27.61 | 29.30 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.03 | 0.09 | 0.09 | 0.10 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.12 | 0.16 | 0.17 | 0.16 | 0.16 | 0.17 | 0.13 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.12 | 0.16 | 0.17 | 0.16 | 0.16 | 0.17 | 0.13 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.52 | 1.08 | 1.75 | 2.24 | 2.17 | 2.32 | 2.50 | 2.08 |

Table F-666. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 33.84 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 52.37 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 2.46 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 8.72 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 8.72 |
| Sea turtles | $L_{E}$ [d] | 204 | 8.03 |

Table F-667. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.07 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.24 | 4.77 | 5.79 | 6.79 | 7.94 | 9.42 | 12.13 | 11.66 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.07 | 0.06 | 0.05 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.24 | 4.77 | 5.79 | 6.79 | 7.94 | 9.42 | 12.13 | 11.66 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.12 | 0.18 | 0.46 | 0.57 | 0.53 | 0.60 | 0.68 | 0.48 |

Table F-668. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 14.44 |
| Fish < 2 g | $L_E$ [a] | 183 | 19.83 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.61 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 3.47 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 3.47 |
| Sea turtles | $L_E$ [d] | 204 | 3.06 |

Table F-669. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.02 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.70 | 4.17 | 5.14 | 6.08 | 6.90 | 8.12 | 10.00 | 9.37 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.02 | 0.06 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.70 | 4.17 | 5.14 | 6.08 | 6.90 | 8.12 | 10.00 | 9.37 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.05 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.09 | 0.16 | 0.31 | 0.36 | 0.43 | 0.46 | 0.45 | 0.39 |

Table F-670. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 12.32 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 16.88 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.44 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.72 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.72 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.46 |

Table F-671. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.98 | 3.27 | 4.25 | 5.09 | 5.53 | 6.27 | 7.60 | 6.91 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.98 | 3.27 | 4.25 | 5.09 | 5.53 | 6.27 | 7.60 | 6.91 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.03 | 0.09 | 0.10 | 0.10 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.02 | 0.13 | 0.17 | 0.19 | 0.17 | 0.26 | 0.27 | 0.24 |

Table F-672. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 9.36 |
| Fish < 2 g | $L_E$ [a] | 183 | 13.34 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.26 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.89 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.89 |
| Sea turtles | $L_E$ [d] | 204 | 1.69 |

Table F-673. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.03 | 0.14 | 0.18 | 0.19 | 0.18 | 0.18 | 0.25 | 0.15 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 6.65 | 9.26 | 11.83 | 13.32 | 20.05 | 30.50 | 50.59 | 41.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.03 | 0.14 | 0.18 | 0.19 | 0.18 | 0.18 | 0.25 | 0.15 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 6.65 | 9.26 | 11.83 | 13.32 | 20.05 | 30.50 | 50.59 | 41.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | 0.03 | 0.09 | 0.10 | 0.10 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.12 | 0.17 | 0.18 | 0.17 | 0.16 | 0.16 | 0.13 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.12 | 0.17 | 0.18 | 0.17 | 0.16 | 0.16 | 0.13 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.53 | 1.13 | 1.81 | 2.31 | 2.32 | 2.33 | 2.42 | 2.10 |

Table F-674. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 73.44 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 85.11 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 2.53 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 9.34 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 9.34 |
| Sea turtles | $L_{E}$ [d] | 204 | 8.61 |

Table F-675. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.03 | 0.07 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.38 | 4.99 | 6.06 | 7.29 | 8.80 | 11.30 | 13.73 | 11.50 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.03 | 0.07 | 0.06 | 0.05 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.38 | 4.99 | 6.06 | 7.29 | 8.80 | 11.30 | 13.73 | 11.50 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.05 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.05 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.12 | 0.19 | 0.46 | 0.57 | 0.57 | 0.61 | 0.68 | 0.56 |

Table F-676. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 16.95 |
| Fish < 2 g | $L_E$ [a] | 183 | 26.65 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.62 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 3.60 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 3.60 |
| Sea turtles | $L_E$ [d] | 204 | 3.17 |

Table F-677. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.02 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.78 | 4.36 | 5.38 | 6.43 | 7.65 | 9.17 | 11.12 | 9.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.02 | 0.06 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.78 | 4.36 | 5.38 | 6.43 | 7.65 | 9.17 | 11.12 | 9.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.05 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.09 | 0.17 | 0.30 | 0.34 | 0.46 | 0.47 | 0.46 | 0.40 |

Table F-678. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 13.96 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 21.11 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.46 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.80 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.80 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.53 |

Table F-679. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.07 | 3.43 | 4.43 | 5.35 | 6.05 | 6.80 | 8.06 | 6.53 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.07 | 3.43 | 4.43 | 5.35 | 6.05 | 6.80 | 8.06 | 6.53 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.02 | 0.13 | 0.18 | 0.20 | 0.22 | 0.25 | 0.26 | 0.25 |

Table F-680. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 10.39 |
| Fish < 2 g | $L_E$ [a] | 183 | 15.38 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.26 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.97 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.97 |
| Sea turtles | $L_E$ [d] | 204 | 1.74 |

Table F-681. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.07 | 0.11 | 0.13 | 0.20 | 0.28 | 0.32 | 0.35 | 0.30 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.48 | 7.98 | 9.84 | 11.36 | 12.40 | 12.50 | 14.89 | 18.19 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.07 | 0.11 | 0.13 | 0.20 | 0.28 | 0.32 | 0.35 | 0.30 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.48 | 7.98 | 9.84 | 11.36 | 12.40 | 12.50 | 14.89 | 18.19 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.06 | 0.07 | 0.09 | 0.11 | 0.11 | 0.12 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.06 | 0.10 | 0.13 | 0.17 | 0.25 | 0.30 | 0.33 | 0.27 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.06 | 0.10 | 0.13 | 0.17 | 0.25 | 0.30 | 0.33 | 0.27 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.51 | 1.00 | 1.57 | 1.86 | 2.10 | 2.39 | 2.83 | 2.87 |

Table F-682. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 19.49 |
| Fish < 2 g | $L_E$ [a] | 183 | 25.60 |
| Fish without swim bladder | $L_E$ [c] | 216 | 2.57 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 6.98 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 6.98 |
| Sea turtles | $L_E$ [d] | 204 | 6.50 |

Table F-683. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.06 | 0.07 | 0.07 | 0.08 | 0.09 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.71 | 4.15 | 5.27 | 5.96 | 6.39 | 6.57 | 8.18 | 9.38 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.06 | 0.07 | 0.07 | 0.08 | 0.09 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.71 | 4.15 | 5.27 | 5.96 | 6.39 | 6.57 | 8.18 | 9.38 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.05 | 0.06 | 0.06 | 0.07 | 0.08 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.05 | 0.06 | 0.06 | 0.07 | 0.08 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.09 | 0.26 | 0.46 | 0.58 | 0.71 | 0.84 | 0.97 | 0.85 |

Table F-684. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 10.43 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 13.53 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.82 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 3.40 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 3.40 |
| Sea turtles | $L_{E}$ [d] | 204 | 3.07 |

Table F-685. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.06 | 0.06 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.33 | 3.62 | 4.62 | 5.22 | 5.61 | 5.83 | 7.22 | 8.29 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.06 | 0.06 | 0.07 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.33 | 3.62 | 4.62 | 5.22 | 5.61 | 5.83 | 7.22 | 8.29 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.05 | 0.06 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.05 | 0.06 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.08 | 0.17 | 0.32 | 0.42 | 0.54 | 0.66 | 0.77 | 0.64 |

Table F-686. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 9.03 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 11.94 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.62 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.78 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.78 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.57 |

Table F-687. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.74 | 2.78 | 3.76 | 4.29 | 4.61 | 4.83 | 5.97 | 6.63 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.74 | 2.78 | 3.76 | 4.29 | 4.61 | 4.83 | 5.97 | 6.63 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.03 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.03 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.06 | 0.11 | 0.18 | 0.26 | 0.34 | 0.42 | 0.48 | 0.39 |

Table F-688. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 7.50 |
| Fish < 2 g | $L_E$ [a] | 183 | 9.63 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.39 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.10 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.10 |
| Sea turtles | $L_E$ [d] | 204 | 1.86 |

Table F-689. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.07 | 0.11 | 0.14 | 0.20 | 0.27 | 0.32 | 0.34 | 0.28 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 6.07 | 9.26 | 12.24 | 14.22 | 16.08 | 16.05 | 21.40 | 31.78 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.07 | 0.11 | 0.14 | 0.20 | 0.27 | 0.32 | 0.34 | 0.28 |
| Fish < 2 g | $L_p$ [b] | 150 | 6.07 | 9.26 | 12.24 | 14.22 | 16.08 | 16.05 | 21.40 | 31.78 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.05 | 0.08 | 0.09 | 0.11 | 0.11 | 0.12 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.06 | 0.11 | 0.13 | 0.18 | 0.20 | 0.30 | 0.32 | 0.26 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.06 | 0.11 | 0.13 | 0.18 | 0.20 | 0.30 | 0.32 | 0.26 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.54 | 1.05 | 1.63 | 1.95 | 2.22 | 2.50 | 3.05 | 3.03 |

Table F-690. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 35.77 |
| Fish < 2 g | $L_E$ [a] | 183 | 65.01 |
| Fish without swim bladder | $L_E$ [c] | 216 | 2.69 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 8.15 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 8.15 |
| Sea turtles | $L_E$ [d] | 204 | 7.53 |

Table F-691. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.06 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.82 | 4.46 | 5.83 | 6.68 | 7.35 | 7.51 | 9.69 | 11.99 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.06 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.82 | 4.46 | 5.83 | 6.68 | 7.35 | 7.51 | 9.69 | 11.99 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.07 | 0.08 | 0.09 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.07 | 0.08 | 0.09 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.11 | 0.26 | 0.46 | 0.62 | 0.74 | 0.88 | 0.99 | 0.85 |

Table F-692. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 13.47 |
| Fish < 2 g | $L_E$ [a] | 183 | 18.83 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.84 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 3.64 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 3.64 |
| Sea turtles | $L_E$ [d] | 204 | 3.30 |

Table F-693. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.44 | 3.87 | 5.03 | 5.78 | 6.27 | 6.46 | 8.44 | 9.88 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.44 | 3.87 | 5.03 | 5.78 | 6.27 | 6.46 | 8.44 | 9.88 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.08 | 0.17 | 0.32 | 0.44 | 0.57 | 0.69 | 0.79 | 0.64 |

Table F-694. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 11.41 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 15.95 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.64 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.95 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.95 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.69 |

Table F-695. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.80 | 2.94 | 4.03 | 4.63 | 5.01 | 5.25 | 6.72 | 7.74 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.80 | 2.94 | 4.03 | 4.63 | 5.01 | 5.25 | 6.72 | 7.74 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.02 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.02 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.06 | 0.11 | 0.18 | 0.27 | 0.35 | 0.44 | 0.49 | 0.40 |

Table F-696. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 8.79 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 12.40 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.40 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.22 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.22 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.95 |

Table F-697. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.09 | 0.16 | 0.19 | 0.34 | 0.32 | 0.32 | 0.38 | 0.23 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 7.08 | 9.71 | 12.22 | 13.27 | 17.34 | 23.65 | 32.49 | 35.96 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.09 | 0.16 | 0.19 | 0.34 | 0.32 | 0.32 | 0.38 | 0.23 |
| Fish < 2 g | $L_p$ [b] | 150 | 7.08 | 9.71 | 12.22 | 13.27 | 17.34 | 23.65 | 32.49 | 35.96 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.02 | 0.10 | 0.13 | 0.12 | 0.12 | 0.12 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.05 | 0.15 | 0.18 | 0.20 | 0.28 | 0.30 | 0.28 | 0.17 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.05 | 0.15 | 0.18 | 0.20 | 0.28 | 0.30 | 0.28 | 0.17 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.64 | 1.42 | 2.14 | 2.68 | 2.71 | 2.79 | 3.21 | 2.70 |

Table F-698. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 42.21 |
| Fish < 2 g | $L_E$ [a] | 183 | 59.59 |
| Fish without swim bladder | $L_E$ [c] | 216 | 3.06 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 10.32 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 10.32 |
| Sea turtles | $L_E$ [d] | 204 | 9.36 |

Table F-699. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.05 | 0.09 | 0.09 | 0.09 | 0.06 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.85 | 5.40 | 6.47 | 7.63 | 8.94 | 11.33 | 14.31 | 14.01 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.05 | 0.09 | 0.09 | 0.09 | 0.06 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.85 | 5.40 | 6.47 | 7.63 | 8.94 | 11.33 | 14.31 | 14.01 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.08 | 0.08 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.08 | 0.08 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.15 | 0.32 | 0.58 | 0.72 | 0.80 | 0.81 | 0.82 | 0.72 |

Table F-700. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 16.88 |
| Fish < 2 g | $L_E$ [a] | 183 | 23.85 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.82 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 4.26 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 4.26 |
| Sea turtles | $L_E$ [d] | 204 | 3.85 |

Table F-701. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.07 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.24 | 4.77 | 5.78 | 6.79 | 7.94 | 9.42 | 12.13 | 11.66 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.07 | 0.06 | 0.05 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.24 | 4.77 | 5.78 | 6.79 | 7.94 | 9.42 | 12.13 | 11.66 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.05 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.12 | 0.18 | 0.46 | 0.57 | 0.53 | 0.60 | 0.68 | 0.48 |

Table F-702. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 14.44 |
| Fish < 2 g | $L_E$ [a] | 183 | 19.83 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.61 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 3.47 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 3.47 |
| Sea turtles | $L_E$ [d] | 204 | 3.06 |

Table F-703. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.48 | 3.89 | 4.83 | 5.75 | 6.42 | 7.45 | 9.12 | 8.58 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.48 | 3.89 | 4.83 | 5.75 | 6.42 | 7.45 | 9.12 | 8.58 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.03 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.03 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.06 | 0.15 | 0.19 | 0.32 | 0.31 | 0.39 | 0.41 | 0.36 |

Table F-704. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 11.35 |
| Fish < 2 g | $L_E$ [a] | 183 | 15.62 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.37 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.46 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.46 |
| Sea turtles | $L_E$ [d] | 204 | 2.15 |

Table F-705. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa²) and SPL (dB re 1 μPa) thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.07 | 0.17 | 0.20 | 0.32 | 0.32 | 0.32 | 0.38 | 0.23 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 7.54 | 10.99 | 13.45 | 15.38 | 24.19 | 43.03 | 80.70 | 64.62 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.07 | 0.17 | 0.20 | 0.32 | 0.32 | 0.32 | 0.38 | 0.23 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 7.54 | 10.99 | 13.45 | 15.38 | 24.19 | 43.03 | 80.70 | 64.62 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.02 | 0.10 | 0.13 | 0.13 | 0.12 | 0.12 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.05 | 0.15 | 0.19 | 0.20 | 0.28 | 0.28 | 0.28 | 0.17 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.05 | 0.15 | 0.19 | 0.20 | 0.28 | 0.28 | 0.28 | 0.17 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.66 | 1.47 | 2.25 | 2.78 | 2.83 | 2.84 | 3.11 | 2.65 |

Table F-706. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 84.48 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 85.28 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 3.17 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 11.55 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 11.55 |
| Sea turtles | $L_{E}$ [d] | 204 | 10.39 |

Table F-707. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.05 | 0.09 | 0.09 | 0.09 | 0.06 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.99 | 5.67 | 6.84 | 8.24 | 10.25 | 13.62 | 16.86 | 14.32 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.05 | 0.09 | 0.09 | 0.09 | 0.06 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.99 | 5.67 | 6.84 | 8.24 | 10.25 | 13.62 | 16.86 | 14.32 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.03 | 0.07 | 0.09 | 0.08 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.03 | 0.07 | 0.09 | 0.08 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.15 | 0.32 | 0.60 | 0.74 | 0.88 | 0.82 | 0.84 | 0.71 |

Table F-708. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 21.11 |
| Fish < 2 g | $L_E$ [a] | 183 | 34.80 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.85 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 4.42 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 4.42 |
| Sea turtles | $L_E$ [d] | 204 | 3.99 |

Table F-709. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.03 | 0.07 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.38 | 4.99 | 6.06 | 7.29 | 8.80 | 11.29 | 13.73 | 11.51 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.03 | 0.07 | 0.06 | 0.05 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.38 | 4.99 | 6.06 | 7.29 | 8.80 | 11.29 | 13.73 | 11.51 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.05 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.05 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.12 | 0.19 | 0.46 | 0.57 | 0.57 | 0.61 | 0.68 | 0.56 |

Table F-710. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 16.95 |
| Fish < 2 g | $L_E$ [a] | 183 | 26.65 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.62 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 3.60 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 3.60 |
| Sea turtles | $L_E$ [d] | 204 | 3.17 |

Table F-711. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 200 kJ | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 2500 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.57 | 4.05 | 5.05 | 6.07 | 7.09 | 8.40 | 9.82 | 8.26 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.05 | 0.03 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.57 | 4.05 | 5.05 | 6.07 | 7.09 | 8.40 | 9.82 | 8.26 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.02 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | 0.02 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.05 | 0.16 | 0.20 | 0.31 | 0.39 | 0.40 | 0.41 | 0.37 |

Table F-712. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 12.70 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 18.58 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.38 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.53 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.53 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.26 |

## F.4.4. Jacket Foundation (Difficult-to-drive)

### F.4.4.1. 4 m Diameter Pin Pile, 4 Legs

Table F-713. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.09 | 0.11 | 0.13 | 0.15 | 0.29 | 0.28 | 0.10 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 6.44 | 8.45 | 9.46 | 10.42 | 11.10 | 13.59 | 11.48 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.09 | 0.11 | 0.13 | 0.15 | 0.29 | 0.28 | 0.10 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 6.44 | 8.45 | 9.46 | 10.42 | 11.10 | 13.59 | 11.48 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.08 | 0.11 | 0.12 | 0.13 | 0.26 | 0.25 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.08 | 0.11 | 0.12 | 0.13 | 0.26 | 0.25 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.68 | 1.14 | 1.45 | 1.64 | 2.07 | 2.29 | 1.14 |

Table F-714. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 12.90 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 16.63 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 1.29 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 4.35 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 4.35 |
| Sea turtles | $L_{E}$ [d] | 204 | 4.05 |

Table F-715. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.06 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.17 | 4.40 | 5.03 | 5.38 | 5.91 | 7.25 | 5.14 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.06 | 0.06 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.17 | 4.40 | 5.03 | 5.38 | 5.91 | 7.25 | 5.14 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.05 | 0.06 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.05 | 0.06 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.13 | 0.29 | 0.43 | 0.47 | 0.70 | 0.69 | 0.28 |

Table F-716. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 6.54 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 8.57 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.33 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.78 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.78 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.61 |

Table F-717. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.68 | 3.86 | 4.39 | 4.73 | 5.24 | 6.32 | 4.36 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.68 | 3.86 | 4.39 | 4.73 | 5.24 | 6.32 | 4.36 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.11 | 0.18 | 0.28 | 0.38 | 0.52 | 0.50 | 0.23 |

Table F-718. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 5.73 |
| Fish < 2 g | $L_E$ [a] | 183 | 7.54 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.23 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.45 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.45 |
| Sea turtles | $L_E$ [d] | 204 | 1.29 |

Table F-719. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.05 | 3.01 | 3.57 | 3.89 | 4.39 | 5.17 | 3.34 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.05 | 3.01 | 3.57 | 3.89 | 4.39 | 5.17 | 3.34 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.07 | 0.11 | 0.15 | 0.21 | 0.34 | 0.30 | 0.15 |

Table F-720. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 4.67 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 6.13 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.13 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.00 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.00 |
| Sea turtles | $L_{E}$ [d] | 204 | 0.90 |

Table F-721. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.09 | 0.12 | 0.13 | 0.14 | 0.28 | 0.27 | 0.09 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 7.46 | 9.94 | 11.76 | 13.11 | 13.82 | 18.39 | 13.41 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.09 | 0.12 | 0.13 | 0.14 | 0.28 | 0.27 | 0.09 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 7.46 | 9.94 | 11.76 | 13.11 | 13.82 | 18.39 | 13.41 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.08 | 0.11 | 0.12 | 0.13 | 0.20 | 0.23 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.08 | 0.11 | 0.12 | 0.13 | 0.20 | 0.23 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.72 | 1.19 | 1.51 | 1.72 | 2.19 | 2.41 | 1.13 |

Table F-722. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 16.95 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 25.09 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 1.33 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 4.67 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 4.67 |
| Sea turtles | $L_{E}$ [d] | 204 | 4.32 |

Table F-723. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.06 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.44 | 4.76 | 5.54 | 5.94 | 6.58 | 8.52 | 5.15 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.06 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.44 | 4.76 | 5.54 | 5.94 | 6.58 | 8.52 | 5.15 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.13 | 0.30 | 0.44 | 0.50 | 0.72 | 0.70 | 0.29 |

Table F-724. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 7.44 |
| Fish < 2 g | $L_E$ [a] | 183 | 10.18 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.33 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.84 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.84 |
| Sea turtles | $L_E$ [d] | 204 | 1.67 |

Table F-725. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.81 | 4.12 | 4.77 | 5.14 | 5.74 | 7.35 | 4.31 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.81 | 4.12 | 4.77 | 5.14 | 5.74 | 7.35 | 4.31 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.11 | 0.18 | 0.29 | 0.38 | 0.54 | 0.51 | 0.22 |

Table F-726. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 6.33 |
| Fish < 2 g | $L_E$ [a] | 183 | 8.66 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.23 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.49 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.49 |
| Sea turtles | $L_E$ [d] | 204 | 1.33 |

Table F-727. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.18 | 3.23 | 3.82 | 4.15 | 4.71 | 5.81 | 3.25 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.18 | 3.23 | 3.82 | 4.15 | 4.71 | 5.81 | 3.25 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.07 | 0.12 | 0.15 | 0.22 | 0.34 | 0.30 | 0.14 |

Table F-728. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 5.04 |
| Fish < 2 g | $L_E$ [a] | 183 | 6.85 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.13 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.04 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.04 |
| Sea turtles | $L_E$ [d] | 204 | 0.92 |

Table F-729. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.12 | 0.16 | 0.17 | 0.17 | 0.17 | 0.16 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 8.24 | 10.08 | 12.06 | 15.00 | 22.42 | 27.59 | 14.24 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.12 | 0.16 | 0.17 | 0.17 | 0.17 | 0.16 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 8.24 | 10.08 | 12.06 | 15.00 | 22.42 | 27.59 | 14.24 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.02 | 0.08 | 0.09 | 0.09 | 0.09 | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.10 | 0.15 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.10 | 0.15 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.92 | 1.60 | 1.98 | 2.14 | 2.33 | 2.22 | 1.10 |

Table F-730. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 22.09 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 30.85 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 1.46 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 5.94 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 5.94 |
| Sea turtles | $L_{E}$ [d] | 204 | 5.45 |

Table F-731. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.33 | 5.57 | 6.72 | 8.01 | 10.06 | 11.74 | 5.30 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.33 | 5.57 | 6.72 | 8.01 | 10.06 | 11.74 | 5.30 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.06 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.06 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.17 | 0.36 | 0.47 | 0.53 | 0.58 | 0.54 | 0.28 |

Table F-732. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 9.68 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 13.62 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.30 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.12 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.12 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.85 |

Table F-733. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.75 | 4.95 | 6.00 | 6.86 | 8.61 | 9.51 | 4.37 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.75 | 4.95 | 6.00 | 6.86 | 8.61 | 9.51 | 4.37 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.15 | 0.28 | 0.32 | 0.42 | 0.47 | 0.42 | 0.21 |

Table F-734. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 8.35 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 11.67 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.20 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.65 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.65 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.46 |

Table F-735. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.82 | 4.09 | 4.96 | 5.44 | 6.62 | 7.32 | 3.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.82 | 4.09 | 4.96 | 5.44 | 6.62 | 7.32 | 3.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.11 | 0.16 | 0.17 | 0.17 | 0.26 | 0.24 | 0.16 |

Table F-736. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 6.46 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 8.99 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.13 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.10 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.10 |
| Sea turtles | $L_{E}$ [d] | 204 | 0.92 |

Table F-737. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.13 | 0.17 | 0.18 | 0.17 | 0.17 | 0.16 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 8.87 | 11.16 | 13.58 | 20.45 | 34.13 | 46.85 | 13.28 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.13 | 0.17 | 0.18 | 0.17 | 0.17 | 0.16 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 8.87 | 11.16 | 13.58 | 20.45 | 34.13 | 46.85 | 13.28 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.02 | 0.05 | 0.09 | 0.09 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.10 | 0.16 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.10 | 0.16 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.95 | 1.66 | 2.04 | 2.14 | 2.40 | 2.19 | 1.11 |

Table F-738. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 31.59 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 63.51 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 1.48 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 6.25 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 6.25 |
| Sea turtles | $L_{E}$ [d] | 204 | 5.70 |

Table F-739. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.57 | 5.85 | 7.22 | 8.80 | 12.03 | 13.07 | 5.02 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.57 | 5.85 | 7.22 | 8.80 | 12.03 | 13.07 | 5.02 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.05 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.05 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.18 | 0.35 | 0.48 | 0.54 | 0.59 | 0.54 | 0.28 |

Table F-740. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 11.03 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 16.10 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.30 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.17 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.17 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.88 |

Table F-741. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.94 | 5.19 | 6.36 | 7.51 | 9.60 | 10.35 | 4.15 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.94 | 5.19 | 6.36 | 7.51 | 9.60 | 10.35 | 4.15 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.16 | 0.21 | 0.31 | 0.44 | 0.48 | 0.43 | 0.20 |

Table F-742. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 9.03 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 13.32 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.20 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.68 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.68 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.48 |

Table F-743. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.95 | 4.28 | 5.22 | 5.72 | 7.26 | 7.47 | 3.01 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.95 | 4.28 | 5.22 | 5.72 | 7.26 | 7.47 | 3.01 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.10 | 0.17 | 0.18 | 0.17 | 0.25 | 0.23 | 0.16 |

Table F-744. Jacket foundation with 4 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 6.85 |
| Fish < 2 g | $L_E$ [a] | 183 | 9.86 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.13 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.12 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.12 |
| Sea turtles | $L_E$ [d] | 204 | 0.94 |

Table F-745. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.11 | 0.13 | 0.18 | 0.27 | 0.33 | 0.33 | 0.12 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 7.40 | 9.51 | 10.91 | 11.94 | 12.54 | 15.25 | 13.30 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.11 | 0.13 | 0.18 | 0.27 | 0.33 | 0.33 | 0.12 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 7.40 | 9.51 | 10.91 | 11.94 | 12.54 | 15.25 | 13.30 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | 0.05 | 0.07 | 0.09 | 0.09 | 0.11 | 0.11 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.09 | 0.12 | 0.14 | 0.18 | 0.31 | 0.31 | 0.10 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.09 | 0.12 | 0.14 | 0.18 | 0.31 | 0.31 | 0.10 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.86 | 1.44 | 1.77 | 1.95 | 2.48 | 2.73 | 1.44 |

Table F-746. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 14.63 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 18.68 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 1.61 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 5.00 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 5.00 |
| Sea turtles | $L_{E}$ [d] | 204 | 4.67 |

Table F-747. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.05 | 0.06 | 0.07 | 0.08 | 0.08 | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.76 | 5.01 | 5.74 | 6.12 | 6.67 | 8.25 | 6.05 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.05 | 0.06 | 0.07 | 0.08 | 0.08 | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.76 | 5.01 | 5.74 | 6.12 | 6.67 | 8.25 | 6.05 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.06 | 0.06 | 0.07 | 0.06 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.06 | 0.06 | 0.07 | 0.06 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.20 | 0.37 | 0.51 | 0.65 | 0.88 | 0.90 | 0.39 |

Table F-748. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 7.54 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 9.72 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.44 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.21 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.21 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.96 |

TableF-749. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.06 | 0.06 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.17 | 4.40 | 5.03 | 5.38 | 5.91 | 7.25 | 5.14 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.06 | 0.06 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 3.17 | 4.40 | 5.03 | 5.38 | 5.91 | 7.25 | 5.14 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.05 | 0.06 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.05 | 0.06 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.13 | 0.29 | 0.43 | 0.47 | 0.70 | 0.69 | 0.28 |

TableF-750. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 6.54 |
| Fish < 2 g | $L_E$ [a] | 183 | 8.57 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.33 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.78 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.78 |
| Sea turtles | $L_E$ [d] | 204 | 1.61 |

Table F-751. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.48 | 3.59 | 4.11 | 4.43 | 4.94 | 5.92 | 4.01 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.48 | 3.59 | 4.11 | 4.43 | 4.94 | 5.92 | 4.01 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.09 | 0.16 | 0.24 | 0.32 | 0.42 | 0.44 | 0.20 |

Table F-752. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 5.35 |
| Fish < 2 g | $L_E$ [a] | 183 | 7.03 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.19 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.29 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.29 |
| Sea turtles | $L_E$ [d] | 204 | 1.15 |

Table F-753. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.11 | 0.13 | 0.18 | 0.26 | 0.32 | 0.32 | 0.12 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 8.66 | 11.75 | 13.57 | 15.36 | 16.01 | 22.60 | 16.43 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.11 | 0.13 | 0.18 | 0.26 | 0.32 | 0.32 | 0.12 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 8.66 | 11.75 | 13.57 | 15.36 | 16.01 | 22.60 | 16.43 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | 0.04 | 0.07 | 0.09 | 0.09 | 0.12 | 0.11 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.09 | 0.13 | 0.14 | 0.18 | 0.30 | 0.30 | 0.10 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.09 | 0.13 | 0.14 | 0.18 | 0.30 | 0.30 | 0.10 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.90 | 1.50 | 1.83 | 2.06 | 2.60 | 2.91 | 1.40 |

Table F-754. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 20.46 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 30.90 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 1.67 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 5.43 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 5.43 |
| Sea turtles | $L_{E}$ [d] | 204 | 5.04 |

Table F-755. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.04 | 0.06 | 0.07 | 0.09 | 0.08 | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.05 | 5.51 | 6.40 | 6.90 | 7.63 | 9.83 | 6.19 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.04 | 0.06 | 0.07 | 0.09 | 0.08 | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.05 | 5.51 | 6.40 | 6.90 | 7.63 | 9.83 | 6.19 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.06 | 0.06 | 0.08 | 0.06 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.06 | 0.06 | 0.08 | 0.06 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.19 | 0.38 | 0.54 | 0.68 | 0.91 | 0.91 | 0.39 |

Table F-756. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 8.66 |
| Fish < 2 g | $L_E$ [a] | 183 | 12.15 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.46 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.32 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.32 |
| Sea turtles | $L_E$ [d] | 204 | 2.07 |

Table F-757. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.06 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.44 | 4.76 | 5.54 | 5.94 | 6.58 | 8.52 | 5.15 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.06 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 3.44 | 4.76 | 5.54 | 5.94 | 6.58 | 8.52 | 5.15 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.13 | 0.30 | 0.44 | 0.50 | 0.72 | 0.70 | 0.29 |

Table F-758. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 7.44 |
| Fish < 2 g | $L_E$ [a] | 183 | 10.18 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.33 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.84 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.84 |
| Sea turtles | $L_E$ [d] | 204 | 1.67 |

Table F-759. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.61 | 3.83 | 4.43 | 4.78 | 5.36 | 6.77 | 3.95 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.61 | 3.83 | 4.43 | 4.78 | 5.36 | 6.77 | 3.95 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.09 | 0.16 | 0.25 | 0.33 | 0.45 | 0.45 | 0.20 |

Table F-760. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 5.87 |
| Fish < 2 g | $L_E$ [a] | 183 | 8.04 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.19 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.33 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.33 |
| Sea turtles | $L_E$ [d] | 204 | 1.19 |

Table F-761. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.15 | 0.18 | 0.20 | 0.31 | 0.31 | 0.28 | 0.10 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 9.27 | 11.68 | 13.37 | 16.91 | 25.98 | 32.84 | 17.26 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.15 | 0.18 | 0.20 | 0.31 | 0.31 | 0.28 | 0.10 |
| Fish < 2 g | $L_p$ [b] | 150 | 9.27 | 11.68 | 13.37 | 16.91 | 25.98 | 32.84 | 17.26 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.09 | 0.11 | 0.11 | 0.12 | 0.10 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.13 | 0.17 | 0.18 | 0.18 | 0.28 | 0.23 | 0.07 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.13 | 0.17 | 0.18 | 0.18 | 0.28 | 0.23 | 0.07 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 1.22 | 1.99 | 2.53 | 2.60 | 2.85 | 2.86 | 1.37 |

Table F-762. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 26.03 |
| Fish < 2 g | $L_E$ [a] | 183 | 37.46 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.85 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 7.05 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 7.05 |
| Sea turtles | $L_E$ [d] | 204 | 6.46 |

Table F-763. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.03 | 0.08 | 0.09 | 0.07 | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.97 | 6.24 | 7.57 | 9.10 | 12.00 | 14.04 | 6.43 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.03 | 0.08 | 0.09 | 0.07 | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.97 | 6.24 | 7.57 | 9.10 | 12.00 | 14.04 | 6.43 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.08 | 0.06 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.08 | 0.06 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.30 | 0.54 | 0.70 | 0.67 | 0.83 | 0.77 | 0.37 |

Table F-764. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 11.67 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 15.88 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.45 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.66 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.66 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.40 |

Table F-765. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 4.33 | 5.57 | 6.72 | 8.01 | 10.06 | 11.74 | 5.30 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 4.33 | 5.57 | 6.72 | 8.01 | 10.06 | 11.74 | 5.30 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.06 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.06 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.17 | 0.36 | 0.47 | 0.53 | 0.58 | 0.54 | 0.28 |

Table F-766. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 9.68 |
| Fish < 2 g | $L_E$ [a] | 183 | 13.62 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.30 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.12 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.12 |
| Sea turtles | $L_E$ [d] | 204 | 1.85 |

Table F-767. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.41 | 4.66 | 5.65 | 6.36 | 7.95 | 8.80 | 3.94 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.41 | 4.66 | 5.65 | 6.36 | 7.95 | 8.80 | 3.94 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.13 | 0.19 | 0.28 | 0.31 | 0.42 | 0.31 | 0.20 |

Table F-768. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 7.69 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 10.70 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.18 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.46 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.46 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.26 |

Table F-769. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.16 | 0.19 | 0.20 | 0.30 | 0.31 | 0.27 | 0.09 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 10.27 | 12.86 | 15.19 | 25.24 | 48.35 | 75.87 | 16.32 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.16 | 0.19 | 0.20 | 0.30 | 0.31 | 0.27 | 0.09 |
| Fish < 2 g | $L_p$ [b] | 150 | 10.27 | 12.86 | 15.19 | 25.24 | 48.35 | 75.87 | 16.32 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.06 | 0.11 | 0.12 | 0.12 | 0.10 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.14 | 0.18 | 0.19 | 0.18 | 0.27 | 0.24 | 0.07 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.14 | 0.18 | 0.19 | 0.18 | 0.27 | 0.24 | 0.07 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 1.27 | 2.08 | 2.60 | 2.62 | 2.97 | 2.77 | 1.37 |

Table F-770. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 43.52 |
| Fish < 2 g | $L_E$ [a] | 183 | 83.86 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.88 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 7.57 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 7.57 |
| Sea turtles | $L_E$ [d] | 204 | 6.85 |

Table F-771. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.03 | 0.07 | 0.09 | 0.08 | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 5.25 | 6.53 | 8.17 | 10.25 | 14.61 | 16.15 | 6.03 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.03 | 0.07 | 0.09 | 0.08 | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 5.25 | 6.53 | 8.17 | 10.25 | 14.61 | 16.15 | 6.03 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.08 | 0.06 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.08 | 0.06 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.20 | 0.55 | 0.70 | 0.67 | 0.85 | 0.79 | 0.36 |

Table F-772. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 13.32 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 19.55 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.46 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.72 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.72 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.46 |

Table F-773. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 4.57 | 5.85 | 7.22 | 8.80 | 12.03 | 13.07 | 5.02 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 4.57 | 5.85 | 7.22 | 8.80 | 12.03 | 13.07 | 5.02 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.05 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.05 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.18 | 0.35 | 0.48 | 0.54 | 0.59 | 0.54 | 0.28 |

Table F-774. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 11.03 |
| Fish < 2 g | $L_E$ [a] | 183 | 16.03 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.30 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.17 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.17 |
| Sea turtles | $L_E$ [d] | 204 | 1.88 |

Table F-775. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.61 | 4.87 | 5.98 | 6.85 | 8.81 | 9.21 | 3.82 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 3.61 | 4.87 | 5.98 | 6.85 | 8.81 | 9.21 | 3.82 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.14 | 0.20 | 0.21 | 0.30 | 0.41 | 0.32 | 0.19 |

Table F-776. Jacket foundation with 4 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 8.30 |
| Fish < 2 g | $L_E$ [a] | 183 | 12.15 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.17 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.48 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.48 |
| Sea turtles | $L_E$ [d] | 204 | 1.28 |

### F.4.4.2. 4 m Diameter Pin Pile, 8 Legs

Table F-777. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.09 | 0.11 | 0.13 | 0.15 | 0.29 | 0.28 | 0.10 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 6.44 | 8.45 | 9.46 | 10.42 | 11.10 | 13.59 | 11.48 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.09 | 0.11 | 0.13 | 0.15 | 0.29 | 0.28 | 0.10 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 6.44 | 8.45 | 9.46 | 10.42 | 11.10 | 13.59 | 11.48 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.08 | 0.11 | 0.12 | 0.13 | 0.26 | 0.25 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.08 | 0.11 | 0.12 | 0.13 | 0.26 | 0.25 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.68 | 1.14 | 1.45 | 1.64 | 2.07 | 2.29 | 1.14 |

Table F-778. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 15.60 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 20.28 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 1.78 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 5.35 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 5.35 |
| Sea turtles | $L_{E}$ [d] | 204 | 5.00 |

Table F-779. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.06 | 0.06 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.17 | 4.40 | 5.03 | 5.38 | 5.91 | 7.25 | 5.14 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.06 | 0.06 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 3.17 | 4.40 | 5.03 | 5.38 | 5.91 | 7.25 | 5.14 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.05 | 0.06 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.05 | 0.06 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.13 | 0.29 | 0.43 | 0.47 | 0.70 | 0.69 | 0.28 |

Table F-780. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 8.06 |
| Fish < 2 g | $L_E$ [a] | 183 | 10.55 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.51 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.44 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.44 |
| Sea turtles | $L_E$ [d] | 204 | 2.22 |

Table F-781. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.68 | 3.86 | 4.39 | 4.73 | 5.24 | 6.32 | 4.36 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.68 | 3.86 | 4.39 | 4.73 | 5.24 | 6.32 | 4.36 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.11 | 0.18 | 0.28 | 0.38 | 0.52 | 0.50 | 0.23 |

Table F-782. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 7.03 |
| Fish < 2 g | $L_E$ [a] | 183 | 9.10 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.38 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.96 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.96 |
| Sea turtles | $L_E$ [d] | 204 | 1.78 |

Table F-783. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.05 | 3.01 | 3.57 | 3.89 | 4.39 | 5.17 | 3.34 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.05 | 3.01 | 3.57 | 3.89 | 4.39 | 5.17 | 3.34 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.07 | 0.11 | 0.15 | 0.21 | 0.34 | 0.30 | 0.15 |

Table F-784. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 5.73 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 7.55 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.23 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.45 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.45 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.29 |

Table F-785. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.09 | 0.12 | 0.13 | 0.14 | 0.28 | 0.27 | 0.09 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 7.46 | 9.94 | 11.76 | 13.11 | 13.82 | 18.39 | 13.41 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.09 | 0.12 | 0.13 | 0.14 | 0.28 | 0.27 | 0.09 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 7.46 | 9.94 | 11.76 | 13.11 | 13.82 | 18.39 | 13.41 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.08 | 0.11 | 0.12 | 0.13 | 0.20 | 0.23 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.08 | 0.11 | 0.12 | 0.13 | 0.20 | 0.23 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.72 | 1.19 | 1.51 | 1.72 | 2.19 | 2.41 | 1.13 |

Table F-786. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 22.79 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 34.82 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 1.84 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 5.88 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 5.88 |
| Sea turtles | $L_{E}$ [d] | 204 | 5.44 |

Table F-787. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.06 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.44 | 4.76 | 5.54 | 5.94 | 6.58 | 8.52 | 5.15 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.06 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 3.44 | 4.76 | 5.54 | 5.94 | 6.58 | 8.52 | 5.15 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.13 | 0.30 | 0.44 | 0.50 | 0.72 | 0.70 | 0.29 |

Table F-788. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 9.32 |
| Fish < 2 g | $L_E$ [a] | 183 | 13.19 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.53 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.55 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.55 |
| Sea turtles | $L_E$ [d] | 204 | 2.33 |

Table F-789. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.81 | 4.12 | 4.77 | 5.14 | 5.74 | 7.35 | 4.31 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.81 | 4.12 | 4.77 | 5.14 | 5.74 | 7.35 | 4.31 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.11 | 0.18 | 0.29 | 0.38 | 0.54 | 0.51 | 0.22 |

Table F-790. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 8.05 |
| Fish < 2 g | $L_E$ [a] | 183 | 11.18 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.38 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.07 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.07 |
| Sea turtles | $L_E$ [d] | 204 | 1.84 |

Table F-791. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.18 | 3.23 | 3.82 | 4.15 | 4.71 | 5.81 | 3.25 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.18 | 3.23 | 3.82 | 4.15 | 4.71 | 5.81 | 3.25 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.07 | 0.12 | 0.15 | 0.22 | 0.34 | 0.30 | 0.14 |

Table F-792. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 6.34 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 8.67 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.23 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.50 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.50 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.34 |

Table F-793. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.12 | 0.16 | 0.17 | 0.17 | 0.17 | 0.16 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 8.24 | 10.08 | 12.06 | 15.00 | 22.42 | 27.59 | 14.24 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.12 | 0.16 | 0.17 | 0.17 | 0.17 | 0.16 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 8.24 | 10.08 | 12.06 | 15.00 | 22.42 | 27.59 | 14.24 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.02 | 0.08 | 0.09 | 0.09 | 0.09 | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.10 | 0.15 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.10 | 0.15 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.92 | 1.60 | 1.98 | 2.14 | 2.33 | 2.22 | 1.10 |

Table F-794. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 28.31 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 42.14 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 2.13 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 7.69 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 7.69 |
| Sea turtles | $L_{E}$ [d] | 204 | 7.05 |

Table F-795. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 4.33 | 5.57 | 6.72 | 8.01 | 10.06 | 11.74 | 5.30 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 4.33 | 5.57 | 6.72 | 8.01 | 10.06 | 11.74 | 5.30 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.06 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.06 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.17 | 0.36 | 0.47 | 0.53 | 0.58 | 0.54 | 0.28 |

Table F-796. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 12.63 |
| Fish < 2 g | $L_E$ [a] | 183 | 17.12 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.50 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.94 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.94 |
| Sea turtles | $L_E$ [d] | 204 | 2.67 |

Table F-797. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.75 | 4.95 | 6.00 | 6.86 | 8.61 | 9.51 | 4.37 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 3.75 | 4.95 | 6.00 | 6.86 | 8.61 | 9.51 | 4.37 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.15 | 0.28 | 0.32 | 0.42 | 0.47 | 0.42 | 0.21 |

Table F-798. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 10.71 |
| Fish < 2 g | $L_E$ [a] | 183 | 14.71 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.36 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.40 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.40 |
| Sea turtles | $L_E$ [d] | 204 | 2.13 |

Table F-799. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.82 | 4.09 | 4.96 | 5.44 | 6.62 | 7.32 | 3.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.82 | 4.09 | 4.96 | 5.44 | 6.62 | 7.32 | 3.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.11 | 0.16 | 0.17 | 0.17 | 0.26 | 0.24 | 0.16 |

Table F-800. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 8.35 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 11.68 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.20 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.65 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.65 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.46 |

Table F-801. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.13 | 0.17 | 0.18 | 0.17 | 0.17 | 0.16 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 8.87 | 11.16 | 13.58 | 20.45 | 34.13 | 46.85 | 13.28 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.13 | 0.17 | 0.18 | 0.17 | 0.17 | 0.16 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 8.87 | 11.16 | 13.58 | 20.45 | 34.13 | 46.85 | 13.28 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.02 | 0.05 | 0.09 | 0.09 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.10 | 0.16 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.10 | 0.16 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.95 | 1.66 | 2.04 | 2.14 | 2.40 | 2.19 | 1.11 |

Table F-802. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 52.50 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 84.55 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 2.17 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 8.30 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 8.30 |
| Sea turtles | $L_{E}$ [d] | 204 | 7.57 |

Table F-803. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.57 | 5.85 | 7.22 | 8.80 | 12.03 | 13.07 | 5.02 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.57 | 5.85 | 7.22 | 8.80 | 12.03 | 13.07 | 5.02 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.05 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.05 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.18 | 0.35 | 0.48 | 0.54 | 0.59 | 0.54 | 0.28 |

Table F-804. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 14.64 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 22.18 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.51 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 3.05 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 3.05 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.72 |

Table F-805. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.94 | 5.19 | 6.36 | 7.51 | 9.60 | 10.35 | 4.15 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 3.94 | 5.19 | 6.36 | 7.51 | 9.60 | 10.35 | 4.15 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.16 | 0.21 | 0.31 | 0.44 | 0.48 | 0.43 | 0.20 |

Table F-806. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 12.16 |
| Fish < 2 g | $L_E$ [a] | 183 | 17.66 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.36 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.47 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.47 |
| Sea turtles | $L_E$ [d] | 204 | 2.17 |

Table F-807. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.95 | 4.28 | 5.22 | 5.72 | 7.26 | 7.47 | 3.01 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.95 | 4.28 | 5.22 | 5.72 | 7.26 | 7.47 | 3.01 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.10 | 0.17 | 0.18 | 0.17 | 0.25 | 0.23 | 0.16 |

Table F-808. Jacket foundation with 8 pin piles (pre-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 9.03 |
| Fish < 2 g | $L_E$ [a] | 183 | 13.33 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.20 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.68 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.68 |
| Sea turtles | $L_E$ [d] | 204 | 1.48 |

Table F-809. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.11 | 0.13 | 0.18 | 0.27 | 0.33 | 0.33 | 0.12 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 7.40 | 9.51 | 10.91 | 11.94 | 12.54 | 15.25 | 13.30 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.11 | 0.13 | 0.18 | 0.27 | 0.33 | 0.33 | 0.12 |
| Fish < 2 g | $L_p$ [b] | 150 | 7.40 | 9.51 | 10.91 | 11.94 | 12.54 | 15.25 | 13.30 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | 0.05 | 0.07 | 0.09 | 0.09 | 0.11 | 0.11 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.09 | 0.12 | 0.14 | 0.18 | 0.31 | 0.31 | 0.10 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.09 | 0.12 | 0.14 | 0.18 | 0.31 | 0.31 | 0.10 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.86 | 1.44 | 1.77 | 1.95 | 2.48 | 2.73 | 1.44 |

Table F-810. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 17.63 |
| Fish < 2 g | $L_E$ [a] | 183 | 23.48 |
| Fish without swim bladder | $L_E$ [c] | 216 | 2.22 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 6.13 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 6.13 |
| Sea turtles | $L_E$ [d] | 204 | 5.73 |

Table F-811. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.05 | 0.06 | 0.07 | 0.08 | 0.08 | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.76 | 5.01 | 5.74 | 6.12 | 6.67 | 8.25 | 6.05 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.05 | 0.06 | 0.07 | 0.08 | 0.08 | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.76 | 5.01 | 5.74 | 6.12 | 6.67 | 8.25 | 6.05 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.06 | 0.06 | 0.07 | 0.06 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.06 | 0.06 | 0.07 | 0.06 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.20 | 0.37 | 0.51 | 0.65 | 0.88 | 0.90 | 0.39 |

Table F-812. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 9.10 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 12.11 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.70 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.86 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.86 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.65 |

Table F-813. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.06 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.17 | 4.40 | 5.03 | 5.38 | 5.91 | 7.25 | 5.14 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.06 | 0.06 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.17 | 4.40 | 5.03 | 5.38 | 5.91 | 7.25 | 5.14 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.05 | 0.06 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.05 | 0.06 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.13 | 0.29 | 0.43 | 0.47 | 0.70 | 0.69 | 0.28 |

Table F-814. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 8.06 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 10.55 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.51 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.44 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.44 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.22 |

Table F-815. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.48 | 3.59 | 4.11 | 4.43 | 4.94 | 5.92 | 4.01 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.48 | 3.59 | 4.11 | 4.43 | 4.94 | 5.92 | 4.01 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.09 | 0.16 | 0.24 | 0.32 | 0.42 | 0.44 | 0.20 |

Table F-816. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 6.55 |
| Fish < 2 g | $L_E$ [a] | 183 | 8.58 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.33 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.78 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.78 |
| Sea turtles | $L_E$ [d] | 204 | 1.61 |

Table F-817. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.11 | 0.13 | 0.18 | 0.26 | 0.32 | 0.32 | 0.12 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 8.66 | 11.75 | 13.57 | 15.36 | 16.01 | 22.60 | 16.43 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.11 | 0.13 | 0.18 | 0.26 | 0.32 | 0.32 | 0.12 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 8.66 | 11.75 | 13.57 | 15.36 | 16.01 | 22.60 | 16.43 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | 0.04 | 0.07 | 0.09 | 0.09 | 0.12 | 0.11 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.09 | 0.13 | 0.14 | 0.18 | 0.30 | 0.30 | 0.10 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.09 | 0.13 | 0.14 | 0.18 | 0.30 | 0.30 | 0.10 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.90 | 1.50 | 1.83 | 2.06 | 2.60 | 2.91 | 1.40 |

Table F-818. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 27.77 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 45.63 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 2.33 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 6.85 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 6.85 |
| Sea turtles | $L_{E}$ [d] | 204 | 6.34 |

Table F-819. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.04 | 0.06 | 0.07 | 0.09 | 0.08 | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.05 | 5.51 | 6.40 | 6.90 | 7.63 | 9.83 | 6.19 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.04 | 0.06 | 0.07 | 0.09 | 0.08 | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.05 | 5.51 | 6.40 | 6.90 | 7.63 | 9.83 | 6.19 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.06 | 0.06 | 0.08 | 0.06 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.06 | 0.06 | 0.08 | 0.06 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.19 | 0.38 | 0.54 | 0.68 | 0.91 | 0.91 | 0.39 |

Table F-820. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 11.18 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 15.58 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.72 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 3.05 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 3.05 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.77 |

Table F-821. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.06 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.44 | 4.76 | 5.54 | 5.94 | 6.58 | 8.52 | 5.15 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.06 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 3.44 | 4.76 | 5.54 | 5.94 | 6.58 | 8.52 | 5.15 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.13 | 0.30 | 0.44 | 0.50 | 0.72 | 0.70 | 0.29 |

Table F-822. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 9.32 |
| Fish < 2 g | $L_E$ [a] | 183 | 13.19 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.53 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.55 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.55 |
| Sea turtles | $L_E$ [d] | 204 | 2.33 |

Table F-823. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.61 | 3.83 | 4.43 | 4.78 | 5.36 | 6.77 | 3.95 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.61 | 3.83 | 4.43 | 4.78 | 5.36 | 6.77 | 3.95 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.09 | 0.16 | 0.25 | 0.33 | 0.45 | 0.45 | 0.20 |

Table F-824. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 7.44 |
| Fish < 2 g | $L_E$ [a] | 183 | 10.19 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.33 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.84 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.84 |
| Sea turtles | $L_E$ [d] | 204 | 1.67 |

Table F-825. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.15 | 0.18 | 0.20 | 0.31 | 0.31 | 0.28 | 0.10 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 9.27 | 11.68 | 13.37 | 16.91 | 25.98 | 32.84 | 17.26 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.15 | 0.18 | 0.20 | 0.31 | 0.31 | 0.28 | 0.10 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 9.27 | 11.68 | 13.37 | 16.91 | 25.98 | 32.84 | 17.26 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.09 | 0.11 | 0.11 | 0.12 | 0.10 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.13 | 0.17 | 0.18 | 0.18 | 0.28 | 0.23 | 0.07 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.13 | 0.17 | 0.18 | 0.18 | 0.28 | 0.23 | 0.07 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 1.22 | 1.99 | 2.53 | 2.60 | 2.85 | 2.86 | 1.37 |

Table F-826. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 33.86 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 52.19 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 2.67 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 9.00 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 9.00 |
| Sea turtles | $L_{E}$ [d] | 204 | 8.35 |

Table F-827. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.03 | 0.08 | 0.09 | 0.07 | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 4.97 | 6.24 | 7.57 | 9.10 | 12.00 | 14.04 | 6.43 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.03 | 0.08 | 0.09 | 0.07 | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 4.97 | 6.24 | 7.57 | 9.10 | 12.00 | 14.04 | 6.43 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.08 | 0.06 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.08 | 0.06 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.30 | 0.54 | 0.70 | 0.67 | 0.83 | 0.77 | 0.37 |

Table F-828. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 14.71 |
| Fish < 2 g | $L_E$ [a] | 183 | 20.13 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.69 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 3.76 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 3.76 |
| Sea turtles | $L_E$ [d] | 204 | 3.34 |

Table F-829. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.33 | 5.57 | 6.72 | 8.01 | 10.06 | 11.74 | 5.30 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.33 | 5.57 | 6.72 | 8.01 | 10.06 | 11.74 | 5.30 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.06 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.06 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.17 | 0.36 | 0.47 | 0.53 | 0.58 | 0.54 | 0.28 |

Table F-830. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 12.63 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 17.12 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.50 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.94 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.94 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.67 |

Table F-831. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.41 | 4.66 | 5.65 | 6.36 | 7.95 | 8.80 | 3.94 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.41 | 4.66 | 5.65 | 6.36 | 7.95 | 8.80 | 3.94 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.13 | 0.19 | 0.28 | 0.31 | 0.42 | 0.31 | 0.20 |

Table F-832. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 9.69 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 13.63 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.30 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.13 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.13 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.86 |

Table F-833. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.16 | 0.19 | 0.20 | 0.30 | 0.31 | 0.27 | 0.09 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 10.27 | 12.86 | 15.19 | 25.24 | 48.35 | 75.87 | 16.32 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.16 | 0.19 | 0.20 | 0.30 | 0.31 | 0.27 | 0.09 |
| Fish < 2 g | $L_p$ [b] | 150 | 10.27 | 12.86 | 15.19 | 25.24 | 48.35 | 75.87 | 16.32 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.06 | 0.11 | 0.12 | 0.12 | 0.10 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.14 | 0.18 | 0.19 | 0.18 | 0.27 | 0.24 | 0.07 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.14 | 0.18 | 0.19 | 0.18 | 0.27 | 0.24 | 0.07 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 1.27 | 2.08 | 2.60 | 2.62 | 2.97 | 2.77 | 1.37 |

Table F-834. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 78.31 |
| Fish < 2 g | $L_E$ [a] | 183 | 85.13 |
| Fish without swim bladder | $L_E$ [c] | 216 | 2.72 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 9.87 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 9.87 |
| Sea turtles | $L_E$ [d] | 204 | 9.03 |

Table F-835. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.03 | 0.07 | 0.09 | 0.08 | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 5.25 | 6.53 | 8.17 | 10.25 | 14.61 | 16.15 | 6.03 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.03 | 0.07 | 0.09 | 0.08 | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 5.25 | 6.53 | 8.17 | 10.25 | 14.61 | 16.15 | 6.03 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.08 | 0.06 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.08 | 0.06 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.20 | 0.55 | 0.70 | 0.67 | 0.85 | 0.79 | 0.36 |

Table F-836. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 17.66 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 27.85 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.70 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 3.88 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 3.88 |
| Sea turtles | $L_{E}$ [d] | 204 | 3.48 |

Table F-837. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 4.57 | 5.85 | 7.22 | 8.80 | 12.03 | 13.07 | 5.02 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.02 | 0.07 | 0.06 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 4.57 | 5.85 | 7.22 | 8.80 | 12.03 | 13.07 | 5.02 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.05 | 0.06 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.05 | 0.06 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.18 | 0.35 | 0.48 | 0.54 | 0.59 | 0.54 | 0.28 |

Table F-838. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 14.64 |
| Fish < 2 g | $L_E$ [a] | 183 | 22.19 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.51 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 3.05 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 3.05 |
| Sea turtles | $L_E$ [d] | 204 | 2.72 |

Table F-839. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.61 | 4.87 | 5.98 | 6.85 | 8.81 | 9.21 | 3.82 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | 0.03 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.61 | 4.87 | 5.98 | 6.85 | 8.81 | 9.21 | 3.82 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.14 | 0.20 | 0.21 | 0.30 | 0.41 | 0.32 | 0.19 |

Table F-840. Jacket foundation with 8 pin piles (post-piled 4 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 11.04 |
| Fish < 2 g | $L_E$ [a] | 183 | 16.11 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.30 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.17 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.17 |
| Sea turtles | $L_E$ [d] | 204 | 1.88 |

### F.4.4.3. 4.25 m Diameter Pin Pile, 4 Legs

Table F-841. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.09 | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 6.67 | 8.89 | 9.90 | 10.99 | 12.45 | 13.35 | 16.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.09 | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 6.67 | 8.89 | 9.90 | 10.99 | 12.45 | 13.35 | 16.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.06 | 0.07 | 0.09 | 0.09 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.08 | 0.11 | 0.13 | 0.15 | 0.24 | 0.29 | 0.15 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.08 | 0.11 | 0.13 | 0.15 | 0.24 | 0.29 | 0.15 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.73 | 1.28 | 1.58 | 1.78 | 2.11 | 2.43 | 2.37 |

Table F-842. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 15.14 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 19.15 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 1.68 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 5.30 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 5.30 |
| Sea turtles | $L_{E}$ [d] | 204 | 4.94 |

Table F-843. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.35 | 4.68 | 5.30 | 5.76 | 6.41 | 7.22 | 8.29 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.35 | 4.68 | 5.30 | 5.76 | 6.41 | 7.22 | 8.29 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.04 | 0.06 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.04 | 0.06 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.15 | 0.33 | 0.46 | 0.52 | 0.72 | 0.77 | 0.64 |

Table F-844. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 7.98 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 10.34 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.45 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.34 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.34 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.09 |

Table F-845. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.05 | 0.06 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.79 | 4.10 | 4.65 | 5.05 | 5.63 | 6.34 | 7.18 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.05 | 0.06 | 0.06 | 0.04 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.79 | 4.10 | 4.65 | 5.05 | 5.63 | 6.34 | 7.18 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.05 | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.05 | 0.05 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.11 | 0.23 | 0.32 | 0.41 | 0.55 | 0.58 | 0.46 |

Table F-846. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 6.96 |
| Fish < 2 g | $L_E$ [a] | 183 | 8.99 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.33 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.86 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.86 |
| Sea turtles | $L_E$ [d] | 204 | 1.68 |

Table F-847. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.19 | 3.27 | 3.78 | 4.15 | 4.62 | 5.24 | 5.75 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.19 | 3.27 | 3.78 | 4.15 | 4.62 | 5.24 | 5.75 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.08 | 0.12 | 0.18 | 0.23 | 0.34 | 0.37 | 0.30 |

Table F-848. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 5.68 |
| Fish < 2 g | $L_E$ [a] | 183 | 7.47 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.19 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.35 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.35 |
| Sea turtles | $L_E$ [d] | 204 | 1.20 |

Table F-849. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.09 | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 7.78 | 10.78 | 12.40 | 13.68 | 16.15 | 17.80 | 25.79 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.09 | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish < 2 g | $L_p$ [b] | 150 | 7.78 | 10.78 | 12.40 | 13.68 | 16.15 | 17.80 | 25.79 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.06 | 0.08 | 0.09 | 0.11 | 0.10 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.09 | 0.11 | 0.13 | 0.14 | 0.20 | 0.28 | 0.18 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.09 | 0.11 | 0.13 | 0.14 | 0.20 | 0.28 | 0.18 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.76 | 1.33 | 1.66 | 1.85 | 2.22 | 2.54 | 2.45 |

Table F-850. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 22.97 |
| Fish < 2 g | $L_E$ [a] | 183 | 34.60 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.75 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 5.92 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 5.92 |
| Sea turtles | $L_E$ [d] | 204 | 5.46 |

Table F-851. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.62 | 5.09 | 5.92 | 6.43 | 7.38 | 8.44 | 9.88 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.62 | 5.09 | 5.92 | 6.43 | 7.38 | 8.44 | 9.88 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.14 | 0.33 | 0.47 | 0.55 | 0.75 | 0.79 | 0.64 |

Table F-852. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 9.43 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 13.35 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.46 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.47 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.47 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.22 |

Table F-853. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.04 | 0.06 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.98 | 4.40 | 5.11 | 5.56 | 6.29 | 7.28 | 8.39 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.04 | 0.06 | 0.06 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.98 | 4.40 | 5.11 | 5.56 | 6.29 | 7.28 | 8.39 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.05 | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.05 | 0.05 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.11 | 0.24 | 0.33 | 0.42 | 0.58 | 0.59 | 0.46 |

Table F-854. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 8.13 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 11.33 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.34 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.95 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.95 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.75 |

Table F-855. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.32 | 3.51 | 4.09 | 4.46 | 5.02 | 5.83 | 6.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.32 | 3.51 | 4.09 | 4.46 | 5.02 | 5.83 | 6.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.08 | 0.13 | 0.18 | 0.24 | 0.35 | 0.37 | 0.29 |

Table F-856. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 6.39 |
| Fish < 2 g | $L_E$ [a] | 183 | 8.76 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.19 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.40 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.40 |
| Sea turtles | $L_E$ [d] | 204 | 1.25 |

Table F-857. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.13 | 0.17 | 0.19 | 0.32 | 0.33 | 0.25 | 0.15 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 8.52 | 11.14 | 12.18 | 12.84 | 17.24 | 27.61 | 29.30 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.13 | 0.17 | 0.19 | 0.32 | 0.33 | 0.25 | 0.15 |
| Fish < 2 g | $L_p$ [b] | 150 | 8.52 | 11.14 | 12.18 | 12.84 | 17.24 | 27.61 | 29.30 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.04 | 0.10 | 0.11 | 0.12 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.12 | 0.16 | 0.18 | 0.19 | 0.28 | 0.17 | 0.13 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.12 | 0.16 | 0.18 | 0.19 | 0.28 | 0.17 | 0.13 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 1.02 | 1.71 | 2.14 | 2.55 | 2.81 | 2.50 | 2.08 |

Table F-858. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 27.72 |
| Fish < 2 g | $L_E$ [a] | 183 | 41.01 |
| Fish without swim bladder | $L_E$ [c] | 216 | 1.92 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 7.37 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 7.37 |
| Sea turtles | $L_E$ [d] | 204 | 6.74 |

Table F-859. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 4.54 | 5.98 | 6.46 | 7.43 | 9.15 | 12.13 | 11.66 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish < 2 g | $L_p$ [b] | 150 | 4.54 | 5.98 | 6.46 | 7.43 | 9.15 | 12.13 | 11.66 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.18 | 0.47 | 0.58 | 0.69 | 0.88 | 0.68 | 0.48 |

Table F-860. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 12.23 |
| Fish < 2 g | $L_E$ [a] | 183 | 16.70 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.46 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.76 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.76 |
| Sea turtles | $L_E$ [d] | 204 | 2.51 |

Table F-861. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.03 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.95 | 5.30 | 5.78 | 6.61 | 8.19 | 10.00 | 9.37 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.03 | 0.06 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.95 | 5.30 | 5.78 | 6.61 | 8.19 | 10.00 | 9.37 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.05 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.16 | 0.31 | 0.47 | 0.51 | 0.56 | 0.45 | 0.39 |

Table F-862. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 10.25 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 14.29 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.31 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.20 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.20 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.92 |

Table F-863. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.02 | 4.37 | 4.82 | 5.58 | 6.66 | 7.60 | 6.91 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.02 | 4.37 | 4.82 | 5.58 | 6.66 | 7.60 | 6.91 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.12 | 0.17 | 0.20 | 0.30 | 0.39 | 0.27 | 0.24 |

Table F-864. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 8.03 |
| Fish < 2 g | $L_E$ [a] | 183 | 11.27 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.18 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.53 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.53 |
| Sea turtles | $L_E$ [d] | 204 | 1.32 |

Table F-865. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.14 | 0.18 | 0.20 | 0.20 | 0.32 | 0.25 | 0.15 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 9.11 | 12.58 | 13.44 | 14.65 | 24.17 | 50.59 | 41.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.14 | 0.18 | 0.20 | 0.20 | 0.32 | 0.25 | 0.15 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 9.11 | 12.58 | 13.44 | 14.65 | 24.17 | 50.59 | 41.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.04 | 0.10 | 0.11 | 0.13 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.12 | 0.17 | 0.18 | 0.20 | 0.20 | 0.16 | 0.13 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.12 | 0.17 | 0.18 | 0.20 | 0.20 | 0.16 | 0.13 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 1.06 | 1.77 | 2.28 | 2.64 | 2.84 | 2.42 | 2.10 |

Table F-866. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 47.58 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 84.38 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 2.00 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 7.79 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 7.79 |
| Sea turtles | $L_{E}$ [d] | 204 | 7.09 |

Table F-867. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.79 | 6.28 | 6.87 | 8.00 | 10.38 | 13.73 | 11.51 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.79 | 6.28 | 6.87 | 8.00 | 10.38 | 13.73 | 11.51 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.19 | 0.47 | 0.61 | 0.70 | 0.88 | 0.68 | 0.56 |

Table F-868. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 13.73 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 20.56 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.46 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.82 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.82 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.57 |

Table F-869. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa[2]) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.03 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.15 | 5.56 | 6.08 | 7.07 | 8.89 | 11.12 | 9.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.03 | 0.06 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.15 | 5.56 | 6.08 | 7.07 | 8.89 | 11.12 | 9.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.05 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.16 | 0.30 | 0.47 | 0.51 | 0.57 | 0.46 | 0.40 |

Table F-870. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 11.38 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 16.64 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.31 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.28 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.28 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.00 |

Table F-871. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.20 | 4.55 | 5.06 | 5.89 | 7.16 | 8.06 | 6.53 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.20 | 4.55 | 5.06 | 5.89 | 7.16 | 8.06 | 6.53 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.12 | 0.17 | 0.20 | 0.27 | 0.40 | 0.26 | 0.25 |

Table F-872. Jacket foundation with 4 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 8.54 |
| Fish < 2 g | $L_E$ [a] | 183 | 12.50 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.18 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.57 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.57 |
| Sea turtles | $L_E$ [d] | 204 | 1.36 |

Table F-873. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.11 | 0.16 | 0.20 | 0.27 | 0.32 | 0.35 | 0.30 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 7.67 | 10.13 | 11.35 | 12.43 | 14.02 | 14.89 | 18.19 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.11 | 0.16 | 0.20 | 0.27 | 0.32 | 0.35 | 0.30 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 7.67 | 10.13 | 11.35 | 12.43 | 14.02 | 14.89 | 18.19 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | 0.06 | 0.08 | 0.09 | 0.11 | 0.12 | 0.12 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.10 | 0.13 | 0.18 | 0.23 | 0.30 | 0.33 | 0.27 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.10 | 0.13 | 0.18 | 0.23 | 0.30 | 0.33 | 0.27 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.93 | 1.58 | 1.88 | 2.16 | 2.54 | 2.83 | 2.87 |

Table F-874. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 17.07 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 22.27 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 2.09 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 6.08 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 6.08 |
| Sea turtles | $L_{E}$ [d] | 204 | 5.68 |

Table F-875. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.06 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.92 | 5.33 | 6.04 | 6.55 | 7.37 | 8.18 | 9.38 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.06 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.92 | 5.33 | 6.04 | 6.55 | 7.37 | 8.18 | 9.38 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.02 | 0.06 | 0.07 | 0.08 | 0.08 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.02 | 0.06 | 0.07 | 0.08 | 0.08 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.21 | 0.41 | 0.60 | 0.70 | 0.90 | 0.97 | 0.85 |

Table F-876. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 8.99 |
| Fish < 2 g | $L_E$ [a] | 183 | 11.85 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.62 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.78 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.78 |
| Sea turtles | $L_E$ [d] | 204 | 2.57 |

Table F-877. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.35 | 4.68 | 5.30 | 5.76 | 6.41 | 7.22 | 8.29 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.35 | 4.68 | 5.30 | 5.76 | 6.41 | 7.22 | 8.29 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.04 | 0.06 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.04 | 0.06 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.15 | 0.33 | 0.46 | 0.52 | 0.72 | 0.77 | 0.64 |

Table F-878. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 7.98 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 10.34 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.45 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.34 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.34 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.09 |

Table F-879. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.05 | 0.05 | 0.03 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.60 | 3.84 | 4.34 | 4.73 | 5.27 | 5.97 | 6.63 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.05 | 0.05 | 0.03 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.60 | 3.84 | 4.34 | 4.73 | 5.27 | 5.97 | 6.63 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.03 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.03 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.10 | 0.18 | 0.28 | 0.36 | 0.47 | 0.48 | 0.39 |

Table F-880. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 6.48 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 8.48 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.28 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.68 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.68 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.52 |

Table F-881. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.11 | 0.16 | 0.20 | 0.26 | 0.31 | 0.34 | 0.28 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 8.98 | 12.53 | 14.38 | 15.88 | 18.61 | 21.40 | 31.79 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.11 | 0.16 | 0.20 | 0.26 | 0.31 | 0.34 | 0.28 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 8.98 | 12.53 | 14.38 | 15.88 | 18.61 | 21.40 | 31.79 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | 0.05 | 0.08 | 0.09 | 0.11 | 0.12 | 0.12 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.10 | 0.13 | 0.18 | 0.20 | 0.29 | 0.32 | 0.26 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.10 | 0.13 | 0.18 | 0.20 | 0.29 | 0.32 | 0.26 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.96 | 1.64 | 2.02 | 2.28 | 2.65 | 3.05 | 3.03 |

Table F-882. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 27.84 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 44.85 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 2.22 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 6.92 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 6.92 |
| Sea turtles | $L_{E}$ [d] | 204 | 6.39 |

Table F-883. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.22 | 5.91 | 6.83 | 7.51 | 8.60 | 9.69 | 11.99 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.22 | 5.91 | 6.83 | 7.51 | 8.60 | 9.69 | 11.99 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.02 | 0.06 | 0.07 | 0.09 | 0.09 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.02 | 0.06 | 0.07 | 0.09 | 0.09 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.21 | 0.45 | 0.64 | 0.73 | 0.93 | 0.99 | 0.85 |

Table F-884. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 11.33 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 15.76 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.64 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.96 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.96 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.70 |

Table F-885. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa²) and SPL (dB re 1 μPa) thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.62 | 5.09 | 5.92 | 6.43 | 7.38 | 8.44 | 9.88 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.62 | 5.09 | 5.92 | 6.43 | 7.38 | 8.44 | 9.88 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.14 | 0.33 | 0.47 | 0.55 | 0.75 | 0.79 | 0.64 |

Table F-886. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 9.43 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 13.35 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.46 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.47 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.47 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.22 |

Table F-887. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.05 | 0.05 | 0.03 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.73 | 4.09 | 4.75 | 5.16 | 5.84 | 6.72 | 7.74 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.05 | 0.05 | 0.03 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.73 | 4.09 | 4.75 | 5.16 | 5.84 | 6.72 | 7.74 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.02 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.02 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.11 | 0.18 | 0.29 | 0.38 | 0.50 | 0.49 | 0.40 |

Table F-888. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 7.52 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 10.35 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.29 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.75 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.75 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.58 |

Table F-889. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa²) and SPL (dB re 1 μPa) thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.16 | 0.19 | 0.33 | 0.36 | 0.48 | 0.38 | 0.23 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 9.53 | 12.77 | 13.70 | 14.31 | 19.55 | 32.49 | 35.96 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.16 | 0.19 | 0.33 | 0.36 | 0.48 | 0.38 | 0.23 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 9.53 | 12.77 | 13.70 | 14.31 | 19.55 | 32.49 | 35.96 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | 0.02 | 0.11 | 0.13 | 0.14 | 0.14 | 0.12 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.15 | 0.18 | 0.20 | 0.34 | 0.36 | 0.28 | 0.17 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.15 | 0.18 | 0.20 | 0.34 | 0.36 | 0.28 | 0.17 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 1.33 | 2.13 | 2.64 | 3.05 | 3.51 | 3.21 | 2.70 |

Table F-890. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa²·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 33.13 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 51.25 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 2.51 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 8.70 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 8.70 |
| Sea turtles | $L_{E}$ [d] | 204 | 8.03 |

Table F-891. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.02 | 0.06 | 0.09 | 0.11 | 0.09 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 5.18 | 6.71 | 7.31 | 8.29 | 10.48 | 14.31 | 14.01 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.02 | 0.06 | 0.09 | 0.11 | 0.09 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 5.18 | 6.71 | 7.31 | 8.29 | 10.48 | 14.31 | 14.01 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.03 | 0.07 | 0.10 | 0.08 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.03 | 0.07 | 0.10 | 0.08 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.32 | 0.56 | 0.72 | 0.95 | 1.11 | 0.82 | 0.72 |

Table F-892. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 14.29 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 19.49 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.63 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 3.53 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 3.53 |
| Sea turtles | $L_{E}$ [d] | 204 | 3.13 |

Table F-893. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.54 | 5.98 | 6.46 | 7.43 | 9.15 | 12.13 | 11.66 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.54 | 5.98 | 6.46 | 7.43 | 9.15 | 12.13 | 11.66 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.18 | 0.47 | 0.58 | 0.69 | 0.88 | 0.68 | 0.48 |

Table F-894. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 12.23 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 16.70 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.46 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.76 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.76 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.51 |

Table F-895. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | 0.03 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.66 | 4.98 | 5.44 | 6.25 | 7.69 | 9.12 | 8.58 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | 0.03 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.66 | 4.98 | 5.44 | 6.25 | 7.69 | 9.12 | 8.58 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.15 | 0.28 | 0.34 | 0.38 | 0.50 | 0.41 | 0.36 |

Table F-896. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 9.33 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 13.22 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.27 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.92 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.92 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.72 |

Table F-897. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.17 | 0.20 | 0.32 | 0.36 | 0.47 | 0.38 | 0.23 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 10.68 | 14.63 | 15.24 | 17.07 | 29.55 | 80.70 | 64.61 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.17 | 0.20 | 0.32 | 0.36 | 0.47 | 0.38 | 0.23 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 10.68 | 14.63 | 15.24 | 17.07 | 29.55 | 80.70 | 64.61 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.16 | 0.19 | 0.20 | 0.34 | 0.34 | 0.28 | 0.17 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.16 | 0.19 | 0.20 | 0.34 | 0.34 | 0.28 | 0.17 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 1.39 | 2.23 | 2.75 | 3.20 | 3.56 | 3.11 | 2.65 |

Table F-898. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 70.18 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 85.05 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 2.57 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 9.25 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 9.25 |
| Sea turtles | $L_{E}$ [d] | 204 | 8.54 |

Table F-899. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.02 | 0.05 | 0.09 | 0.11 | 0.09 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 5.48 | 7.16 | 7.80 | 8.94 | 12.27 | 16.86 | 14.32 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.02 | 0.05 | 0.09 | 0.11 | 0.09 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 5.48 | 7.16 | 7.80 | 8.94 | 12.27 | 16.86 | 14.32 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.03 | 0.05 | 0.10 | 0.08 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.03 | 0.05 | 0.10 | 0.08 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.31 | 0.57 | 0.74 | 0.96 | 1.13 | 0.84 | 0.71 |

Table F-900. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 16.64 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 25.98 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.64 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 3.62 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 3.62 |
| Sea turtles | $L_{E}$ [d] | 204 | 3.20 |

Table F-901. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.79 | 6.28 | 6.87 | 8.00 | 10.38 | 13.73 | 11.50 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.79 | 6.28 | 6.87 | 8.00 | 10.38 | 13.73 | 11.50 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.19 | 0.47 | 0.61 | 0.70 | 0.88 | 0.68 | 0.56 |

Table F-902. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 13.73 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 20.56 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.46 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.82 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.82 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.57 |

Table F-903. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | 0.03 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.85 | 5.21 | 5.73 | 6.63 | 8.31 | 9.82 | 8.26 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | 0.03 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.85 | 5.21 | 5.73 | 6.63 | 8.31 | 9.82 | 8.26 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.15 | 0.20 | 0.34 | 0.37 | 0.51 | 0.41 | 0.37 |

Table F-904. Jacket foundation with 4 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 10.23 |
| Fish < 2 g | $L_E$ [a] | 183 | 15.10 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.26 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.00 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.00 |
| Sea turtles | $L_E$ [d] | 204 | 1.77 |

### F.4.4.4. 4.25 m Diameter Pin Pile, 8 Legs

Table F-905. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.09 | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 6.67 | 8.89 | 9.90 | 10.99 | 12.45 | 13.35 | 16.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.09 | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 6.67 | 8.89 | 9.90 | 10.99 | 12.45 | 13.35 | 16.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.06 | 0.07 | 0.09 | 0.09 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.08 | 0.11 | 0.13 | 0.15 | 0.24 | 0.29 | 0.15 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.08 | 0.11 | 0.13 | 0.15 | 0.24 | 0.29 | 0.15 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.73 | 1.28 | 1.58 | 1.78 | 2.11 | 2.43 | 2.37 |

Table F-906. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 18.02 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 23.76 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 2.35 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 6.49 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 6.49 |
| Sea turtles | $L_{E}$ [d] | 204 | 6.08 |

Table F-907. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.35 | 4.68 | 5.30 | 5.76 | 6.41 | 7.22 | 8.29 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.35 | 4.68 | 5.30 | 5.76 | 6.41 | 7.22 | 8.29 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.04 | 0.06 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.04 | 0.06 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.15 | 0.33 | 0.46 | 0.52 | 0.72 | 0.77 | 0.64 |

Table F-908. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 9.57 |
| Fish < 2 g | $L_E$ [a] | 183 | 12.63 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.72 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 3.07 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 3.07 |
| Sea turtles | $L_E$ [d] | 204 | 2.78 |

Table F-909. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.05 | 0.06 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.79 | 4.10 | 4.65 | 5.05 | 5.63 | 6.34 | 7.18 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.05 | 0.06 | 0.06 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.79 | 4.10 | 4.65 | 5.05 | 5.63 | 6.34 | 7.18 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.05 | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.05 | 0.05 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.11 | 0.23 | 0.32 | 0.41 | 0.55 | 0.58 | 0.46 |

Table F-910. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 8.49 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 11.12 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.53 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.57 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.57 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.35 |

Table F-911. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.19 | 3.27 | 3.78 | 4.15 | 4.62 | 5.24 | 5.75 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.19 | 3.27 | 3.78 | 4.15 | 4.62 | 5.24 | 5.75 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.08 | 0.12 | 0.18 | 0.23 | 0.34 | 0.37 | 0.30 |

Table F-912. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 6.96 |
| Fish < 2 g | $L_E$ [a] | 183 | 8.99 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.34 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 1.86 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 1.86 |
| Sea turtles | $L_E$ [d] | 204 | 1.69 |

Table F-913. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.09 | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 7.78 | 10.78 | 12.40 | 13.68 | 16.15 | 17.80 | 25.79 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.09 | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 7.78 | 10.78 | 12.40 | 13.68 | 16.15 | 17.80 | 25.79 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.06 | 0.08 | 0.09 | 0.11 | 0.10 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.09 | 0.11 | 0.13 | 0.14 | 0.20 | 0.28 | 0.18 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.09 | 0.11 | 0.13 | 0.14 | 0.20 | 0.28 | 0.18 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.76 | 1.33 | 1.66 | 1.85 | 2.22 | 2.54 | 2.45 |

Table F-914. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 30.92 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 51.95 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 2.47 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 7.53 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 7.53 |
| Sea turtles | $L_{E}$ [d] | 204 | 6.93 |

Table F-915. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.62 | 5.09 | 5.92 | 6.43 | 7.38 | 8.44 | 9.88 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.62 | 5.09 | 5.92 | 6.43 | 7.38 | 8.44 | 9.88 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.14 | 0.33 | 0.47 | 0.55 | 0.75 | 0.79 | 0.64 |

Table F-916. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 12.31 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 17.14 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.73 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 3.31 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 3.31 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.96 |

Table F-917. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 μPa²) and SPL (dB re 1 μPa) thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.04 | 0.06 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.98 | 4.40 | 5.11 | 5.56 | 6.29 | 7.28 | 8.39 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.04 | 0.06 | 0.06 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.98 | 4.40 | 5.11 | 5.56 | 6.29 | 7.28 | 8.39 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.05 | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.05 | 0.05 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.11 | 0.24 | 0.33 | 0.42 | 0.58 | 0.59 | 0.46 |

Table F-918. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 10.36 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 14.50 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.55 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.70 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.70 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.47 |

Table F-919. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.32 | 3.51 | 4.09 | 4.46 | 5.02 | 5.83 | 6.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.32 | 3.51 | 4.09 | 4.46 | 5.02 | 5.83 | 6.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.08 | 0.13 | 0.18 | 0.24 | 0.35 | 0.37 | 0.29 |

Table F-920. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 8.14 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 11.34 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.34 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 1.95 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 1.95 |
| Sea turtles | $L_{E}$ [d] | 204 | 1.76 |

Table F-921. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.13 | 0.17 | 0.19 | 0.32 | 0.33 | 0.25 | 0.15 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 8.52 | 11.14 | 12.18 | 12.84 | 17.24 | 27.61 | 29.30 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.13 | 0.17 | 0.19 | 0.32 | 0.33 | 0.25 | 0.15 |
| Fish < 2 g | $L_p$ [b] | 150 | 8.52 | 11.14 | 12.18 | 12.84 | 17.24 | 27.61 | 29.30 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.04 | 0.10 | 0.11 | 0.12 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.12 | 0.16 | 0.18 | 0.19 | 0.28 | 0.17 | 0.13 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.12 | 0.16 | 0.18 | 0.19 | 0.28 | 0.17 | 0.13 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 1.02 | 1.71 | 2.14 | 2.55 | 2.81 | 2.50 | 2.08 |

Table F-922. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 36.67 |
| Fish < 2 g | $L_E$ [a] | 183 | 55.19 |
| Fish without swim bladder | $L_E$ [c] | 216 | 2.76 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 9.34 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 9.34 |
| Sea turtles | $L_E$ [d] | 204 | 8.71 |

Table F-923. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 4.54 | 5.98 | 6.46 | 7.43 | 9.15 | 12.13 | 11.66 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish < 2 g | $L_p$ [b] | 150 | 4.54 | 5.98 | 6.46 | 7.43 | 9.15 | 12.13 | 11.66 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.18 | 0.47 | 0.58 | 0.69 | 0.88 | 0.68 | 0.48 |

Table F-924. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 15.47 |
| Fish < 2 g | $L_E$ [a] | 183 | 21.56 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.72 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 3.92 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 3.92 |
| Sea turtles | $L_E$ [d] | 204 | 3.53 |

Table F-925. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.03 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.95 | 5.30 | 5.78 | 6.61 | 8.19 | 10.00 | 9.37 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.03 | 0.06 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.95 | 5.30 | 5.78 | 6.61 | 8.19 | 10.00 | 9.37 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.05 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.16 | 0.31 | 0.47 | 0.51 | 0.56 | 0.45 | 0.39 |

Table F-926. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 13.23 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 17.93 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.54 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 3.14 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 3.14 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.76 |

Table F-927. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.02 | 4.37 | 4.82 | 5.58 | 6.66 | 7.60 | 6.91 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.02 | 4.37 | 4.82 | 5.58 | 6.66 | 7.60 | 6.91 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.12 | 0.17 | 0.20 | 0.30 | 0.39 | 0.27 | 0.24 |

Table F-928. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 10.26 |
| Fish < 2 g | $L_E$ [a] | 183 | 14.30 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.31 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.21 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.21 |
| Sea turtles | $L_E$ [d] | 204 | 1.93 |

Table F-929. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.14 | 0.18 | 0.20 | 0.20 | 0.32 | 0.25 | 0.15 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 9.11 | 12.58 | 13.44 | 14.65 | 24.17 | 50.59 | 41.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.14 | 0.18 | 0.20 | 0.20 | 0.32 | 0.25 | 0.15 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 9.11 | 12.58 | 13.44 | 14.65 | 24.17 | 50.59 | 41.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | 0.04 | 0.10 | 0.11 | 0.13 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.12 | 0.17 | 0.18 | 0.20 | 0.20 | 0.16 | 0.13 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.12 | 0.17 | 0.18 | 0.20 | 0.20 | 0.16 | 0.13 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 1.06 | 1.77 | 2.28 | 2.64 | 2.84 | 2.42 | 2.10 |

Table F-930. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 82.95 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 85.22 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 2.82 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 10.24 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 10.24 |
| Sea turtles | $L_{E}$ [d] | 204 | 9.25 |

Table F-931. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.79 | 6.28 | 6.87 | 8.00 | 10.38 | 13.73 | 11.51 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.79 | 6.28 | 6.87 | 8.00 | 10.38 | 13.73 | 11.51 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.19 | 0.47 | 0.61 | 0.70 | 0.88 | 0.68 | 0.56 |

Table F-932. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 18.22 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 29.39 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.72 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 4.01 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 4.01 |
| Sea turtles | $L_{E}$ [d] | 204 | 3.62 |

Table F-933. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.03 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.15 | 5.56 | 6.08 | 7.07 | 8.89 | 11.12 | 9.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.03 | 0.06 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.15 | 5.56 | 6.08 | 7.07 | 8.89 | 11.12 | 9.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.05 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.16 | 0.30 | 0.47 | 0.51 | 0.57 | 0.46 | 0.40 |

Table F-934. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 15.12 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 23.23 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.54 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 3.21 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 3.21 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.82 |

Table F-935. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.20 | 4.55 | 5.06 | 5.89 | 7.16 | 8.06 | 6.53 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.20 | 4.55 | 5.06 | 5.89 | 7.16 | 8.06 | 6.53 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | - | - |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.12 | 0.17 | 0.20 | 0.27 | 0.40 | 0.26 | 0.25 |

Table F-936. Jacket foundation with 8 pin piles (pre-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 11.39 |
| Fish < 2 g | $L_E$ [a] | 183 | 16.66 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.31 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.29 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.29 |
| Sea turtles | $L_E$ [d] | 204 | 2.01 |

Table F-937. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.11 | 0.16 | 0.20 | 0.27 | 0.32 | 0.35 | 0.30 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 7.67 | 10.13 | 11.35 | 12.43 | 14.02 | 14.89 | 18.19 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.11 | 0.16 | 0.20 | 0.27 | 0.32 | 0.35 | 0.30 |
| Fish < 2 g | $L_p$ [b] | 150 | 7.67 | 10.13 | 11.35 | 12.43 | 14.02 | 14.89 | 18.19 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | 0.06 | 0.08 | 0.09 | 0.11 | 0.12 | 0.12 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.10 | 0.13 | 0.18 | 0.23 | 0.30 | 0.33 | 0.27 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.10 | 0.13 | 0.18 | 0.23 | 0.30 | 0.33 | 0.27 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.93 | 1.58 | 1.88 | 2.16 | 2.54 | 2.83 | 2.87 |

Table F-938. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 20.77 |
| Fish < 2 g | $L_E$ [a] | 183 | 26.79 |
| Fish without swim bladder | $L_E$ [c] | 216 | 2.78 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 7.47 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 7.47 |
| Sea turtles | $L_E$ [d] | 204 | 6.96 |

Table F-939. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.92 | 5.33 | 6.04 | 6.55 | 7.37 | 8.18 | 9.38 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.92 | 5.33 | 6.04 | 6.55 | 7.37 | 8.18 | 9.38 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.02 | 0.06 | 0.07 | 0.08 | 0.08 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.02 | 0.06 | 0.07 | 0.08 | 0.08 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.21 | 0.41 | 0.60 | 0.70 | 0.90 | 0.97 | 0.85 |

Table F-940. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 11.12 |
| Fish < 2 g | $L_E$ [a] | 183 | 14.26 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.92 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 3.70 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 3.70 |
| Sea turtles | $L_E$ [d] | 204 | 3.39 |

Table F-941. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.35 | 4.68 | 5.30 | 5.76 | 6.41 | 7.22 | 8.29 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.06 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.35 | 4.68 | 5.30 | 5.76 | 6.41 | 7.22 | 8.29 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.04 | 0.06 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.04 | 0.06 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.15 | 0.33 | 0.46 | 0.52 | 0.72 | 0.77 | 0.64 |

Table F-942. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 9.57 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 12.63 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.72 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 3.07 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 3.07 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.78 |

Table F-943. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.05 | 0.05 | 0.03 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.60 | 3.84 | 4.34 | 4.73 | 5.27 | 5.97 | 6.63 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.05 | 0.05 | 0.03 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.60 | 3.84 | 4.34 | 4.73 | 5.27 | 5.97 | 6.63 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.03 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.03 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.10 | 0.18 | 0.28 | 0.36 | 0.47 | 0.48 | 0.39 |

Table F-944. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 7.98 |
| Fish < 2 g | $L_E$ [a] | 183 | 10.35 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.45 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.35 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.35 |
| Sea turtles | $L_E$ [d] | 204 | 2.09 |

Table F-945. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.11 | 0.16 | 0.20 | 0.26 | 0.31 | 0.34 | 0.28 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 8.98 | 12.53 | 14.38 | 15.88 | 18.61 | 21.40 | 31.79 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.11 | 0.16 | 0.20 | 0.26 | 0.31 | 0.34 | 0.28 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 8.98 | 12.53 | 14.38 | 15.88 | 18.61 | 21.40 | 31.79 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | 0.05 | 0.08 | 0.09 | 0.11 | 0.12 | 0.12 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.10 | 0.13 | 0.18 | 0.20 | 0.29 | 0.32 | 0.26 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.10 | 0.13 | 0.18 | 0.20 | 0.29 | 0.32 | 0.26 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.96 | 1.64 | 2.02 | 2.28 | 2.65 | 3.05 | 3.03 |

Table F-946. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 39.23 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 74.43 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 2.96 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 8.77 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 8.77 |
| Sea turtles | $L_{E}$ [d] | 204 | 8.14 |

Table F-947. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.22 | 5.91 | 6.83 | 7.51 | 8.60 | 9.69 | 11.99 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.22 | 5.91 | 6.83 | 7.51 | 8.60 | 9.69 | 11.99 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | 0.02 | 0.06 | 0.07 | 0.09 | 0.09 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | 0.02 | 0.06 | 0.07 | 0.09 | 0.09 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.21 | 0.45 | 0.64 | 0.73 | 0.93 | 0.99 | 0.85 |

Table F-948. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 14.50 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 20.72 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.94 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 3.98 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 3.98 |
| Sea turtles | $L_{E}$ [d] | 204 | 3.65 |

Table F-949. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.62 | 5.09 | 5.92 | 6.43 | 7.38 | 8.44 | 9.88 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.05 | 0.06 | 0.07 | 0.07 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.62 | 5.09 | 5.92 | 6.43 | 7.38 | 8.44 | 9.88 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.02 | 0.06 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.14 | 0.33 | 0.47 | 0.55 | 0.75 | 0.79 | 0.64 |

Table F-950. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 12.31 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 17.14 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.73 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 3.31 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 3.31 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.96 |

Table F-951. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.05 | 0.05 | 0.03 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.73 | 4.09 | 4.75 | 5.16 | 5.84 | 6.72 | 7.74 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.05 | 0.05 | 0.03 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.73 | 4.09 | 4.75 | 5.16 | 5.84 | 6.72 | 7.74 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.02 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | 0.02 | 0.02 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.11 | 0.18 | 0.29 | 0.38 | 0.50 | 0.49 | 0.64 |

Table F-952. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 9.43 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 13.36 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.46 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.47 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.47 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.22 |

Table F-953. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.16 | 0.19 | 0.33 | 0.36 | 0.48 | 0.38 | 0.23 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 9.53 | 12.77 | 13.70 | 14.31 | 19.55 | 32.49 | 35.96 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.16 | 0.19 | 0.33 | 0.36 | 0.48 | 0.38 | 0.23 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 9.53 | 12.77 | 13.70 | 14.31 | 19.55 | 32.49 | 35.96 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | 0.02 | 0.11 | 0.13 | 0.14 | 0.14 | 0.12 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.15 | 0.18 | 0.20 | 0.34 | 0.36 | 0.28 | 0.17 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.15 | 0.18 | 0.20 | 0.34 | 0.36 | 0.28 | 0.17 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 1.33 | 2.13 | 2.64 | 3.05 | 3.51 | 3.21 | 2.70 |

Table F-954. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 46.39 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 62.04 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 3.53 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 11.28 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 11.28 |
| Sea turtles | $L_{E}$ [d] | 204 | 10.26 |

Table F-955. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.02 | 0.06 | 0.09 | 0.11 | 0.09 | 0.06 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.18 | 6.71 | 7.31 | 8.29 | 10.48 | 14.31 | 14.01 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.02 | 0.06 | 0.09 | 0.11 | 0.09 | 0.06 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.18 | 6.71 | 7.31 | 8.29 | 10.48 | 14.31 | 14.01 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.03 | 0.07 | 0.10 | 0.08 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.03 | 0.07 | 0.10 | 0.08 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.32 | 0.56 | 0.72 | 0.95 | 1.11 | 0.82 | 0.72 |

Table F-956. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 17.93 |
| Fish < 2 g | $L_E$ [a] | 183 | 25.52 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.98 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 4.74 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 4.74 |
| Sea turtles | $L_E$ [d] | 204 | 4.32 |

Table F-957. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.54 | 5.98 | 6.46 | 7.43 | 9.15 | 12.13 | 11.66 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | 0.02 | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.54 | 5.98 | 6.46 | 7.43 | 9.15 | 12.13 | 11.66 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.18 | 0.47 | 0.58 | 0.69 | 0.88 | 0.68 | 0.48 |

Table F-958. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 15.47 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 21.56 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.72 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 3.92 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 3.92 |
| Sea turtles | $L_{E}$ [d] | 204 | 3.53 |

Table F-959. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | 0.03 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.66 | 4.98 | 5.44 | 6.25 | 7.69 | 9.12 | 8.58 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | 0.03 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.66 | 4.98 | 5.44 | 6.25 | 7.69 | 9.12 | 8.58 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | 0.02 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.03 | 0.02 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.15 | 0.28 | 0.34 | 0.38 | 0.50 | 0.41 | 0.36 |

Table F-960. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during summer at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Summer |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 12.24 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 16.71 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.46 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 2.76 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 2.76 |
| Sea turtles | $L_{E}$ [d] | 204 | 2.51 |

Table F-961. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | 0.17 | 0.20 | 0.32 | 0.36 | 0.47 | 0.38 | 0.23 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 10.68 | 14.63 | 15.24 | 17.07 | 29.55 | 80.70 | 64.61 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | 0.17 | 0.20 | 0.32 | 0.36 | 0.47 | 0.38 | 0.23 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 10.68 | 14.63 | 15.24 | 17.07 | 29.55 | 80.70 | 64.61 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | 0.02 | 0.11 | 0.13 | 0.14 | 0.15 | 0.12 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | 0.16 | 0.19 | 0.20 | 0.34 | 0.34 | 0.28 | 0.17 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | 0.16 | 0.19 | 0.20 | 0.34 | 0.34 | 0.28 | 0.17 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 1.39 | 2.23 | 2.75 | 3.20 | 3.56 | 3.11 | 2.65 |

Table F-962. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 84.74 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 85.31 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 3.62 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 12.52 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 12.52 |
| Sea turtles | $L_{E}$ [d] | 204 | 11.39 |

Table F-963. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | 0.02 | 0.05 | 0.09 | 0.11 | 0.09 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 5.48 | 7.16 | 7.80 | 8.94 | 12.27 | 16.86 | 14.32 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | 0.02 | 0.05 | 0.09 | 0.11 | 0.09 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 5.48 | 7.16 | 7.80 | 8.94 | 12.27 | 16.86 | 14.32 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | 0.02 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.03 | 0.05 | 0.10 | 0.08 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | 0.03 | 0.05 | 0.10 | 0.08 | 0.06 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.31 | 0.57 | 0.74 | 0.96 | 1.13 | 0.84 | 0.71 |

Table F-964. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 10 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 23.23 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 39.56 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 1.02 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 4.88 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 4.88 |
| Sea turtles | $L_{E}$ [d] | 204 | 4.43 |

Table F-965. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 4.79 | 6.28 | 6.87 | 8.00 | 10.38 | 13.73 | 11.50 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | 0.03 | 0.09 | 0.06 | 0.05 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 4.79 | 6.28 | 6.87 | 8.00 | 10.38 | 13.73 | 11.50 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | 0.02 | 0.06 | 0.06 | 0.05 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.19 | 0.47 | 0.61 | 0.70 | 0.88 | 0.68 | 0.56 |

Table F-966. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_{E}$ [a] | 187 | 18.22 |
| Fish < 2 g | $L_{E}$ [a] | 183 | 29.40 |
| Fish without swim bladder | $L_{E}$ [c] | 216 | 0.72 |
| Fish with swim bladder not involved in hearing | $L_{E}$ [c] | 203 | 4.01 |
| Fish with swim bladder involved in hearing | $L_{E}$ [c] | 203 | 4.01 |
| Sea turtles | $L_{E}$ [d] | 204 | 3.62 |

Table F-967. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Hammer energy 500 kJ | Hammer energy 1000 kJ | Hammer energy 1500 kJ | Hammer energy 2000 kJ | Hammer energy 3000 kJ | Hammer energy 3500 (a) kJ | Hammer energy 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | 0.03 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.85 | 5.21 | 5.73 | 6.63 | 8.31 | 9.82 | 8.26 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | - | - | - | - | 0.02 | 0.05 | 0.03 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.85 | 5.21 | 5.73 | 6.63 | 8.31 | 9.82 | 8.26 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | - | - | - | - | - | 0.02 | 0.03 |
| Sea turtles | $L_{pk}$ [d] | 232 | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.15 | 0.20 | 0.34 | 0.37 | 0.51 | 0.41 | 0.37 |

Table F-968. Jacket foundation with 8 pin piles (post-piled 4.25 m diameter, MHU 3500S) acoustic ranges ($R_{max}$ in km) to fish and sea turtle SEL thresholds during winter at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa$^2$·s) | Winter |
|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 | 13.74 |
| Fish < 2 g | $L_E$ [a] | 183 | 20.58 |
| Fish without swim bladder | $L_E$ [c] | 216 | 0.46 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 | 2.82 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 | 2.82 |
| Sea turtles | $L_E$ [d] | 204 | 2.57 |

# Appendix G. Acoustic Range Results – Vibratory Pile Setting Followed by Impact Pile Driving

The following subsections contain tables of acoustic ranges ($R_{max}$ and $R_{95\%}$ in km) to marine mammal (NMFS 2018), sea turtle (Finneran et al. 2017), and fish (FHWG 2008, Stadler and Woodbury 2009, Popper et al. 2014) injury thresholds. The acoustic ranges to behavioral thresholds for marine mammals (NOAA 2005, Wood et al. 2012), sea turtles (McCauley et al. 2000b), and fish (Andersson et al. 2007, Wysocki et al. 2007, Mueller-Blenkle et al. 2010, Purser and Radford 2011) are also included. The acoustic ranges are shown for the following categories: Flat is unweighted, LF is low-frequency cetaceans, MF is mid-frequency cetaceans, HF is high-frequency cetaceans, PW is phocid pinnipeds in water, and TUW is turtles in water. TUW weighting functions are from the US Navy (Finneran et al. 2017), the rest are from the Technical Guidance (NMFS 2018). $R_{max}$ is the maximum distance at which the sound level was encountered in the modeled maximum-over-depth sound field and $R_{95\%}$ is the maximum distance at which the sound level was encountered after the 5% farthest such points were excluded.

## G.1. Marine Mammal and Sea Turtle Distances to Threshold - Vibratory and Impact Pile Driving

Tables G-1 to G-12 show distances to vibratory (non-impulsive signals) pile driving injury thresholds and distances to injury thresholds from the combined sound fields produced by vibratory and impact (impulsive signals) pile driving, for marine mammals and sea turtles. See Section 2.6 for details on combining the sound field from vibratory and impact pile driving. Distances to the behavioral threshold of 120 dB, valid for all marine mammal species considering vibratory pile driving only are shown in Tables G-13 to G-14 for jacket foundations and Table G-15 for monopiles.

Table G-1. Jacket pin pile (4 m diameter, TR-CV320, MHU3500S) SEL acoustic ranges ($R_{95\%}$ in km) to acoustic threshold criteria (Finneran et al. 2017, NMFS 2018) with various levels of attenuation for location L01 in summer and winter. Ranges to impact pile driving thresholds include the acoustic energy from vibratory driving.

| Hammer type | Hearing group | Threshold (dB re 1 µPa²·s) | Summer 0 dB | Summer 10 dB | Summer 12 dB | Summer 15 dB | Winter 0 dB | Winter 10 dB | Winter 12 dB | Winter 15 dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Vibratory (30 min) | LF | 199 | 0.46 | 0.10 | 0.06 | 0.04 | 0.47 | 0.11 | 0.06 | 0.05 |
| Vibratory (30 min) | MF | 198 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | HF | 173 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | PW | 201 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | TUW | 220 | 0.05 | - | - | - | 0.05 | - | - | - |
| Vibratory and Impact | LF | 183 | 7.55 | 3.55 | 2.89 | 2.22 | 8.61 | 3.77 | 3.09 | 2.34 |
| Vibratory and Impact | MF | 185 | 0.02 | - | - | - | 0.02 | - | - | - |
| Vibratory and Impact | HF | 155 | 1.08 | 0.28 | 0.21 | 0.12 | 1.12 | 0.32 | 0.20 | 0.13 |
| Vibratory and Impact | PW | 185 | 1.57 | 0.40 | 0.32 | 0.18 | 1.64 | 0.42 | 0.33 | 0.18 |
| Vibratory and Impact | TUW | 204 | 1.88 | 0.58 | 0.43 | 0.27 | 1.97 | 0.60 | 0.44 | 0.27 |

Table G-2. Jacket pin pile (4 m diameter, TR-CV320, MHU3500S) SEL acoustic ranges ($R_{95\%}$ in km) to acoustic threshold criteria (Finneran et al. 2017, NMFS 2018) with various levels of attenuation for location L02 in summer and winter. Ranges to impact pile driving thresholds include the acoustic energy from vibratory driving.

| Hammer type | Hearing group | Threshold (dB re 1 µPa²·s) | Summer 0 dB | Summer 10 dB | Summer 12 dB | Summer 15 dB | Winter 0 dB | Winter 10 dB | Winter 12 dB | Winter 15 dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Vibratory (30 min) | LF | 199 | 0.57 | 0.13 | 0.10 | 0.04 | 0.60 | 0.13 | 0.10 | 0.04 |
| Vibratory (30 min) | MF | 198 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | HF | 173 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | PW | 201 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | TUW | 220 | 0.04 | - | - | - | 0.04 | - | - | - |
| Vibratory and Impact | LF | 183 | 10.37 | 4.37 | 3.60 | 2.60 | 11.58 | 4.48 | 3.70 | 2.65 |
| Vibratory and Impact | MF | 185 | 0.02 | - | - | - | 0.02 | - | - | - |
| Vibratory and Impact | HF | 155 | 1.22 | 0.31 | 0.21 | 0.09 | 1.21 | 0.30 | 0.22 | 0.10 |
| Vibratory and Impact | PW | 185 | 1.72 | 0.37 | 0.30 | 0.16 | 1.77 | 0.43 | 0.28 | 0.16 |
| Vibratory and Impact | TUW | 204 | 2.27 | 0.56 | 0.42 | 0.26 | 2.33 | 0.57 | 0.43 | 0.25 |

A dash (-) indicates that the acoustic threshold was not reached.

Table G-3. Difficult-to-drive jacket pin pile (4 m diameter, TR-CV320, MHU3500S) SEL acoustic ranges ($R_{95\%}$ in km) to acoustic threshold criteria (Finneran et al. 2017, NMFS 2018) with various levels of attenuation for location L01 in summer and winter. Ranges to impact pile driving thresholds include the acoustic energy from vibratory driving.

| Hammer type | Hearing group | Threshold (dB re 1 µPa²·s) | Summer 0 dB | Summer 10 dB | Summer 12 dB | Summer 15 dB | Winter 0 dB | Winter 10 dB | Winter 12 dB | Winter 15 dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Vibratory (30 min) | LF | 199 | 0.46 | 0.10 | 0.06 | 0.04 | 0.47 | 0.11 | 0.06 | 0.05 |
| Vibratory (30 min) | MF | 198 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | HF | 173 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | PW | 201 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | TUW | 220 | 0.05 | - | - | - | 0.05 | - | - | - |
| Vibratory and Impact | LF | 183 | 7.80 | 3.79 | 3.17 | 2.44 | 8.96 | 4.03 | 3.39 | 2.55 |
| Vibratory and Impact | MF | 185 | 0.02 | - | - | - | 0.02 | - | - | - |
| Vibratory and Impact | HF | 155 | 1.17 | 0.31 | 0.23 | 0.13 | 1.22 | 0.35 | 0.27 | 0.14 |
| Vibratory and Impact | PW | 185 | 1.72 | 0.48 | 0.35 | 0.21 | 1.81 | 0.51 | 0.37 | 0.21 |
| Vibratory and Impact | TUW | 204 | 2.11 | 0.66 | 0.49 | 0.32 | 2.24 | 0.69 | 0.51 | 0.33 |

A dash (-) indicates that the acoustic threshold was not reached.

Table G-4. Difficult-to-drive jacket pin pile (4 m diameter, TR-CV320, MHU3500S) SEL acoustic ranges ($R_{95\%}$ in km) to acoustic threshold criteria (Finneran et al. 2017, NMFS 2018) with various levels of attenuation for location L02 in summer and winter. Ranges to impact pile driving thresholds include the acoustic energy from vibratory driving.

| Hammer type | Hearing group | Threshold (dB re 1 µPa²·s) | Summer 0 dB | Summer 10 dB | Summer 12 dB | Summer 15 dB | Winter 0 dB | Winter 10 dB | Winter 12 dB | Winter 15 dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Vibratory (30 min) | LF | 199 | 0.57 | 0.13 | 0.10 | 0.04 | 0.60 | 0.13 | 0.10 | 0.04 |
| Vibratory (30 min) | MF | 198 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | HF | 173 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | PW | 201 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | TUW | 220 | 0.04 | - | - | - | 0.04 | - | - | - |
| Vibratory and Impact | LF | 183 | 11.12 | 11.12 | 4.78 | 4.01 | 12.66 | 4.95 | 4.12 | 2.96 |
| Vibratory and Impact | MF | 185 | 0.02 | 0.02 | - | - | 0.02 | - | - | - |
| Vibratory and Impact | HF | 155 | 1.35 | 1.35 | 0.32 | 0.27 | 1.39 | 0.32 | 0.26 | 0.12 |
| Vibratory and Impact | PW | 185 | 1.94 | 1.94 | 0.50 | 0.33 | 2.03 | 0.50 | 0.32 | 0.18 |
| Vibratory and Impact | TUW | 204 | 2.58 | 2.58 | 0.67 | 0.48 | 2.63 | 0.68 | 0.50 | 0.30 |

A dash (-) indicates that the acoustic threshold was not reached.

Table G-5. Jacket pin pile (4.25 m diameter, TR-CV320, MHU3500S) SEL acoustic ranges ($R_{95\%}$ in km) to acoustic threshold criteria (Finneran et al. 2017, NMFS 2018) with various levels of attenuation for location L01 in summer and winter. Ranges to impact pile driving thresholds include the acoustic energy from vibratory driving.

| Hammer type | Hearing group | Threshold (dB re 1 µPa²·s) | Summer 0 dB | Summer 10 dB | Summer 12 dB | Summer 15 dB | Winter 0 dB | Winter 10 dB | Winter 12 dB | Winter 15 dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Vibratory (30 min) | LF | 199 | 0.37 | 0.08 | 0.06 | 0.02 | 0.38 | 0.08 | 0.06 | 0.02 |
| Vibratory (30 min) | MF | 198 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | HF | 173 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | PW | 201 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | TUW | 220 | - | - | - | - | - | - | - | - |
| Vibratory and Impact | LF | 183 | 8.43 | 4.13 | 3.55 | 2.68 | 10.74 | 4.53 | 3.86 | 2.84 |
| Vibratory and Impact | MF | 185 | - | - | - | - | - | - | - | - |
| Vibratory and Impact | HF | 155 | 0.87 | 0.21 | 0.14 | 0.09 | 0.95 | 0.25 | 0.15 | 0.10 |
| Vibratory and Impact | PW | 185 | 1.85 | 0.56 | 0.40 | 0.27 | 1.99 | 0.58 | 0.41 | 0.28 |
| Vibratory and Impact | TUW | 204 | 2.44 | 0.76 | 0.57 | 0.36 | 2.58 | 0.78 | 0.59 | 0.37 |

A dash (-) indicates that the acoustic threshold was not reached.

Table G-6. Jacket pin pile (4.25 m diameter, TR-CV320, MHU3500S) SEL acoustic ranges ($R_{95\%}$ in km) to acoustic threshold criteria (Finneran et al. 2017, NMFS 2018) with various levels of attenuation for location L02 in summer and winter. Ranges to impact pile driving thresholds include the acoustic energy from vibratory driving.

| Hammer type | Hearing group | Threshold (dB re 1 µPa²·s) | Summer 0 dB | Summer 10 dB | Summer 12 dB | Summer 15 dB | Winter 0 dB | Winter 10 dB | Winter 12 dB | Winter 15 dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Vibratory (30 min) | LF | 199 | 0.52 | 0.12 | 0.09 | 0.02 | 0.54 | 0.12 | 0.05 | 0.02 |
| Vibratory (30 min) | MF | 198 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | HF | 173 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | PW | 201 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | TUW | 220 | - | - | - | - | - | - | - | - |
| Vibratory and Impact | LF | 183 | 12.50 | 5.23 | 4.38 | 3.24 | 14.19 | 5.45 | 4.53 | 3.37 |
| Vibratory and Impact | MF | 185 | - | - | - | - | - | - | - | - |
| Vibratory and Impact | HF | 155 | 0.92 | 0.23 | 0.11 | 0.08 | 1.06 | 0.23 | 0.15 | 0.09 |
| Vibratory and Impact | PW | 185 | 2.19 | 0.56 | 0.36 | 0.20 | 2.29 | 0.57 | 0.37 | 0.20 |
| Vibratory and Impact | TUW | 204 | 2.82 | 0.74 | 0.57 | 0.34 | 2.91 | 0.76 | 0.58 | 0.34 |

A dash (-) indicates that the acoustic threshold was not reached.

Table G-7. Difficult-to-drive jacket pin pile (4.25 m diameter, TR-CV320, MHU3500S) SEL acoustic ranges ($R_{95\%}$ in km) to acoustic threshold criteria (Finneran et al. 2017, NMFS 2018) with various levels of attenuation for location L01 in summer and winter. Ranges to impact pile driving thresholds include the acoustic energy from vibratory driving.

| Hammer type | Hearing group | Threshold (dB re 1 µPa²·s) | Summer 0 dB | Summer 10 dB | Summer 12 dB | Summer 15 dB | Winter 0 dB | Winter 10 dB | Winter 12 dB | Winter 15 dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Vibratory (30 min) | LF | 199 | 0.37 | 0.08 | 0.06 | 0.02 | 0.38 | 0.08 | 0.06 | 0.02 |
| Vibratory (30 min) | MF | 198 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | HF | 173 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | PW | 201 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | TUW | 220 | - | - | - | - | - | - | - | - |
| Vibratory and Impact | LF | 183 | 8.86 | 4.42 | 3.82 | 2.89 | 11.61 | 4.88 | 4.16 | 3.17 |
| Vibratory and Impact | MF | 185 | - | - | - | - | 0.02 | - | - | - |
| Vibratory and Impact | HF | 155 | 0.94 | 0.25 | 0.17 | 0.10 | 1.04 | 0.29 | 0.19 | 0.12 |
| Vibratory and Impact | PW | 185 | 2.08 | 0.65 | 0.47 | 0.31 | 2.26 | 0.67 | 0.48 | 0.32 |
| Vibratory and Impact | TUW | 204 | 2.65 | 0.86 | 0.65 | 0.41 | 2.79 | 0.89 | 0.68 | 0.42 |

A dash (-) indicates that the acoustic threshold was not reached.

Table G-8. Difficult-to-drive jacket pin pile (4.25 m diameter, TR-CV320, MHU3500S) SEL acoustic ranges ($R_{95\%}$ in km) to acoustic threshold criteria (Finneran et al. 2017, NMFS 2018) with various levels of attenuation for location L02 in summer and winter. Ranges to impact pile driving thresholds include the acoustic energy from vibratory driving.

| Hammer type | Hearing group | Threshold (dB re 1 µPa²·s) | Summer 0 dB | Summer 10 dB | Summer 12 dB | Summer 15 dB | Winter 0 dB | Winter 10 dB | Winter 12 dB | Winter 15 dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Vibratory (30 min) | LF | 199 | 0.52 | 0.12 | 0.09 | 0.02 | 0.54 | 0.12 | 0.05 | 0.02 |
| Vibratory (30 min) | MF | 198 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | HF | 173 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | PW | 201 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | TUW | 220 | - | - | - | - | - | - | - | - |
| Vibratory and Impact | LF | 183 | 13.33 | 5.72 | 4.80 | 3.62 | 15.36 | 5.94 | 4.97 | 3.74 |
| Vibratory and Impact | MF | 185 | 0.02 | - | - | - | 0.02 | - | - | - |
| Vibratory and Impact | HF | 155 | 1.00 | 0.27 | 0.18 | 0.09 | 1.13 | 0.26 | 0.19 | 0.09 |
| Vibratory and Impact | PW | 185 | 2.48 | 0.61 | 0.50 | 0.30 | 2.57 | 0.62 | 0.51 | 0.28 |
| Vibratory and Impact | TUW | 204 | 3.25 | 0.90 | 0.66 | 0.41 | 3.34 | 0.93 | 0.67 | 0.42 |

A dash (-) indicates that the acoustic threshold was not reached.

Table G-9. Monopile (14 m diameter, TR-CV640, MHU5500) SEL acoustic ranges ($R_{95\%}$ in km) to acoustic threshold criteria (Finneran et al. 2017, NMFS 2018) with various levels of attenuation for location L01 in summer and winter. Ranges to impact pile driving thresholds include the acoustic energy from vibratory driving.

| Hammer type | Hearing group | Threshold (dB re 1 µPa²·s) | Summer 0 dB | Summer 10 dB | Summer 12 dB | Summer 15 dB | Winter 0 dB | Winter 10 dB | Winter 12 dB | Winter 15 dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Vibratory (30 min) | LF | 199 | 0.31 | 0.06 | 0.05 | 0.02 | 0.32 | 0.06 | 0.05 | 0.02 |
| Vibratory (30 min) | MF | 198 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | HF | 173 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | PW | 201 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | TUW | 220 | 0.02 | - | - | - | 0.02 | - | - | - |
| Vibratory and Impact | LF | 183 | 7.74 | 3.97 | 3.43 | 2.67 | 9.04 | 4.29 | 3.71 | 2.82 |
| Vibratory and Impact | MF | 185 | - | - | - | - | - | - | - | - |
| Vibratory and Impact | HF | 155 | 0.32 | 0.08 | 0.03 | 0.02 | 0.33 | 0.08 | 0.03 | 0.02 |
| Vibratory and Impact | PW | 185 | 1.79 | 0.57 | 0.40 | 0.27 | 1.90 | 0.60 | 0.41 | 0.27 |
| Vibratory and Impact | TUW | 204 | 2.61 | 0.92 | 0.72 | 0.47 | 2.76 | 0.96 | 0.76 | 0.49 |

A dash (-) indicates that the acoustic threshold was not reached.

Table G-10. Monopile (14 m diameter, TR-CV640, MHU5500) SEL acoustic ranges ($R_{95\%}$ in km) to acoustic threshold criteria (Finneran et al. 2017, NMFS 2018) with various levels of attenuation for location L02 in summer and winter. Ranges to impact pile driving thresholds include the acoustic energy from vibratory driving.

| Hammer type | Hearing group | Threshold (dB re 1 µPa²·s) | Summer 0 dB | Summer 10 dB | Summer 12 dB | Summer 15 dB | Winter 0 dB | Winter 10 dB | Winter 12 dB | Winter 15 dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Vibratory (30 min) | LF | 199 | 0.32 | 0.09 | 0.03 | - | 0.31 | 0.06 | 0.03 | - |
| Vibratory (30 min) | MF | 198 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | HF | 173 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | PW | 201 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | TUW | 220 | - | - | - | - | - | - | - | - |
| Vibratory and Impact | LF | 183 | 10.76 | 5.71 | 4.97 | 3.96 | 12.20 | 6.10 | 5.28 | 4.19 |
| Vibratory and Impact | MF | 185 | - | - | - | - | - | - | - | - |
| Vibratory and Impact | HF | 155 | 0.36 | 0.05 | 0.03 | - | 0.36 | 0.05 | 0.03 | - |
| Vibratory and Impact | PW | 185 | 2.60 | 0.65 | 0.56 | 0.33 | 2.72 | 0.67 | 0.57 | 0.32 |
| Vibratory and Impact | TUW | 204 | 3.86 | 1.26 | 0.94 | 0.60 | 4.09 | 1.31 | 0.96 | 0.62 |

A dash (-) indicates that the acoustic threshold was not reached.

Table G-11. Monopile (14 m diameter, TR-CV640, MHU6600) SEL acoustic ranges ($R_{95\%}$ in km) to acoustic threshold criteria (Finneran et al. 2017, NMFS 2018) with various levels of attenuation for location L01 in summer and winter. Ranges to impact pile driving thresholds include the acoustic energy from vibratory driving.

| Hammer type | Hearing group | Threshold (dB re 1 µPa$^2$·s) | Summer 0 dB | Summer 10 dB | Summer 12 dB | Summer 15 dB | Winter 0 dB | Winter 10 dB | Winter 12 dB | Winter 15 dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Vibratory (30 min) | LF | 199 | 0.31 | 0.06 | 0.05 | 0.02 | 0.32 | 0.06 | 0.05 | 0.02 |
| Vibratory (30 min) | MF | 198 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | HF | 173 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | PW | 201 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | TUW | 220 | 0.02 | - | - | - | 0.02 | - | - | - |
| Vibratory and Impact | LF | 183 | 9.25 | 4.88 | 4.26 | 3.45 | 11.52 | 5.40 | 4.64 | 3.72 |
| Vibratory and Impact | MF | 185 | - | - | - | - | - | - | - | - |
| Vibratory and Impact | HF | 155 | 0.46 | 0.11 | 0.09 | 0.03 | 0.47 | 0.11 | 0.09 | 0.03 |
| Vibratory and Impact | PW | 185 | 2.43 | 0.84 | 0.65 | 0.40 | 2.56 | 0.89 | 0.68 | 0.42 |
| Vibratory and Impact | TUW | 204 | 3.40 | 1.33 | 1.04 | 0.73 | 3.67 | 1.41 | 1.12 | 0.76 |

A dash (-) indicates that the acoustic threshold was not reached.

Table G-12. Monopile (14 m diameter, TR-CV640, MHU6600) SEL acoustic ranges ($R_{95\%}$ in km) to acoustic threshold criteria (Finneran et al. 2017, NMFS 2018) with various levels of attenuation for location L02 in summer and winter. Ranges to impact pile driving thresholds include the acoustic energy from vibratory driving.

| Hammer type | Hearing group | Threshold (dB re 1 µPa²·s) | Summer 0 dB | Summer 10 dB | Summer 12 dB | Summer 15 dB | Winter 0 dB | Winter 10 dB | Winter 12 dB | Winter 15 dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Vibratory (30 min) | LF | 199 | 0.32 | 0.09 | 0.03 | - | 0.31 | 0.06 | 0.03 | - |
| Vibratory (30 min) | MF | 198 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | HF | 173 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | PW | 201 | - | - | - | - | - | - | - | - |
| Vibratory (30 min) | TUW | 220 | - | - | - | - | - | - | - | - |
| Vibratory and Impact | LF | 183 | 12.83 | 6.87 | 6.05 | 4.92 | 14.76 | 7.43 | 6.45 | 5.22 |
| Vibratory and Impact | MF | 185 | - | - | - | - | - | - | - | - |
| Vibratory and Impact | HF | 155 | 0.59 | 0.13 | 0.08 | 0.03 | 0.60 | 0.13 | 0.07 | 0.03 |
| Vibratory and Impact | PW | 185 | 3.45 | 1.09 | 0.74 | 0.55 | 3.68 | 1.14 | 0.76 | 0.56 |
| Vibratory and Impact | TUW | 204 | 4.85 | 1.81 | 1.41 | 0.93 | 5.15 | 1.89 | 1.49 | 0.94 |

A dash (-) indicates that the acoustic threshold was not reached.

Table G-13. Jacket pin pile (4 m diameter, TRCV320) SPL acoustic ranges ($R_{95\%}$ in km) to behavior acoustic threshold criteria (Finneran et al. 2017, NMFS 2018) with various levels of attenuation for locations L01 and L02 in summer and winter.

| Hammer type | Location | Threshold (dB re 1 µPa²) | Summer 0 dB | Summer 10 dB | Summer 12 dB | Summer 15 dB | Winter 0 dB | Winter 10 dB | Winter 12 dB | Winter 15 dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Vibratory (30 min) | L01 | 120 | 31.44 | 17.95 | 16.38 | 14.26 | 58.93 | 26.83 | 23.16 | 18.03 |
| Vibratory (30 min) | L02 | 120 | 72.19 | 42.27 | 35.88 | 29.15 | 85.35 | 84.08 | 75.32 | 46.67 |

Table G-14. Jacket pin pile (4.25 m diameter, TRCV320) SPL acoustic ranges ($R_{95\%}$ in km) to behavior acoustic threshold criteria (Finneran et al. 2017, NMFS 2018) with various levels of attenuation for locations L01 and L02 in summer and winter.

| Hammer type | Location | Threshold (dB re 1 µPa²) | Summer 0 dB | Summer 10 dB | Summer 12 dB | Summer 15 dB | Winter 0 dB | Winter 10 dB | Winter 12 dB | Winter 15 dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Vibratory (30 min) | L01 | 120 | 30.89 | 17.21 | 15.65 | 13.48 | 60.97 | 25.66 | 21.67 | 17.01 |
| Vibratory (30 min) | L02 | 120 | 60.51 | 31.52 | 27.72 | 22.09 | 85.02 | 53.77 | 40.35 | 29.22 |

Table G-15. Monopile (14 m diameter, TRCV640) SPL acoustic ranges ($R_{95\%}$ in km) to behavior acoustic threshold criteria (Finneran et al. 2017, NMFS 2018) with various levels of attenuation for locations L01 and L02 in summer and winter.

| Hammer type | Location | Threshold (dB re 1 µPa$^2$) | Summer 0 dB | Summer 10 dB | Summer 12 dB | Summer 15 dB | Winter 0 dB | Winter 10 dB | Winter 12 dB | Winter 15 dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Vibratory (30 min) | L01 | 120 | 24.28 | 14.20 | 12.91 | 10.75 | 34.77 | 17.09 | 15.36 | 12.98 |
| Vibratory (30 min) | L02 | 120 | 53.58 | 26.74 | 23.17 | 18.29 | 84.95 | 40.63 | 32.32 | 24.68 |

## G.2. Fish and Sea Turtle Acoustic Distances to Threshold

The calculated acoustic distances for fish to the GARFO (2020) and Popper et al. (2014) thresholds (Andersson et al. 2007, Wysocki et al. 2007, FHWG 2008, Stadler and Woodbury 2009, Mueller-Blenkle et al. 2010, Purser and Radford 2011, Popper et al. 2014) with 0, 12, and 15 dB of broadband attenuation are shown in Tables G-16 to G-230. In the following tables, a dash indicates that distances could not be estimated because thresholds were not reached. “NA” means that the thresholds are not applicable for the specific case. The metrics used in the tables are $L_{pk}$ for peak sound pressure (dB re 1 µPa), $L_E$ for sound exposure level (dB re 1 µPa$^2$·s), and $L_p$ for root mean square sound pressure (dB re 1 µPa$^2$). References [a] through [e] are as follows:

- [a] NMFS recommended criteria adopted from the Fisheries Hydroacoustic Working Group (FHWG 2008).
- [b] Andersson et al. (2007), Mueller-Blenkle et al. (2010), Purser and Radford (2011), Wysocki et al. (2007).
- [c] Popper et al. (2014).
- [d] Finneran et al. (2017).
- [e] McCauley et al. (2000).

SEL results were estimated from the combined vibratory and impact pile driving acoustic fields. Post-piled jacket foundation SEL results ($L_E$) include the addition of a 2 dB shift.

## G.2.1. Monopile Foundation (Typical)

### G.2.1.1. 14 m Typical Monopile with an MHU 5500 Hammer

Table G-16. Typical monopile foundation (14 m diameter, TRC V640 and MHU5500) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 2500 kJ | Summer 3500 kJ | Summer 4400 kJ | Winter Vibr. | Winter 2500 kJ | Winter 3500 kJ | Winter 4400 kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.17 | 0.30 | 0.32 | NA | 0.17 | 0.30 | 0.33 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.02 | 12.33 | 13.01 | 14.99 | 5.33 | 15.17 | 16.22 | 19.33 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.17 | 0.30 | 0.32 | NA | 0.17 | 0.30 | 0.33 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.02 | 12.33 | 13.01 | 14.99 | 5.33 | 15.17 | 16.22 | 19.33 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.07 | 0.09 | 0.09 | NA | 0.07 | 0.09 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.15 | 0.18 | 0.31 | NA | 0.15 | 0.27 | 0.31 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.15 | 0.18 | 0.31 | NA | 0.15 | 0.27 | 0.31 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | NA | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.58 | 2.27 | 2.65 | 3.13 | 0.63 | 2.39 | 2.77 | 3.38 |

Table G-17. Typical monopile foundation (14 m diameter, TRC V640 and MHU5500) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 9.66 | 11.89 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 12.41 | 15.57 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.96 | 1.02 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 3.53 | 3.79 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 3.53 | 3.79 |
| Sea turtles | $L_E$ [d] | 204 [d] | 3.23 | 3.49 |

Table G-18. Typical monopile foundation (14 m diameter, TRC V640 and MHU5500) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 2500 kJ | Summer 3500 kJ | Summer 4400 kJ | Winter Vibr. | Winter 2500 kJ | Winter 3500 kJ | Winter 4400 kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.03 | 0.04 | 0.05 | NA | 0.03 | 0.04 | 0.05 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.20 | 6.06 | 6.57 | 7.63 | 2.36 | 6.80 | 7.48 | 8.70 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.03 | 0.04 | 0.05 | NA | 0.03 | 0.04 | 0.05 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.20 | 6.06 | 6.57 | 7.63 | 2.36 | 6.80 | 7.48 | 8.70 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | NA | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.02 | 0.03 | 0.04 | NA | 0.02 | 0.03 | 0.04 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.02 | 0.03 | 0.04 | NA | 0.02 | 0.03 | 0.04 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | NA | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.08 | 0.60 | 0.76 | 0.92 | 0.08 | 0.62 | 0.79 | 0.94 |

Table G-19. Typical monopile foundation (14 m diameter, TRC V640 and MHU5500) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 4.67 | 5.09 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 6.03 | 6.74 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.16 | 0.16 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 1.10 | 1.18 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 1.10 | 1.18 |
| Sea turtles | $L_E$ [d] | 204 [d] | 0.96 | 1.02 |

Table G-20. Typical monopile foundation (14 m diameter, TRC V640 and MHU5500) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 2500 kJ | Summer 3500 kJ | Summer 4400 kJ | Winter Vibr. | Winter 2500 kJ | Winter 3500 kJ | Winter 4400 kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | 0.02 | 0.03 | NA | - | 0.02 | 0.03 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.70 | 4.99 | 5.48 | 6.34 | 1.80 | 5.52 | 6.09 | 7.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | 0.02 | 0.03 | NA | - | 0.02 | 0.03 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.70 | 4.99 | 5.48 | 6.34 | 1.80 | 5.52 | 6.09 | 7.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | NA | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | 0.03 | NA | - | - | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | 0.03 | NA | - | - | 0.03 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | NA | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.05 | 0.36 | 0.52 | 0.64 | 0.05 | 0.37 | 0.54 | 0.66 |

Table G-21. Typical monopile foundation (14 m diameter, TRC V640 and MHU5500) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 3.81 | 4.09 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 4.98 | 5.46 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.09 | 0.09 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 0.76 | 0.82 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 0.76 | 0.82 |
| Sea turtles | $L_E$ [d] | 204 [d] | 0.67 | 0.71 |

Table G-22. Typical monopile foundation (14 m diameter, TRC V640 and MHU5500) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 2500 kJ | Summer 3500 kJ | Summer 4400 kJ | Winter Vibr. | Winter 2500 kJ | Winter 3500 kJ | Winter 4400 kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.20 | 0.32 | 0.51 | NA | 0.22 | 0.34 | 0.50 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 8.07 | 18.77 | 20.68 | 22.88 | 8.47 | 25.01 | 27.98 | 32.76 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.20 | 0.32 | 0.51 | NA | 0.22 | 0.34 | 0.50 |
| Fish < 2 g | $L_p$ [b] | 150 | 8.07 | 18.77 | 20.68 | 22.88 | 8.47 | 25.01 | 27.98 | 32.76 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.11 | 0.13 | 0.14 | NA | 0.11 | 0.13 | 0.14 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.19 | 0.27 | 0.37 | NA | 0.20 | 0.28 | 0.38 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.19 | 0.27 | 0.37 | NA | 0.20 | 0.28 | 0.38 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | NA | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.55 | 3.15 | 3.72 | 4.19 | 0.54 | 3.32 | 3.89 | 4.38 |

Table G-23. Typical monopile foundation (14 m diameter, TRC V640 and MHU5500) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 14.70 | 17.34 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 18.47 | 24.47 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 1.33 | 1.39 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 5.10 | 5.42 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 5.10 | 5.42 |
| Sea turtles | $L_E$ [d] | 204 [d] | 4.73 | 5.02 |

Table G-24. Typical monopile foundation (14 m diameter, TRC V640 and MHU5500) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 2500 kJ | Summer 3500 kJ | Summer 4400 kJ | Winter Vibr. | Winter 2500 kJ | Winter 3500 kJ | Winter 4400 kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.02 | 0.06 | 0.08 | NA | 0.02 | 0.04 | 0.08 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 3.30 | 8.44 | 9.22 | 10.48 | 3.43 | 9.14 | 10.49 | 11.84 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.02 | 0.06 | 0.08 | NA | 0.02 | 0.04 | 0.08 |
| Fish < 2 g | $L_p$ [b] | 150 | 3.30 | 8.44 | 9.22 | 10.48 | 3.43 | 9.14 | 10.49 | 11.84 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | NA | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | 0.02 | 0.06 | NA | - | 0.02 | 0.05 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | 0.02 | 0.06 | NA | - | 0.02 | 0.05 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | NA | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.09 | 0.74 | 1.01 | 1.25 | 0.09 | 0.76 | 1.06 | 1.29 |

Table G-25. Typical monopile foundation (14 m diameter, TRC V640 and MHU5500) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 6.75 | 7.31 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 8.80 | 9.59 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.18 | 0.18 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 1.55 | 1.60 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 1.55 | 1.60 |
| Sea turtles | $L_E$ [d] | 204 [d] | 1.33 | 1.39 |

Table G-26. Typical monopile foundation (14 m diameter, TRC V640 and MHU5500) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 2500 kJ | Summer 3500 kJ | Summer 4400 kJ | Winter Vibr. | Winter 2500 kJ | Winter 3500 kJ | Winter 4400 kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | 0.02 | NA | - | - | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.38 | 6.86 | 7.53 | 8.60 | 2.43 | 7.41 | 8.30 | 9.21 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | 0.02 | NA | - | - | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.38 | 6.86 | 7.53 | 8.60 | 2.43 | 7.41 | 8.30 | 9.21 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | NA | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | NA | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | NA | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | NA | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.06 | 0.53 | 0.66 | 0.88 | 0.06 | 0.54 | 0.68 | 0.90 |

Table G-27. Typical monopile foundation (14 m diameter, TRC V640 and MHU5500) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 5.50 | 5.84 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 7.25 | 7.87 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.14 | 0.14 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 1.00 | 1.05 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 1.00 | 1.05 |
| Sea turtles | $L_E$ [d] | 204 [d] | 0.89 | 0.91 |

## G.2.2. Monopile Foundation (Difficult-to-drive)

### G.2.2.1. 14 m Difficult-to-Drive Monopile with an MHU-6600 Hammer

Table G-28. Difficult-to-drive monopile foundation (14 m diameter, TRC V640 and MHU6600) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 4500 kJ | Summer 6600 (a) kJ | Summer 6600 (b) kJ | Winter Vibr. | Winter 4500 kJ | Winter 6600 (a) kJ | Winter 6600 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.31 | 0.41 | 0.42 | NA | 0.31 | 0.40 | 0.41 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.02 | 14.71 | 15.30 | 16.69 | 5.33 | 18.46 | 20.03 | 22.92 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.31 | 0.41 | 0.42 | NA | 0.31 | 0.40 | 0.41 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.02 | 14.71 | 15.30 | 16.69 | 5.33 | 18.46 | 20.03 | 22.92 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.09 | 0.11 | 0.12 | NA | 0.09 | 0.11 | 0.12 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.28 | 0.32 | 0.34 | NA | 0.29 | 0.33 | 0.34 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.28 | 0.32 | 0.34 | NA | 0.29 | 0.33 | 0.34 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | NA | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.58 | 2.92 | 3.51 | 3.77 | 0.63 | 3.20 | 3.78 | 4.04 |

Table G-29. Difficult-to-drive monopile foundation (14 m diameter, TRC V640 and MHU6600) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 11.78 | 14.57 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 14.61 | 19.02 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 1.39 | 1.46 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 4.38 | 4.75 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 4.38 | 4.75 |
| Sea turtles | $L_E$ [d] | 204 [d] | 4.10 | 4.42 |

Table G-30. Difficult-to-drive monopile foundation (14 m diameter, TRC V640 and MHU6600) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 4500 kJ | Summer 6600 (a) kJ | Summer 6600 (b) kJ | Winter Vibr. | Winter 4500 kJ | Winter 6600 (a) kJ | Winter 6600 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.05 | 0.06 | 0.06 | NA | 0.05 | 0.06 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.20 | 7.50 | 8.07 | 8.59 | 2.36 | 8.56 | 9.17 | 10.01 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.05 | 0.06 | 0.06 | NA | 0.05 | 0.06 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.20 | 7.50 | 8.07 | 8.59 | 2.36 | 8.56 | 9.17 | 10.01 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | NA | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.04 | 0.06 | 0.06 | NA | 0.03 | 0.06 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.04 | 0.06 | 0.06 | NA | 0.03 | 0.06 | 0.06 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | NA | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.08 | 0.84 | 1.17 | 1.17 | 0.08 | 0.88 | 1.22 | 1.23 |

Table G-31. Difficult-to-drive monopile foundation (14 m diameter, TRC V640 and MHU6600) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 5.69 | 6.32 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 7.31 | 8.36 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.28 | 0.29 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 1.54 | 1.63 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 1.54 | 1.63 |
| Sea turtles | $L_E$ [d] | 204 [d] | 1.39 | 1.46 |

Table G-32. Difficult-to-drive monopile foundation (14 m diameter, TRC V640 and MHU6600) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 4500 kJ | Summer 6600 (a) kJ | Summer 6600 (b) kJ | Winter Vibr. | Winter 4500 kJ | Winter 6600 (a) kJ | Winter 6600 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.03 | 0.04 | 0.04 | NA | 0.03 | 0.03 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.70 | 6.20 | 6.75 | 7.23 | 1.80 | 6.98 | 7.65 | 8.22 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.03 | 0.04 | 0.04 | NA | 0.03 | 0.03 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.70 | 6.20 | 6.75 | 7.23 | 1.80 | 6.98 | 7.65 | 8.22 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | NA | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.02 | 0.03 | 0.03 | NA | - | 0.03 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.02 | 0.03 | 0.03 | NA | - | 0.03 | 0.03 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | NA | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.05 | 0.58 | 0.79 | 0.84 | 0.05 | 0.60 | 0.84 | 0.88 |

Table G-33. Difficult-to-drive monopile foundation (14 m diameter, TRC V640 and MHU6600) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 4.69 | 5.11 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 6.06 | 6.77 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.15 | 0.16 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 1.10 | 1.17 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 1.10 | 1.17 |
| Sea turtles | $L_E$ [d] | 204 [d] | 0.96 | 1.01 |

Table G-34. Difficult-to-drive monopile foundation (14 m diameter, TRC V640 and MHU6600) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 4500 kJ | Summer 6600 (a) kJ | Summer 6600 (b) kJ | Winter Vibr. | Winter 4500 kJ | Winter 6600 (a) kJ | Winter 6600 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.38 | 0.56 | 0.57 | NA | 0.38 | 0.55 | 0.57 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 8.07 | 23.36 | 25.36 | 25.98 | 8.47 | 31.39 | 38.08 | 41.18 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.38 | 0.56 | 0.57 | NA | 0.38 | 0.55 | 0.57 |
| Fish < 2 g | $L_p$ [b] | 150 | 8.07 | 23.36 | 25.36 | 25.98 | 8.47 | 31.39 | 38.08 | 41.18 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.14 | 0.16 | 0.17 | NA | 0.14 | 0.17 | 0.18 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.30 | 0.52 | 0.54 | NA | 0.31 | 0.50 | 0.53 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.30 | 0.52 | 0.54 | NA | 0.31 | 0.50 | 0.53 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | NA | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.55 | 4.05 | 4.65 | 4.80 | 0.54 | 4.26 | 4.91 | 5.06 |

Table G-35. Difficult-to-drive monopile foundation (14 m diameter, TRC V640 and MHU6600) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 17.39 | 22.21 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 22.91 | 31.49 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 1.89 | 1.98 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 6.25 | 6.67 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 6.25 | 6.67 |
| Sea turtles | $L_E$ [d] | 204 [d] | 5.83 | 6.22 |

Table G-36. Difficult-to-drive monopile foundation (14 m diameter, TRC V640 and MHU6600) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 4500 kJ | Summer 6600 (a) kJ | Summer 6600 (b) kJ | Winter Vibr. | Winter 4500 kJ | Winter 6600 (a) kJ | Winter 6600 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.08 | 0.10 | 0.10 | NA | 0.08 | 0.09 | 0.10 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 3.30 | 10.35 | 11.76 | 11.97 | 3.43 | 11.94 | 13.35 | 13.60 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.08 | 0.10 | 0.10 | NA | 0.08 | 0.09 | 0.10 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 3.30 | 10.35 | 11.76 | 11.97 | 3.43 | 11.94 | 13.35 | 13.60 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | NA | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.03 | 0.09 | 0.09 | NA | 0.03 | 0.09 | 0.09 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.03 | 0.09 | 0.09 | NA | 0.03 | 0.09 | 0.09 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | NA | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.09 | 1.18 | 1.53 | 1.60 | 0.09 | 1.22 | 1.59 | 1.64 |

Table G-37. Difficult-to-drive monopile foundation (14 m diameter, TRC V640 and MHU6600) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 8.22 | 8.92 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 10.71 | 12.10 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.33 | 0.32 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 2.15 | 2.26 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 2.15 | 2.26 |
| Sea turtles | $L_E$ [d] | 204 [d] | 1.89 | 1.98 |

Table G-38. Difficult-to-drive monopile foundation (14 m diameter, TRC V640 and MHU6600) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 4500 kJ | Summer 6600 (a) kJ | Summer 6600 (b) kJ | Winter Vibr. | Winter 4500 kJ | Winter 6600 (a) kJ | Winter 6600 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.02 | 0.03 | 0.06 | NA | 0.02 | 0.03 | 0.04 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.38 | 8.42 | 9.31 | 9.62 | 2.43 | 9.11 | 10.60 | 10.86 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.02 | 0.03 | 0.06 | NA | 0.02 | 0.03 | 0.04 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.38 | 8.42 | 9.31 | 9.62 | 2.43 | 9.11 | 10.60 | 10.86 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | NA | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | 0.02 | 0.03 | NA | - | 0.02 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | 0.02 | 0.03 | NA | - | 0.02 | 0.03 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | NA | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.06 | 0.73 | 1.01 | 1.11 | 0.06 | 0.74 | 1.06 | 1.15 |

Table G-39. Difficult-to-drive monopile foundation (14 m diameter, TRC V640 and MHU6600) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 6.68 | 7.22 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 8.73 | 9.49 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.17 | 0.18 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 1.51 | 1.57 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 1.51 | 1.57 |
| Sea turtles | $L_E$ [d] | 204 [d] | 1.29 | 1.34 |

## G.2.3. Jacket Foundation, 4 m Diameter Pin Pile (Typical)

### G.2.3.1. 4 Pin Piles, Pre-piled

Table G-40. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$[a] | 206 | NA | 0.09 | 0.11 | 0.13 | 0.17 | 0.28 | 0.09 | NA | 0.09 | 0.12 | 0.13 | 0.17 | 0.26 | 0.09 |
| Fish ≥ 2g | $L_{p}$[b] | 150 | 5.69 | 7.06 | 8.30 | 9.30 | 9.63 | 13.38 | 11.50 | 6.53 | 8.15 | 9.79 | 11.65 | 11.98 | 18.05 | 13.44 |
| Fish < 2 g | $L_{pk}$[a] | 206 | NA | 0.09 | 0.11 | 0.13 | 0.17 | 0.28 | 0.09 | NA | 0.09 | 0.12 | 0.13 | 0.17 | 0.26 | 0.09 |
| Fish < 2 g | $L_{p}$[b] | 150 | 5.69 | 7.06 | 8.30 | 9.30 | 9.63 | 13.38 | 11.50 | 6.53 | 8.15 | 9.79 | 11.65 | 11.98 | 18.05 | 13.44 |
| Fish without swim bladder | $L_{pk}$[c] | 213 | NA | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.02 | NA | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$[c] | 207 | NA | 0.09 | 0.11 | 0.12 | 0.13 | 0.23 | 0.06 | NA | 0.09 | 0.11 | 0.12 | 0.13 | 0.19 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$[c] | 207 | NA | 0.09 | 0.11 | 0.12 | 0.13 | 0.23 | 0.06 | NA | 0.09 | 0.11 | 0.12 | 0.13 | 0.19 | 0.06 |
| Sea turtles | $L_{Pk}$[d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$[e] | 175 | 0.55 | 0.84 | 1.15 | 1.43 | 1.69 | 2.21 | 1.15 | 0.60 | 0.88 | 1.19 | 1.48 | 1.77 | 2.33 | 1.14 |

Table G-41. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 12.66 | 16.42 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 16.30 | 24.25 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 1.21 | 1.25 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 4.20 | 4.50 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 4.20 | 4.50 |
| Sea turtles | $L_E$ [d] | 204 [d] | 3.91 | 4.16 |

Table G-42. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.13 | 3.09 | 3.79 | 4.30 | 4.65 | 6.19 | 4.38 | 2.35 | 3.32 | 4.05 | 4.63 | 5.01 | 7.17 | 4.32 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.13 | 3.09 | 3.79 | 4.30 | 4.65 | 6.19 | 4.38 | 2.35 | 3.32 | 4.05 | 4.63 | 5.01 | 7.17 | 4.32 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.09 | 0.12 | 0.18 | 0.30 | 0.37 | 0.48 | 0.23 | 0.09 | 0.12 | 0.18 | 0.30 | 0.37 | 0.48 | 0.23 |

Table G-43. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa2·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 5.56 | 6.13 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 7.34 | 8.41 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.22 | 0.22 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 1.36 | 1.40 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 1.36 | 1.40 |
| Sea turtles | $L_E$ [d] | 204 [d] | 1.21 | 1.25 |

Table G-44. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.66 | 2.43 | 2.93 | 3.49 | 3.87 | 5.07 | 3.35 | 1.73 | 2.56 | 3.14 | 3.73 | 4.12 | 5.67 | 3.26 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish < 2 g | $L_p$ [b] | 150 | 1.66 | 2.43 | 2.93 | 3.49 | 3.87 | 5.07 | 3.35 | 1.73 | 2.56 | 3.14 | 3.73 | 4.12 | 5.67 | 3.26 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.05 | 0.09 | 0.11 | 0.16 | 0.21 | 0.28 | 0.15 | 0.05 | 0.09 | 0.11 | 0.16 | 0.21 | 0.29 | 0.14 |

Table G-45. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 4.51 | 4.87 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 5.96 | 6.62 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.13 | 0.13 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 0.93 | 0.95 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 0.93 | 0.95 |
| Sea turtles | $L_E$ [d] | 204 [d] | 0.84 | 0.86 |

Table G-46. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.13 | 0.15 | 0.15 | 0.15 | 0.15 | 0.06 | NA | 0.13 | 0.16 | 0.16 | 0.15 | 0.15 | 0.06 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 8.85 | 8.56 | 10.58 | 13.74 | 18.50 | 26.94 | 14.29 | 9.60 | 9.12 | 12.03 | 17.56 | 26.55 | 44.16 | 13.33 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.13 | 0.15 | 0.15 | 0.15 | 0.15 | 0.06 | NA | 0.13 | 0.16 | 0.16 | 0.15 | 0.15 | 0.06 |
| Fish < 2 g | $L_p$ [b] | 150 | 8.85 | 8.56 | 10.58 | 13.74 | 18.50 | 26.94 | 14.29 | 9.60 | 9.12 | 12.03 | 17.56 | 26.55 | 44.16 | 13.33 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | 0.02 | 0.08 | 0.08 | 0.09 | 0.02 | NA | - | 0.02 | 0.07 | 0.09 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.12 | 0.14 | 0.14 | 0.13 | 0.14 | 0.06 | NA | 0.12 | 0.14 | 0.14 | 0.14 | 0.14 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.12 | 0.14 | 0.14 | 0.13 | 0.14 | 0.06 | NA | 0.12 | 0.14 | 0.14 | 0.14 | 0.14 | 0.06 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.66 | 1.13 | 1.58 | 1.77 | 1.86 | 2.12 | 1.11 | 0.67 | 1.18 | 1.62 | 1.78 | 1.85 | 2.12 | 1.11 |

Table G-47. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 21.49 | 29.49 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 30.15 | 56.58 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 1.34 | 1.35 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 5.60 | 5.82 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 5.60 | 5.82 |
| Sea turtles | $L_E$ [d] | 204 [d] | 5.12 | 5.29 |

Table G-48. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.98 | 4.19 | 5.21 | 6.09 | 7.13 | 9.26 | 4.39 | 3.11 | 4.38 | 5.48 | 6.52 | 7.86 | 9.89 | 4.17 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.98 | 4.19 | 5.21 | 6.09 | 7.13 | 9.26 | 4.39 | 3.11 | 4.38 | 5.48 | 6.52 | 7.86 | 9.89 | 4.17 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.02 | - | NA | - | - | - | - | 0.02 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.02 | - | NA | - | - | - | - | 0.02 | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.11 | 0.17 | 0.19 | 0.30 | 0.30 | 0.38 | 0.21 | 0.11 | 0.17 | 0.19 | 0.28 | 0.28 | 0.39 | 0.20 |

Table G-49. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_{E}^{a}$ | 187 [a] | 7.94 | 8.51 |
| Fish < 2 g | $L_{E}^{a}$ | 183 [a] | 11.20 | 12.61 |
| Fish without swim bladder | $L_{E}^{c}$ | 216 [c] | 0.19 | 0.19 |
| Fish with swim bladder not involved in hearing | $L_{E}^{c}$ | 203 [c] | 1.52 | 1.55 |
| Fish with swim bladder involved in hearing | $L_{E}^{c}$ | 203 [c] | 1.52 | 1.55 |
| Sea turtles | $L_{E}^{d}$ | 204 [d] | 1.34 | 1.35 |

Table G-50. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}^{a}$ | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish ≥ 2g | $L_{p}^{b}$ | 150 | 2.22 | 3.30 | 4.24 | 4.82 | 5.37 | 7.06 | 3.14 | 2.31 | 3.49 | 4.43 | 4.96 | 5.78 | 7.18 | 3.02 |
| Fish < 2 g | $L_{pk}^{a}$ | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish < 2 g | $L_{p}^{b}$ | 150 | 2.22 | 3.30 | 4.24 | 4.82 | 5.37 | 7.06 | 3.14 | 2.31 | 3.49 | 4.43 | 4.96 | 5.78 | 7.18 | 3.02 |
| Fish without swim bladder | $L_{pk}^{c}$ | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}^{c}$ | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}^{c}$ | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}^{d}$ | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}^{e}$ | 175 | 0.05 | 0.13 | 0.15 | 0.15 | 0.17 | 0.23 | 0.17 | 0.05 | 0.13 | 0.15 | 0.15 | 0.16 | 0.22 | 0.16 |

Table G-51. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 6.11 | 6.38 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 8.61 | 9.24 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.13 | 0.13 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 0.98 | 1.00 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 0.98 | 1.00 |
| Sea turtles | $L_E$ [d] | 204 [d] | 0.85 | 0.86 |

### G.2.3.2. 4 Pin Piles, Post-piled

Table G-52. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.09 | 0.11 | 0.13 | 0.17 | 0.28 | 0.09 | NA | 0.09 | 0.12 | 0.13 | 0.17 | 0.26 | 0.09 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 5.69 | 7.06 | 8.30 | 9.30 | 9.63 | 13.38 | 11.50 | 6.53 | 8.15 | 9.79 | 11.65 | 11.98 | 18.05 | 13.44 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.09 | 0.11 | 0.13 | 0.17 | 0.28 | 0.09 | NA | 0.09 | 0.12 | 0.13 | 0.17 | 0.26 | 0.09 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 5.69 | 7.06 | 8.30 | 9.30 | 9.63 | 13.38 | 11.50 | 6.53 | 8.15 | 9.79 | 11.65 | 11.98 | 18.05 | 13.44 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.02 | NA | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.09 | 0.11 | 0.12 | 0.13 | 0.23 | 0.06 | NA | 0.09 | 0.11 | 0.12 | 0.13 | 0.19 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.09 | 0.11 | 0.12 | 0.13 | 0.23 | 0.06 | NA | 0.09 | 0.11 | 0.12 | 0.13 | 0.19 | 0.06 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.55 | 0.84 | 1.15 | 1.43 | 1.69 | 2.21 | 1.15 | 0.60 | 0.88 | 1.19 | 1.48 | 1.77 | 2.33 | 1.14 |

Table G-53. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 14.35 | 19.55 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 18.34 | 29.73 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 1.50 | 1.55 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 4.84 | 5.26 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 4.84 | 5.26 |
| Sea turtles | $L_E$ [d] | 204 [d] | 4.51 | 4.87 |

Table G-54. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.13 | 3.09 | 3.79 | 4.30 | 4.65 | 6.19 | 4.38 | 2.35 | 3.32 | 4.05 | 4.63 | 5.01 | 7.17 | 4.32 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.13 | 3.09 | 3.79 | 4.30 | 4.65 | 6.19 | 4.38 | 2.35 | 3.32 | 4.05 | 4.63 | 5.01 | 7.17 | 4.32 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.09 | 0.12 | 0.18 | 0.30 | 0.37 | 0.48 | 0.23 | 0.09 | 0.12 | 0.18 | 0.30 | 0.37 | 0.48 | 0.23 |

Table G-55. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 6.37 | 7.20 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 8.38 | 9.79 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.31 | 0.32 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 1.68 | 1.73 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 1.68 | 1.73 |
| Sea turtles | $L_E$ [d] | 204 [d] | 1.50 | 1.55 |

Table G-56. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.66 | 2.43 | 2.93 | 3.49 | 3.87 | 5.07 | 3.35 | 1.73 | 2.56 | 3.14 | 3.73 | 4.12 | 5.67 | 3.26 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish < 2 g | $L_p$ [b] | 150 | 1.66 | 2.43 | 2.93 | 3.49 | 3.87 | 5.07 | 3.35 | 1.73 | 2.56 | 3.14 | 3.73 | 4.12 | 5.67 | 3.26 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.05 | 0.09 | 0.11 | 0.16 | 0.21 | 0.28 | 0.15 | 0.05 | 0.09 | 0.11 | 0.16 | 0.21 | 0.29 | 0.14 |

Table G-57. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 5.19 | 5.68 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 6.82 | 7.80 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.18 | 0.18 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 1.21 | 1.25 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 1.21 | 1.25 |
| Sea turtles | $L_E$ [d] | 204 [d] | 1.06 | 1.10 |

Table G-58. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.13 | 0.15 | 0.15 | 0.15 | 0.15 | 0.06 | NA | 0.13 | 0.16 | 0.16 | 0.15 | 0.15 | 0.06 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 8.85 | 8.56 | 10.58 | 13.74 | 18.50 | 26.94 | 14.29 | 9.60 | 9.12 | 12.03 | 17.56 | 26.55 | 44.16 | 13.33 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.13 | 0.15 | 0.15 | 0.15 | 0.15 | 0.06 | NA | 0.13 | 0.16 | 0.16 | 0.15 | 0.15 | 0.06 |
| Fish < 2 g | $L_p$ [b] | 150 | 8.85 | 8.56 | 10.58 | 13.74 | 18.50 | 26.94 | 14.29 | 9.60 | 9.12 | 12.03 | 17.56 | 26.55 | 44.16 | 13.33 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | 0.02 | 0.08 | 0.08 | 0.09 | 0.02 | NA | - | 0.02 | 0.07 | 0.09 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.12 | 0.14 | 0.14 | 0.13 | 0.14 | 0.06 | NA | 0.12 | 0.14 | 0.14 | 0.14 | 0.14 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.12 | 0.14 | 0.14 | 0.13 | 0.14 | 0.06 | NA | 0.12 | 0.14 | 0.14 | 0.14 | 0.14 | 0.06 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.66 | 1.13 | 1.58 | 1.77 | 1.86 | 2.12 | 1.11 | 0.67 | 1.18 | 1.62 | 1.78 | 1.85 | 2.12 | 1.11 |

Table G-59. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 25.49 | 39.30 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 36.38 | 82.33 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 1.73 | 1.75 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 6.63 | 7.02 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 6.63 | 7.02 |
| Sea turtles | $L_E$ [d] | 204 [d] | 6.11 | 6.38 |

Table G-60. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.98 | 4.19 | 5.21 | 6.09 | 7.13 | 9.26 | 4.39 | 3.11 | 4.38 | 5.48 | 6.52 | 7.86 | 9.89 | 4.17 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.98 | 4.19 | 5.21 | 6.09 | 7.13 | 9.26 | 4.39 | 3.11 | 4.38 | 5.48 | 6.52 | 7.86 | 9.89 | 4.17 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.02 | - | NA | - | - | - | - | 0.02 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.02 | - | NA | - | - | - | - | 0.02 | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.11 | 0.17 | 0.19 | 0.30 | 0.30 | 0.38 | 0.21 | 0.11 | 0.17 | 0.19 | 0.28 | 0.28 | 0.39 | 0.20 |

Table G-61. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 9.26 | 10.24 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 13.20 | 15.27 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.29 | 0.28 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 1.92 | 1.96 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 1.92 | 1.96 |
| Sea turtles | $L_E$ [d] | 204 [d] | 1.73 | 1.75 |

Table G-62. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.22 | 3.30 | 4.24 | 4.82 | 5.37 | 7.06 | 3.14 | 2.31 | 3.49 | 4.43 | 4.96 | 5.78 | 7.18 | 3.02 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.22 | 3.30 | 4.24 | 4.82 | 5.37 | 7.06 | 3.14 | 2.31 | 3.49 | 4.43 | 4.96 | 5.78 | 7.18 | 3.02 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.05 | 0.13 | 0.15 | 0.15 | 0.17 | 0.23 | 0.17 | 0.05 | 0.13 | 0.15 | 0.15 | 0.16 | 0.22 | 0.16 |

Table G-63. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 7.27 | 7.76 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 10.16 | 11.44 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.17 | 0.17 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 1.34 | 1.35 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 1.34 | 1.35 |
| Sea turtles | $L_E$ [d] | 204 [d] | 1.15 | 1.17 |

### G.2.3.3. 8 Pin Piles, Pre-piled

Table G-64. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.09 | 0.11 | 0.13 | 0.17 | 0.28 | 0.09 | NA | 0.09 | 0.12 | 0.13 | 0.17 | 0.26 | 0.09 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 5.69 | 7.06 | 8.30 | 9.30 | 9.63 | 13.38 | 11.50 | 6.53 | 8.15 | 9.79 | 11.65 | 11.98 | 18.05 | 13.44 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.09 | 0.11 | 0.13 | 0.17 | 0.28 | 0.09 | NA | 0.09 | 0.12 | 0.13 | 0.17 | 0.26 | 0.09 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 5.69 | 7.06 | 8.30 | 9.30 | 9.63 | 13.38 | 11.50 | 6.53 | 8.15 | 9.79 | 11.65 | 11.98 | 18.05 | 13.44 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.02 | NA | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.09 | 0.11 | 0.12 | 0.13 | 0.23 | 0.06 | NA | 0.09 | 0.11 | 0.12 | 0.13 | 0.19 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.09 | 0.11 | 0.12 | 0.13 | 0.23 | 0.06 | NA | 0.09 | 0.11 | 0.12 | 0.13 | 0.19 | 0.06 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.55 | 0.84 | 1.15 | 1.43 | 1.69 | 2.21 | 1.15 | 0.60 | 0.88 | 1.19 | 1.48 | 1.77 | 2.33 | 1.14 |

Table G-65. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 15.30 | 21.93 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 19.79 | 33.38 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 1.68 | 1.73 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 5.20 | 5.69 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 5.20 | 5.69 |
| Sea turtles | $L_E$ [d] | 204 [d] | 4.85 | 5.26 |

Table G-66. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.13 | 3.09 | 3.79 | 4.30 | 4.65 | 6.19 | 4.38 | 2.35 | 3.32 | 4.05 | 4.63 | 5.01 | 7.17 | 4.32 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.13 | 3.09 | 3.79 | 4.30 | 4.65 | 6.19 | 4.38 | 2.35 | 3.32 | 4.05 | 4.63 | 5.01 | 7.17 | 4.32 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.09 | 0.12 | 0.18 | 0.30 | 0.37 | 0.48 | 0.23 | 0.09 | 0.12 | 0.18 | 0.30 | 0.37 | 0.48 | 0.23 |

Table G-67. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 6.83 | 7.81 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 8.90 | 10.81 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.35 | 0.36 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 1.84 | 1.90 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 1.84 | 1.90 |
| Sea turtles | $L_E$ [d] | 204 [d] | 1.68 | 1.73 |

Table G-68. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.66 | 2.43 | 2.93 | 3.49 | 3.87 | 5.07 | 3.35 | 1.73 | 2.56 | 3.14 | 3.73 | 4.12 | 5.67 | 3.26 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish < 2 g | $L_p$ [b] | 150 | 1.66 | 2.43 | 2.93 | 3.49 | 3.87 | 5.07 | 3.35 | 1.73 | 2.56 | 3.14 | 3.73 | 4.12 | 5.67 | 3.26 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.05 | 0.09 | 0.11 | 0.16 | 0.21 | 0.28 | 0.15 | 0.05 | 0.09 | 0.11 | 0.16 | 0.21 | 0.29 | 0.14 |

Table G-69. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 5.56 | 6.14 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 7.35 | 8.42 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.22 | 0.22 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 1.36 | 1.40 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 1.36 | 1.40 |
| Sea turtles | $L_E$ [d] | 204 [d] | 1.21 | 1.25 |

Table G-70. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.13 | 0.15 | 0.15 | 0.15 | 0.15 | 0.06 | NA | 0.13 | 0.16 | 0.16 | 0.15 | 0.15 | 0.06 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 8.85 | 8.56 | 10.58 | 13.74 | 18.50 | 26.94 | 14.29 | 9.60 | 9.12 | 12.03 | 17.56 | 26.55 | 44.16 | 13.33 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.13 | 0.15 | 0.15 | 0.15 | 0.15 | 0.06 | NA | 0.13 | 0.16 | 0.16 | 0.15 | 0.15 | 0.06 |
| Fish < 2 g | $L_p$ [b] | 150 | 8.85 | 8.56 | 10.58 | 13.74 | 18.50 | 26.94 | 14.29 | 9.60 | 9.12 | 12.03 | 17.56 | 26.55 | 44.16 | 13.33 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | 0.02 | 0.08 | 0.08 | 0.09 | 0.02 | NA | - | 0.02 | 0.07 | 0.09 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.12 | 0.14 | 0.14 | 0.13 | 0.14 | 0.06 | NA | 0.12 | 0.14 | 0.14 | 0.14 | 0.14 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.12 | 0.14 | 0.14 | 0.13 | 0.14 | 0.06 | NA | 0.12 | 0.14 | 0.14 | 0.14 | 0.14 | 0.06 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.66 | 1.13 | 1.58 | 1.77 | 1.86 | 2.12 | 1.11 | 0.67 | 1.18 | 1.62 | 1.78 | 1.85 | 2.12 | 1.11 |

Table G-71. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 27.72 | 47.19 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 40.73 | 84.28 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 1.92 | 1.96 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 7.28 | 7.76 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 7.28 | 7.76 |
| Sea turtles | $L_E$ [d] | 204 [d] | 6.64 | 7.03 |

Table G-72. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 μPa²) and SPL (dB re 1 μPa) thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.98 | 4.19 | 5.21 | 6.09 | 7.13 | 9.26 | 4.39 | 3.11 | 4.38 | 5.48 | 6.52 | 7.86 | 9.89 | 4.17 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.98 | 4.19 | 5.21 | 6.09 | 7.13 | 9.26 | 4.39 | 3.11 | 4.38 | 5.48 | 6.52 | 7.86 | 9.89 | 4.17 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.02 | - | NA | - | - | - | - | 0.02 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.02 | - | NA | - | - | - | - | 0.02 | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.11 | 0.17 | 0.19 | 0.30 | 0.30 | 0.38 | 0.21 | 0.11 | 0.17 | 0.19 | 0.28 | 0.28 | 0.39 | 0.20 |

Table G-73. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 μPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 10.17 | 11.45 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 14.29 | 16.81 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.33 | 0.34 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 2.20 | 2.25 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 2.20 | 2.25 |
| Sea turtles | $L_E$ [d] | 204 [d] | 1.92 | 1.96 |

Table G-74. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 μPa²) and SPL (dB re 1 μPa) thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.22 | 3.30 | 4.24 | 4.82 | 5.37 | 7.06 | 3.14 | 2.31 | 3.49 | 4.43 | 4.96 | 5.78 | 7.18 | 3.02 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.22 | 3.30 | 4.24 | 4.82 | 5.37 | 7.06 | 3.14 | 2.31 | 3.49 | 4.43 | 4.96 | 5.78 | 7.18 | 3.02 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.05 | 0.13 | 0.15 | 0.15 | 0.17 | 0.23 | 0.17 | 0.05 | 0.13 | 0.15 | 0.15 | 0.16 | 0.22 | 0.16 |

Table G-75. Typical jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 7.95 | 8.52 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 11.21 | 12.62 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.19 | 0.19 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 1.52 | 1.55 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 1.52 | 1.55 |
| Sea turtles | $L_E$ [d] | 204 [d] | 1.34 | 1.36 |

### G.2.3.4. 8 Pin Piles, Post-piled

Table G-76. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.09 | 0.11 | 0.13 | 0.17 | 0.28 | 0.09 | NA | 0.09 | 0.12 | 0.13 | 0.17 | 0.26 | 0.09 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.69 | 7.06 | 8.30 | 9.30 | 9.63 | 13.38 | 11.50 | 6.53 | 8.15 | 9.79 | 11.65 | 11.98 | 18.05 | 13.44 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.09 | 0.11 | 0.13 | 0.17 | 0.28 | 0.09 | NA | 0.09 | 0.12 | 0.13 | 0.17 | 0.26 | 0.09 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.69 | 7.06 | 8.30 | 9.30 | 9.63 | 13.38 | 11.50 | 6.53 | 8.15 | 9.79 | 11.65 | 11.98 | 18.05 | 13.44 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.02 | NA | - | 0.06 | 0.07 | 0.08 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.09 | 0.11 | 0.12 | 0.13 | 0.23 | 0.06 | NA | 0.09 | 0.11 | 0.12 | 0.13 | 0.19 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.09 | 0.11 | 0.12 | 0.13 | 0.23 | 0.06 | NA | 0.09 | 0.11 | 0.12 | 0.13 | 0.19 | 0.06 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.55 | 0.84 | 1.15 | 1.43 | 1.69 | 2.21 | 1.15 | 0.60 | 0.88 | 1.19 | 1.48 | 1.77 | 2.33 | 1.14 |

Table G-77. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 17.32 | 26.79 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 23.07 | 43.48 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 2.05 | 2.16 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 5.96 | 6.62 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 5.96 | 6.62 |
| Sea turtles | $L_E$ [d] | 204 [d] | 5.56 | 6.14 |

Table G-78. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.13 | 3.09 | 3.79 | 4.30 | 4.65 | 6.19 | 4.38 | 2.35 | 3.32 | 4.05 | 4.63 | 5.01 | 7.17 | 4.32 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.13 | 3.09 | 3.79 | 4.30 | 4.65 | 6.19 | 4.38 | 2.35 | 3.32 | 4.05 | 4.63 | 5.01 | 7.17 | 4.32 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.09 | 0.12 | 0.18 | 0.30 | 0.37 | 0.48 | 0.23 | 0.09 | 0.12 | 0.18 | 0.30 | 0.37 | 0.48 | 0.23 |

Table G-79. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 7.87 | 9.04 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 10.27 | 12.81 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.47 | 0.48 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 2.30 | 2.40 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 2.30 | 2.40 |
| Sea turtles | $L_E$ [d] | 204 [d] | 2.05 | 2.16 |

Table G-80. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.66 | 2.43 | 2.93 | 3.49 | 3.87 | 5.07 | 3.35 | 1.73 | 2.56 | 3.14 | 3.73 | 4.12 | 5.67 | 3.26 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish < 2 g | $L_p$ [b] | 150 | 1.66 | 2.43 | 2.93 | 3.49 | 3.87 | 5.07 | 3.35 | 1.73 | 2.56 | 3.14 | 3.73 | 4.12 | 5.67 | 3.26 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.05 | 0.09 | 0.11 | 0.16 | 0.21 | 0.28 | 0.15 | 0.05 | 0.09 | 0.11 | 0.16 | 0.21 | 0.29 | 0.14 |

Table G-81. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$[a] | 187[a] | 6.37 | 7.20 |
| Fish < 2 g | $L_E$[a] | 183[a] | 8.39 | 9.80 |
| Fish without swim bladder | $L_E$[c] | 216[c] | 0.31 | 0.32 |
| Fish with swim bladder not involved in hearing | $L_E$[c] | 203[c] | 1.68 | 1.73 |
| Fish with swim bladder involved in hearing | $L_E$[c] | 203[c] | 1.68 | 1.73 |
| Sea turtles | $L_E$[d] | 204[d] | 1.50 | 1.55 |

Table G-82. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$[a] | 206 | NA | 0.13 | 0.15 | 0.15 | 0.15 | 0.15 | 0.06 | NA | 0.13 | 0.16 | 0.16 | 0.15 | 0.15 | 0.06 |
| Fish ≥ 2g | $L_p$[b] | 150 | 8.85 | 8.56 | 10.58 | 13.74 | 18.50 | 26.94 | 14.29 | 9.60 | 9.12 | 12.03 | 17.56 | 26.55 | 44.16 | 13.33 |
| Fish < 2 g | $L_{pk}$[a] | 206 | NA | 0.13 | 0.15 | 0.15 | 0.15 | 0.15 | 0.06 | NA | 0.13 | 0.16 | 0.16 | 0.15 | 0.15 | 0.06 |
| Fish < 2 g | $L_p$[b] | 150 | 8.85 | 8.56 | 10.58 | 13.74 | 18.50 | 26.94 | 14.29 | 9.60 | 9.12 | 12.03 | 17.56 | 26.55 | 44.16 | 13.33 |
| Fish without swim bladder | $L_{pk}$[c] | 213 | NA | - | 0.02 | 0.08 | 0.08 | 0.09 | 0.02 | NA | - | 0.02 | 0.07 | 0.09 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$[c] | 207 | NA | 0.12 | 0.14 | 0.14 | 0.13 | 0.14 | 0.06 | NA | 0.12 | 0.14 | 0.14 | 0.14 | 0.14 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$[c] | 207 | NA | 0.12 | 0.14 | 0.14 | 0.13 | 0.14 | 0.06 | NA | 0.12 | 0.14 | 0.14 | 0.14 | 0.14 | 0.06 |
| Sea turtles | $L_{Pk}$[d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$[e] | 175 | 0.66 | 1.13 | 1.58 | 1.77 | 1.86 | 2.12 | 1.11 | 0.67 | 1.18 | 1.62 | 1.78 | 1.85 | 2.12 | 1.11 |

Table G-83. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 33.01 | 69.21 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 50.90 | 84.95 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 2.49 | 2.54 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 8.62 | 9.25 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 8.62 | 9.25 |
| Sea turtles | $L_E$ [d] | 204 [d] | 7.95 | 8.52 |

Table G-84. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.98 | 4.19 | 5.21 | 6.09 | 7.13 | 9.26 | 4.39 | 3.11 | 4.38 | 5.48 | 6.52 | 7.86 | 9.89 | 4.17 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.05 | - | NA | - | - | - | - | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.98 | 4.19 | 5.21 | 6.09 | 7.13 | 9.26 | 4.39 | 3.11 | 4.38 | 5.48 | 6.52 | 7.86 | 9.89 | 4.17 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.02 | - | NA | - | - | - | - | 0.02 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.02 | - | NA | - | - | - | - | 0.02 | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.11 | 0.17 | 0.19 | 0.30 | 0.30 | 0.38 | 0.21 | 0.11 | 0.17 | 0.19 | 0.28 | 0.28 | 0.39 | 0.20 |

Table G-85. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 12.19 | 13.89 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 16.69 | 20.80 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.47 | 0.48 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 2.76 | 2.81 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 2.76 | 2.81 |
| Sea turtles | $L_E$ [d] | 204 [d] | 2.49 | 2.54 |

Table G-86. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 600 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 kJ | Winter Vibr. | Winter 600 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.22 | 3.30 | 4.24 | 4.82 | 5.37 | 7.06 | 3.14 | 2.31 | 3.49 | 4.43 | 4.96 | 5.78 | 7.18 | 3.02 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.22 | 3.30 | 4.24 | 4.82 | 5.37 | 7.06 | 3.14 | 2.31 | 3.49 | 4.43 | 4.96 | 5.78 | 7.18 | 3.02 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.05 | 0.13 | 0.15 | 0.15 | 0.17 | 0.23 | 0.17 | 0.05 | 0.13 | 0.15 | 0.15 | 0.16 | 0.22 | 0.16 |

Table G-87. Typical jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|---|
| Fish ≥ 2g | $L_E$ [a] | 187 [a] | 9.27 | 10.26 |
| Fish < 2 g | $L_E$ [a] | 183 [a] | 13.21 | 15.29 |
| Fish without swim bladder | $L_E$ [c] | 216 [c] | 0.29 | 0.28 |
| Fish with swim bladder not involved in hearing | $L_E$ [c] | 203 [c] | 1.92 | 1.96 |
| Fish with swim bladder involved in hearing | $L_E$ [c] | 203 [c] | 1.92 | 1.96 |
| Sea turtles | $L_E$ [d] | 204 [d] | 1.73 | 1.75 |

## G.2.4. Jacket Foundation, 4.25 m Diameter Pin Pile (Typical)

### G.2.4.1. 4 Pin Piles, Pre-piled

Table G-88. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.09 | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 | NA | 0.09 | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.13 | 6.99 | 8.74 | 9.87 | 10.93 | 11.04 | 13.35 | 16.12 | 5.75 | 8.08 | 10.48 | 12.27 | 13.79 | 13.77 | 17.80 | 25.79 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.09 | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 | NA | 0.09 | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.13 | 6.99 | 8.74 | 9.87 | 10.93 | 11.04 | 13.35 | 16.12 | 5.75 | 8.08 | 10.48 | 12.27 | 13.79 | 13.77 | 17.80 | 25.79 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | 0.06 | 0.07 | 0.09 | 0.09 | 0.09 | 0.07 | NA | - | 0.06 | 0.08 | 0.09 | 0.09 | 0.10 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.08 | 0.11 | 0.13 | 0.15 | 0.19 | 0.29 | 0.15 | NA | 0.09 | 0.12 | 0.13 | 0.14 | 0.19 | 0.28 | 0.18 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.08 | 0.11 | 0.13 | 0.15 | 0.19 | 0.29 | 0.15 | NA | 0.09 | 0.12 | 0.13 | 0.14 | 0.19 | 0.28 | 0.18 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.36 | 0.82 | 1.27 | 1.54 | 1.72 | 1.94 | 2.43 | 2.37 | 0.36 | 0.85 | 1.32 | 1.61 | 1.80 | 2.07 | 2.54 | 2.45 |

Table G-89. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 14.49 | 21.34 |
| Fish < 2 g | 183 [a] | 18.32 | 32.00 |
| Fish without swim bladder | 216 [c] | 1.55 | 1.61 |
| Fish with swim bladder not involved in hearing | 203 [c] | 5.00 | 5.53 |
| Fish with swim bladder involved in hearing | 203 [c] | 5.00 | 5.53 |
| Sea turtles | 204 [d] | 4.66 | 5.11 |

Table G-90. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.04 | 0.05 | 0.06 | 0.04 | NA | - | - | - | 0.02 | 0.04 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.73 | 3.04 | 4.03 | 4.59 | 4.92 | 5.14 | 6.34 | 7.18 | 1.82 | 3.26 | 4.34 | 4.98 | 5.39 | 5.63 | 7.28 | 8.39 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.04 | 0.05 | 0.06 | 0.04 | NA | - | - | - | 0.02 | 0.04 | 0.06 | 0.04 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.73 | 3.04 | 4.03 | 4.59 | 4.92 | 5.14 | 6.34 | 7.18 | 1.82 | 3.26 | 4.34 | 4.98 | 5.39 | 5.63 | 7.28 | 8.39 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | 0.05 | 0.03 | NA | - | - | - | - | - | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | 0.05 | 0.03 | NA | - | - | - | - | - | 0.05 | 0.03 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.05 | 0.11 | 0.21 | 0.32 | 0.38 | 0.48 | 0.58 | 0.46 | 0.05 | 0.12 | 0.23 | 0.34 | 0.39 | 0.50 | 0.59 | 0.46 |

Table G-91. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 μPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 6.56 | 7.62 |
| Fish < 2 g | 183 [a] | 8.59 | 10.55 |
| Fish without swim bladder | 216 [c] | 0.30 | 0.30 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.72 | 1.78 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.72 | 1.78 |
| Sea turtles | 204 [d] | 1.55 | 1.61 |

Table G-92. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.34 | 2.40 | 3.17 | 3.75 | 4.05 | 4.26 | 5.24 | 5.75 | 1.40 | 2.52 | 3.42 | 4.01 | 4.33 | 4.58 | 5.83 | 6.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.34 | 2.40 | 3.17 | 3.75 | 4.05 | 4.26 | 5.24 | 5.75 | 1.40 | 2.52 | 3.42 | 4.01 | 4.33 | 4.58 | 5.83 | 6.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.02 | 0.09 | 0.12 | 0.18 | 0.25 | 0.32 | 0.37 | 0.30 | 0.02 | 0.09 | 0.12 | 0.18 | 0.26 | 0.32 | 0.37 | 0.29 |

Table G-93. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 5.36 | 5.99 |
| Fish < 2 g | 183 [a] | 7.05 | 8.24 |
| Fish without swim bladder | 216 [c] | 0.16 | 0.16 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.23 | 1.27 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.23 | 1.27 |
| Sea turtles | 204 [d] | 1.07 | 1.11 |

Table G-94. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.13 | 0.17 | 0.18 | 0.17 | 0.17 | 0.25 | 0.15 | NA | 0.14 | 0.18 | 0.19 | 0.18 | 0.18 | 0.25 | 0.15 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 7.35 | 8.70 | 10.69 | 11.98 | 15.33 | 20.20 | 27.61 | 29.30 | 7.96 | 9.26 | 11.83 | 13.32 | 20.05 | 30.50 | 50.59 | 41.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.13 | 0.17 | 0.18 | 0.17 | 0.17 | 0.25 | 0.15 | NA | 0.14 | 0.18 | 0.19 | 0.18 | 0.18 | 0.25 | 0.15 |
| Fish < 2 g | $L_p$ [b] | 150 | 7.35 | 8.70 | 10.69 | 11.98 | 15.33 | 20.20 | 27.61 | 29.30 | 7.96 | 9.26 | 11.83 | 13.32 | 20.05 | 30.50 | 50.59 | 41.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | 0.03 | 0.09 | 0.09 | 0.10 | 0.09 | 0.07 | NA | - | 0.03 | 0.09 | 0.10 | 0.10 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.12 | 0.16 | 0.17 | 0.16 | 0.16 | 0.17 | 0.13 | NA | 0.12 | 0.17 | 0.18 | 0.17 | 0.16 | 0.16 | 0.13 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.12 | 0.16 | 0.17 | 0.16 | 0.16 | 0.17 | 0.13 | NA | 0.12 | 0.17 | 0.18 | 0.17 | 0.16 | 0.16 | 0.13 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.38 | 1.08 | 1.75 | 2.24 | 2.17 | 2.32 | 2.50 | 2.08 | 0.46 | 1.13 | 1.81 | 2.31 | 2.32 | 2.33 | 2.42 | 2.10 |

Table G-95. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 26.15 | 41.72 |
| Fish < 2 g | 183 [a] | 37.85 | 83.55 |
| Fish without swim bladder | 216 [c] | 1.75 | 1.80 |
| Fish with swim bladder not involved in hearing | 203 [c] | 6.82 | 7.27 |
| Fish with swim bladder involved in hearing | 203 [c] | 6.82 | 7.27 |
| Sea turtles | 204 [d] | 6.26 | 6.58 |

Table G-96. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.02 | 0.06 | 0.04 | NA | - | - | - | - | 0.02 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.65 | 4.17 | 5.14 | 6.08 | 6.90 | 8.12 | 10.00 | 9.37 | 2.73 | 4.36 | 5.38 | 6.43 | 7.65 | 9.17 | 11.12 | 9.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.02 | 0.06 | 0.04 | NA | - | - | - | - | 0.02 | 0.06 | 0.04 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.65 | 4.17 | 5.14 | 6.08 | 6.90 | 8.12 | 10.00 | 9.37 | 2.73 | 4.36 | 5.38 | 6.43 | 7.65 | 9.17 | 11.12 | 9.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | 0.05 | 0.03 | NA | - | - | - | - | - | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | 0.05 | 0.03 | NA | - | - | - | - | - | 0.05 | 0.03 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.04 | 0.16 | 0.31 | 0.36 | 0.43 | 0.46 | 0.45 | 0.39 | 0.04 | 0.17 | 0.30 | 0.34 | 0.46 | 0.47 | 0.46 | 0.40 |

Table G-97. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 9.48 | 10.58 |
| Fish < 2 g | 183 [a] | 13.50 | 15.59 |
| Fish without swim bladder | 216 [c] | 0.28 | 0.27 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.94 | 2.04 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.94 | 2.04 |
| Sea turtles | 204 [d] | 1.75 | 1.80 |

Table G-98. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.83 | 3.27 | 4.25 | 5.09 | 5.53 | 6.27 | 7.60 | 6.91 | 1.87 | 3.43 | 4.43 | 5.35 | 6.05 | 6.80 | 8.06 | 6.53 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.83 | 3.27 | 4.25 | 5.09 | 5.53 | 6.27 | 7.60 | 6.91 | 1.87 | 3.43 | 4.43 | 5.35 | 6.05 | 6.80 | 8.06 | 6.53 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.02 | 0.13 | 0.17 | 0.19 | 0.17 | 0.26 | 0.27 | 0.24 | 0.02 | 0.13 | 0.18 | 0.20 | 0.22 | 0.25 | 0.26 | 0.25 |

Table G-99. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 μPa2·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 7.48 | 7.99 |
| Fish < 2 g | 183 [a] | 10.48 | 11.74 |
| Fish without swim bladder | 216 [c] | 0.16 | 0.16 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.35 | 1.39 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.35 | 1.39 |
| Sea turtles | 204 [d] | 1.15 | 1.20 |

### G.2.4.2. 4 Pin Piles, Post-piled

Table G-100. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.09 | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 | NA | 0.09 | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.13 | 6.99 | 8.74 | 9.87 | 10.93 | 11.04 | 13.35 | 16.12 | 5.75 | 8.08 | 10.48 | 12.27 | 13.79 | 13.77 | 17.80 | 25.79 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.09 | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 | NA | 0.09 | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.13 | 6.99 | 8.74 | 9.87 | 10.93 | 11.04 | 13.35 | 16.12 | 5.75 | 8.08 | 10.48 | 12.27 | 13.79 | 13.77 | 17.80 | 25.79 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | 0.06 | 0.07 | 0.09 | 0.09 | 0.09 | 0.07 | NA | - | 0.06 | 0.08 | 0.09 | 0.09 | 0.10 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.08 | 0.11 | 0.13 | 0.15 | 0.19 | 0.29 | 0.15 | NA | 0.09 | 0.12 | 0.13 | 0.14 | 0.19 | 0.28 | 0.18 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.08 | 0.11 | 0.13 | 0.15 | 0.19 | 0.29 | 0.15 | NA | 0.09 | 0.12 | 0.13 | 0.14 | 0.19 | 0.28 | 0.18 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.36 | 0.82 | 1.27 | 1.54 | 1.72 | 1.94 | 2.43 | 2.37 | 0.36 | 0.85 | 1.32 | 1.61 | 1.80 | 2.07 | 2.54 | 2.45 |

Table G-101. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 μPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 16.37 | 25.98 |
| Fish < 2 g | 183 [a] | 21.26 | 40.95 |
| Fish without swim bladder | 216 [c] | 1.89 | 1.99 |
| Fish with swim bladder not involved in hearing | 203 [c] | 5.75 | 6.46 |
| Fish with swim bladder involved in hearing | 203 [c] | 5.75 | 6.46 |
| Sea turtles | 204 [d] | 5.36 | 5.99 |

Table G-102. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.04 | 0.05 | 0.06 | 0.04 | NA | - | - | - | 0.02 | 0.04 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.73 | 3.04 | 4.03 | 4.59 | 4.92 | 5.14 | 6.34 | 7.18 | 1.82 | 3.26 | 4.34 | 4.98 | 5.39 | 5.63 | 7.28 | 8.39 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.04 | 0.05 | 0.06 | 0.04 | NA | - | - | - | 0.02 | 0.04 | 0.06 | 0.04 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.73 | 3.04 | 4.03 | 4.59 | 4.92 | 5.14 | 6.34 | 7.18 | 1.82 | 3.26 | 4.34 | 4.98 | 5.39 | 5.63 | 7.28 | 8.39 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | 0.05 | 0.03 | NA | - | - | - | - | - | 0.05 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | 0.05 | 0.03 | NA | - | - | - | - | - | 0.05 | 0.03 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.05 | 0.11 | 0.21 | 0.32 | 0.38 | 0.48 | 0.58 | 0.46 | 0.05 | 0.12 | 0.23 | 0.34 | 0.39 | 0.50 | 0.59 | 0.46 |

Table G-103. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 7.57 | 8.87 |
| Fish < 2 g | 183 [a] | 9.72 | 12.53 |
| Fish without swim bladder | 216 [c] | 0.40 | 0.41 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.13 | 2.25 |
| Fish with swim bladder involved in hearing | 203 [c] | 2.13 | 2.25 |
| Sea turtles | 204 [d] | 1.89 | 1.99 |

Table G-104. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.34 | 2.40 | 3.17 | 3.75 | 4.05 | 4.26 | 5.24 | 5.75 | 1.40 | 2.52 | 3.42 | 4.01 | 4.33 | 4.58 | 5.83 | 6.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.34 | 2.40 | 3.17 | 3.75 | 4.05 | 4.26 | 5.24 | 5.75 | 1.40 | 2.52 | 3.42 | 4.01 | 4.33 | 4.58 | 5.83 | 6.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.02 | 0.09 | 0.12 | 0.18 | 0.25 | 0.32 | 0.37 | 0.30 | 0.02 | 0.09 | 0.12 | 0.18 | 0.26 | 0.32 | 0.37 | 0.29 |

Table G-105. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 μPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 6.15 | 7.02 |
| Fish < 2 g | 183 [a] | 8.08 | 9.57 |
| Fish without swim bladder | 216 [c] | 0.25 | 0.26 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.55 | 1.61 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.55 | 1.61 |
| Sea turtles | 204 [d] | 1.37 | 1.42 |

Table G-106. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.13 | 0.17 | 0.18 | 0.17 | 0.17 | 0.25 | 0.15 | NA | 0.14 | 0.18 | 0.19 | 0.18 | 0.18 | 0.25 | 0.15 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 7.35 | 8.70 | 10.69 | 11.98 | 15.33 | 20.20 | 27.61 | 29.30 | 7.96 | 9.26 | 11.83 | 13.32 | 20.05 | 30.50 | 50.59 | 41.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.13 | 0.17 | 0.18 | 0.17 | 0.17 | 0.25 | 0.15 | NA | 0.14 | 0.18 | 0.19 | 0.18 | 0.18 | 0.25 | 0.15 |
| Fish < 2 g | $L_p$ [b] | 150 | 7.35 | 8.70 | 10.69 | 11.98 | 15.33 | 20.20 | 27.61 | 29.30 | 7.96 | 9.26 | 11.83 | 13.32 | 20.05 | 30.50 | 50.59 | 41.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | 0.03 | 0.09 | 0.09 | 0.10 | 0.09 | 0.07 | NA | - | 0.03 | 0.09 | 0.10 | 0.10 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.12 | 0.16 | 0.17 | 0.16 | 0.16 | 0.17 | 0.13 | NA | 0.12 | 0.17 | 0.18 | 0.17 | 0.16 | 0.16 | 0.13 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.12 | 0.16 | 0.17 | 0.16 | 0.16 | 0.17 | 0.13 | NA | 0.12 | 0.17 | 0.18 | 0.17 | 0.16 | 0.16 | 0.13 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.38 | 1.08 | 1.75 | 2.24 | 2.17 | 2.32 | 2.50 | 2.08 | 0.46 | 1.13 | 1.81 | 2.31 | 2.32 | 2.33 | 2.42 | 2.10 |

Table G-107. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 μPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 31.07 | 60.74 |
| Fish < 2 g | 183 [a] | 47.91 | 84.82 |
| Fish without swim bladder | 216 [c] | 2.23 | 2.32 |
| Fish with swim bladder not involved in hearing | 203 [c] | 8.15 | 8.74 |
| Fish with swim bladder involved in hearing | 203 [c] | 8.15 | 8.74 |
| Sea turtles | 204 [d] | 7.48 | 7.99 |

Table G-108. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.02 | 0.06 | 0.04 | NA | - | - | - | - | 0.02 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.65 | 4.17 | 5.14 | 6.08 | 6.90 | 8.12 | 10.00 | 9.37 | 2.73 | 4.36 | 5.38 | 6.43 | 7.65 | 9.17 | 11.12 | 9.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.02 | 0.06 | 0.04 | NA | - | - | - | - | 0.02 | 0.06 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.65 | 4.17 | 5.14 | 6.08 | 6.90 | 8.12 | 10.00 | 9.37 | 2.73 | 4.36 | 5.38 | 6.43 | 7.65 | 9.17 | 11.12 | 9.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | 0.05 | 0.03 | NA | - | - | - | - | - | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | 0.05 | 0.03 | NA | - | - | - | - | - | 0.05 | 0.03 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.04 | 0.16 | 0.31 | 0.36 | 0.43 | 0.46 | 0.45 | 0.39 | 0.04 | 0.17 | 0.30 | 0.34 | 0.46 | 0.47 | 0.46 | 0.40 |

Table G-109. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea SEL thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 11.50 | 12.88 |
| Fish < 2 g | 183 [a] | 15.78 | 18.84 |
| Fish without swim bladder | 216 [c] | 0.39 | 0.40 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.54 | 2.61 |
| Fish with swim bladder involved in hearing | 203 [c] | 2.54 | 2.61 |
| Sea turtles | 204 [d] | 2.23 | 2.32 |

Table G-110. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 μPa²) and SPL (dB re 1 μPa) thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.83 | 3.27 | 4.25 | 5.09 | 5.53 | 6.27 | 7.60 | 6.91 | 1.87 | 3.43 | 4.43 | 5.35 | 6.05 | 6.80 | 8.06 | 6.53 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.83 | 3.27 | 4.25 | 5.09 | 5.53 | 6.27 | 7.60 | 6.91 | 1.87 | 3.43 | 4.43 | 5.35 | 6.05 | 6.80 | 8.06 | 6.53 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.02 | 0.13 | 0.17 | 0.19 | 0.17 | 0.26 | 0.27 | 0.24 | 0.02 | 0.13 | 0.18 | 0.20 | 0.22 | 0.25 | 0.26 | 0.25 |

Table G-111. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 8.82 | 9.47 |
| Fish < 2 g | 183 [a] | 12.47 | 14.16 |
| Fish without swim bladder | 216 [c] | 0.22 | 0.21 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.75 | 1.80 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.75 | 1.80 |
| Sea turtles | 204 [d] | 1.54 | 1.59 |

### G.2.4.3. 8 Pin Piles, Pre-piled

Table G-112. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.09 | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 | NA | 0.09 | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.13 | 6.99 | 8.74 | 9.87 | 10.93 | 11.04 | 13.35 | 16.12 | 5.75 | 8.08 | 10.48 | 12.27 | 13.79 | 13.77 | 17.80 | 25.79 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.09 | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 | NA | 0.09 | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.13 | 6.99 | 8.74 | 9.87 | 10.93 | 11.04 | 13.35 | 16.12 | 5.75 | 8.08 | 10.48 | 12.27 | 13.79 | 13.77 | 17.80 | 25.79 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | 0.06 | 0.07 | 0.09 | 0.09 | 0.09 | 0.07 | NA | - | 0.06 | 0.08 | 0.09 | 0.09 | 0.10 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.08 | 0.11 | 0.13 | 0.15 | 0.19 | 0.29 | 0.15 | NA | 0.09 | 0.12 | 0.13 | 0.14 | 0.19 | 0.28 | 0.18 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.08 | 0.11 | 0.13 | 0.15 | 0.19 | 0.29 | 0.15 | NA | 0.09 | 0.12 | 0.13 | 0.14 | 0.19 | 0.28 | 0.18 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.36 | 0.82 | 1.27 | 1.54 | 1.72 | 1.94 | 2.43 | 2.37 | 0.36 | 0.85 | 1.32 | 1.61 | 1.80 | 2.07 | 2.54 | 2.45 |

Table G-113. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 μPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 17.35 | 28.77 |
| Fish < 2 g | 183 [a] | 22.81 | 47.16 |
| Fish without swim bladder | 216 [c] | 2.13 | 2.25 |
| Fish with swim bladder not involved in hearing | 203 [c] | 6.15 | 7.02 |
| Fish with swim bladder involved in hearing | 203 [c] | 6.15 | 7.02 |
| Sea turtles | 204 [d] | 5.75 | 6.46 |

Table G-114. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.04 | 0.05 | 0.06 | 0.04 | NA | - | - | - | 0.02 | 0.04 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.73 | 3.04 | 4.03 | 4.59 | 4.92 | 5.14 | 6.34 | 7.18 | 1.82 | 3.26 | 4.34 | 4.98 | 5.39 | 5.63 | 7.28 | 8.39 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.04 | 0.05 | 0.06 | 0.04 | NA | - | - | - | 0.02 | 0.04 | 0.06 | 0.04 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.73 | 3.04 | 4.03 | 4.59 | 4.92 | 5.14 | 6.34 | 7.18 | 1.82 | 3.26 | 4.34 | 4.98 | 5.39 | 5.63 | 7.28 | 8.39 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | 0.05 | 0.03 | NA | - | - | - | - | - | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | 0.05 | 0.03 | NA | - | - | - | - | - | 0.05 | 0.03 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.05 | 0.11 | 0.21 | 0.32 | 0.38 | 0.48 | 0.58 | 0.46 | 0.05 | 0.12 | 0.23 | 0.34 | 0.39 | 0.50 | 0.59 | 0.46 |

Table G-115. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 8.08 | 9.58 |
| Fish < 2 g | 183 [a] | 10.54 | 13.62 |
| Fish without swim bladder | 216 [c] | 0.46 | 0.48 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.38 | 2.50 |
| Fish with swim bladder involved in hearing | 203 [c] | 2.38 | 2.50 |
| Sea turtles | 204 [d] | 2.13 | 2.25 |

Table G-116. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.34 | 2.40 | 3.17 | 3.75 | 4.05 | 4.26 | 5.24 | 5.75 | 1.40 | 2.52 | 3.42 | 4.01 | 4.33 | 4.58 | 5.83 | 6.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.34 | 2.40 | 3.17 | 3.75 | 4.05 | 4.26 | 5.24 | 5.75 | 1.40 | 2.52 | 3.42 | 4.01 | 4.33 | 4.58 | 5.83 | 6.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.02 | 0.09 | 0.12 | 0.18 | 0.25 | 0.32 | 0.37 | 0.30 | 0.02 | 0.09 | 0.12 | 0.18 | 0.26 | 0.32 | 0.37 | 0.29 |

Table G-117. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 6.56 | 7.63 |
| Fish < 2 g | 183 [a] | 8.60 | 10.56 |
| Fish without swim bladder | 216 [c] | 0.30 | 0.30 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.72 | 1.79 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.72 | 1.79 |
| Sea turtles | 204 [d] | 1.55 | 1.61 |

Table G-118. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.13 | 0.17 | 0.18 | 0.17 | 0.17 | 0.25 | 0.15 | NA | 0.14 | 0.18 | 0.19 | 0.18 | 0.18 | 0.25 | 0.15 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 7.35 | 8.70 | 10.69 | 11.98 | 15.33 | 20.20 | 27.61 | 29.30 | 7.96 | 9.26 | 11.83 | 13.32 | 20.05 | 30.50 | 50.59 | 41.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.13 | 0.17 | 0.18 | 0.17 | 0.17 | 0.25 | 0.15 | NA | 0.14 | 0.18 | 0.19 | 0.18 | 0.18 | 0.25 | 0.15 |
| Fish < 2 g | $L_p$ [b] | 150 | 7.35 | 8.70 | 10.69 | 11.98 | 15.33 | 20.20 | 27.61 | 29.30 | 7.96 | 9.26 | 11.83 | 13.32 | 20.05 | 30.50 | 50.59 | 41.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | 0.03 | 0.09 | 0.09 | 0.10 | 0.09 | 0.07 | NA | - | 0.03 | 0.09 | 0.10 | 0.10 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.12 | 0.16 | 0.17 | 0.16 | 0.16 | 0.17 | 0.13 | NA | 0.12 | 0.17 | 0.18 | 0.17 | 0.16 | 0.16 | 0.13 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.12 | 0.16 | 0.17 | 0.16 | 0.16 | 0.17 | 0.13 | NA | 0.12 | 0.17 | 0.18 | 0.17 | 0.16 | 0.16 | 0.13 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.38 | 1.08 | 1.75 | 2.24 | 2.17 | 2.32 | 2.50 | 2.08 | 0.46 | 1.13 | 1.81 | 2.31 | 2.32 | 2.33 | 2.42 | 2.10 |

Table G-119. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 34.16 | 74.55 |
| Fish < 2 g | 183 [a] | 52.62 | 85.12 |
| Fish without swim bladder | 216 [c] | 2.54 | 2.61 |
| Fish with swim bladder not involved in hearing | 203 [c] | 8.83 | 9.48 |
| Fish with swim bladder involved in hearing | 203 [c] | 8.83 | 9.48 |
| Sea turtles | 204 [d] | 8.15 | 8.74 |

Table G-120. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.02 | 0.06 | 0.04 | NA | - | - | - | - | 0.02 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.65 | 4.17 | 5.14 | 6.08 | 6.90 | 8.12 | 10.00 | 9.37 | 2.73 | 4.36 | 5.38 | 6.43 | 7.65 | 9.17 | 11.12 | 9.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.02 | 0.06 | 0.04 | NA | - | - | - | - | 0.02 | 0.06 | 0.04 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.65 | 4.17 | 5.14 | 6.08 | 6.90 | 8.12 | 10.00 | 9.37 | 2.73 | 4.36 | 5.38 | 6.43 | 7.65 | 9.17 | 11.12 | 9.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | 0.05 | 0.03 | NA | - | - | - | - | - | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | 0.05 | 0.03 | NA | - | - | - | - | - | 0.05 | 0.03 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.04 | 0.16 | 0.31 | 0.36 | 0.43 | 0.46 | 0.45 | 0.39 | 0.04 | 0.17 | 0.30 | 0.34 | 0.46 | 0.47 | 0.46 | 0.40 |

Table G-121. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 12.48 | 14.17 |
| Fish < 2 g | 183 [a] | 17.05 | 21.45 |
| Fish without swim bladder | 216 [c] | 0.46 | 0.47 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.78 | 2.86 |
| Fish with swim bladder involved in hearing | 203 [c] | 2.78 | 2.86 |
| Sea turtles | 204 [d] | 2.54 | 2.61 |

Table G-122. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.83 | 3.27 | 4.25 | 5.09 | 5.53 | 6.27 | 7.60 | 6.91 | 1.87 | 3.43 | 4.43 | 5.35 | 6.05 | 6.80 | 8.06 | 6.53 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.83 | 3.27 | 4.25 | 5.09 | 5.53 | 6.27 | 7.60 | 6.91 | 1.87 | 3.43 | 4.43 | 5.35 | 6.05 | 6.80 | 8.06 | 6.53 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.02 | 0.13 | 0.17 | 0.19 | 0.17 | 0.26 | 0.27 | 0.24 | 0.02 | 0.13 | 0.18 | 0.20 | 0.22 | 0.25 | 0.26 | 0.25 |

Table G-123. Typical jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 9.48 | 10.59 |
| Fish < 2 g | 183 [a] | 13.51 | 15.60 |
| Fish without swim bladder | 216 [c] | 0.28 | 0.27 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.94 | 2.04 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.94 | 2.04 |
| Sea turtles | 204 [d] | 1.75 | 1.81 |

## G.2.4.4. 8 Pin Piles, Post-piled

Table G-124. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$[a] | 206 | NA | 0.09 | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 | NA | 0.09 | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish ≥ 2g | $L_{p}$[b] | 150 | 5.13 | 6.99 | 8.74 | 9.87 | 10.93 | 11.04 | 13.35 | 16.12 | 5.75 | 8.08 | 10.48 | 12.27 | 13.79 | 13.77 | 17.80 | 25.79 |
| Fish < 2 g | $L_{pk}$[a] | 206 | NA | 0.09 | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 | NA | 0.09 | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish < 2 g | $L_{p}$[b] | 150 | 5.13 | 6.99 | 8.74 | 9.87 | 10.93 | 11.04 | 13.35 | 16.12 | 5.75 | 8.08 | 10.48 | 12.27 | 13.79 | 13.77 | 17.80 | 25.79 |
| Fish without swim bladder | $L_{pk}$[c] | 213 | NA | - | 0.06 | 0.07 | 0.09 | 0.09 | 0.09 | 0.07 | NA | - | 0.06 | 0.08 | 0.09 | 0.09 | 0.10 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$[c] | 207 | NA | 0.08 | 0.11 | 0.13 | 0.15 | 0.19 | 0.29 | 0.15 | NA | 0.09 | 0.12 | 0.13 | 0.14 | 0.19 | 0.28 | 0.18 |
| Fish with swim bladder involved in hearing | $L_{pk}$[c] | 207 | NA | 0.08 | 0.11 | 0.13 | 0.15 | 0.19 | 0.29 | 0.15 | NA | 0.09 | 0.12 | 0.13 | 0.14 | 0.19 | 0.28 | 0.18 |
| Sea turtles | $L_{Pk}$[d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_{p}$[e] | 175 | 0.36 | 0.82 | 1.27 | 1.54 | 1.72 | 1.94 | 2.43 | 2.37 | 0.36 | 0.85 | 1.32 | 1.61 | 1.80 | 2.07 | 2.54 | 2.45 |

Table G-125. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 19.67 | 36.03 |
| Fish < 2 g | 183 [a] | 25.77 | 65.47 |
| Fish without swim bladder | 216 [c] | 2.60 | 2.73 |
| Fish with swim bladder not involved in hearing | 203 [c] | 7.06 | 8.25 |
| Fish with swim bladder involved in hearing | 203 [c] | 7.06 | 8.25 |
| Sea turtles | 204 [d] | 6.56 | 7.63 |

Table G-126. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.04 | 0.05 | 0.06 | 0.04 | NA | - | - | - | 0.02 | 0.04 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.73 | 3.04 | 4.03 | 4.59 | 4.92 | 5.14 | 6.34 | 7.18 | 1.82 | 3.26 | 4.34 | 4.98 | 5.39 | 5.63 | 7.28 | 8.39 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.04 | 0.05 | 0.06 | 0.04 | NA | - | - | - | 0.02 | 0.04 | 0.06 | 0.04 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.73 | 3.04 | 4.03 | 4.59 | 4.92 | 5.14 | 6.34 | 7.18 | 1.82 | 3.26 | 4.34 | 4.98 | 5.39 | 5.63 | 7.28 | 8.39 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | 0.05 | 0.03 | NA | - | - | - | - | - | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | 0.05 | 0.03 | NA | - | - | - | - | - | 0.05 | 0.03 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.05 | 0.11 | 0.21 | 0.32 | 0.38 | 0.48 | 0.58 | 0.46 | 0.05 | 0.12 | 0.23 | 0.34 | 0.39 | 0.50 | 0.59 | 0.46 |

Table G-127. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 9.11 | 11.55 |
| Fish < 2 g | 183 [a] | 12.05 | 16.11 |
| Fish without swim bladder | 216 [c] | 0.64 | 0.66 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.81 | 3.01 |
| Fish with swim bladder involved in hearing | 203 [c] | 2.81 | 3.01 |
| Sea turtles | 204 [d] | 2.60 | 2.73 |

Table G-128. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.34 | 2.40 | 3.17 | 3.75 | 4.05 | 4.26 | 5.24 | 5.75 | 1.40 | 2.52 | 3.42 | 4.01 | 4.33 | 4.58 | 5.83 | 6.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.34 | 2.40 | 3.17 | 3.75 | 4.05 | 4.26 | 5.24 | 5.75 | 1.40 | 2.52 | 3.42 | 4.01 | 4.33 | 4.58 | 5.83 | 6.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.02 | 0.09 | 0.12 | 0.18 | 0.25 | 0.32 | 0.37 | 0.30 | 0.02 | 0.09 | 0.12 | 0.18 | 0.26 | 0.32 | 0.37 | 0.29 |

Table G-129. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 7.57 | 8.87 |
| Fish < 2 g | 183 [a] | 9.72 | 12.54 |
| Fish without swim bladder | 216 [c] | 0.40 | 0.41 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.13 | 2.25 |
| Fish with swim bladder involved in hearing | 203 [c] | 2.13 | 2.25 |
| Sea turtles | 204 [d] | 1.89 | 1.99 |

Table G-130. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa2) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.13 | 0.17 | 0.18 | 0.17 | 0.17 | 0.25 | 0.15 | NA | 0.14 | 0.18 | 0.19 | 0.18 | 0.18 | 0.25 | 0.15 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 7.35 | 8.70 | 10.69 | 11.98 | 15.33 | 20.20 | 27.61 | 29.30 | 7.96 | 9.26 | 11.83 | 13.32 | 20.05 | 30.50 | 50.59 | 41.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.13 | 0.17 | 0.18 | 0.17 | 0.17 | 0.25 | 0.15 | NA | 0.14 | 0.18 | 0.19 | 0.18 | 0.18 | 0.25 | 0.15 |
| Fish < 2 g | $L_p$ [b] | 150 | 7.35 | 8.70 | 10.69 | 11.98 | 15.33 | 20.20 | 27.61 | 29.30 | 7.96 | 9.26 | 11.83 | 13.32 | 20.05 | 30.50 | 50.59 | 41.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | 0.03 | 0.09 | 0.09 | 0.10 | 0.09 | 0.07 | NA | - | 0.03 | 0.09 | 0.10 | 0.10 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.12 | 0.16 | 0.17 | 0.16 | 0.16 | 0.17 | 0.13 | NA | 0.12 | 0.17 | 0.18 | 0.17 | 0.16 | 0.16 | 0.13 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.12 | 0.16 | 0.17 | 0.16 | 0.16 | 0.17 | 0.13 | NA | 0.12 | 0.17 | 0.18 | 0.17 | 0.16 | 0.16 | 0.13 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.38 | 1.08 | 1.75 | 2.24 | 2.17 | 2.32 | 2.50 | 2.08 | 0.46 | 1.13 | 1.81 | 2.31 | 2.32 | 2.33 | 2.42 | 2.10 |

Table G-131. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea SEL thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 42.62 | 84.50 |
| Fish < 2 g | 183 [a] | 59.76 | 85.28 |
| Fish without swim bladder | 216 [c] | 3.17 | 3.28 |
| Fish with swim bladder not involved in hearing | 203 [c] | 10.49 | 11.75 |
| Fish with swim bladder involved in hearing | 203 [c] | 10.49 | 11.75 |
| Sea turtles | 204 [d] | 9.48 | 10.59 |

Table G-132. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.02 | 0.06 | 0.04 | NA | - | - | - | - | 0.02 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.65 | 4.17 | 5.14 | 6.08 | 6.90 | 8.12 | 10.00 | 9.37 | 2.73 | 4.36 | 5.38 | 6.43 | 7.65 | 9.17 | 11.12 | 9.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | 0.02 | 0.06 | 0.04 | NA | - | - | - | - | 0.02 | 0.06 | 0.04 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.65 | 4.17 | 5.14 | 6.08 | 6.90 | 8.12 | 10.00 | 9.37 | 2.73 | 4.36 | 5.38 | 6.43 | 7.65 | 9.17 | 11.12 | 9.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | 0.05 | 0.03 | NA | - | - | - | - | - | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | 0.05 | 0.03 | NA | - | - | - | - | - | 0.05 | 0.03 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.04 | 0.16 | 0.31 | 0.36 | 0.43 | 0.46 | 0.45 | 0.39 | 0.04 | 0.17 | 0.30 | 0.34 | 0.46 | 0.47 | 0.46 | 0.40 |

Table G-133. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 14.61 | 17.17 |
| Fish < 2 g | 183 [a] | 20.09 | 27.04 |
| Fish without swim bladder | 216 [c] | 0.64 | 0.65 |
| Fish with swim bladder not involved in hearing | 203 [c] | 3.56 | 3.70 |
| Fish with swim bladder involved in hearing | 203 [c] | 3.56 | 3.70 |
| Sea turtles | 204 [d] | 3.17 | 3.28 |

Table G-134. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 500 kJ | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 2500 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 500 kJ | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 2500 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.83 | 3.27 | 4.25 | 5.09 | 5.53 | 6.27 | 7.60 | 6.91 | 1.87 | 3.43 | 4.43 | 5.35 | 6.05 | 6.80 | 8.06 | 6.53 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.83 | 3.27 | 4.25 | 5.09 | 5.53 | 6.27 | 7.60 | 6.91 | 1.87 | 3.43 | 4.43 | 5.35 | 6.05 | 6.80 | 8.06 | 6.53 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | - | NA | - | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.02 | 0.13 | 0.17 | 0.19 | 0.17 | 0.26 | 0.27 | 0.24 | 0.02 | 0.13 | 0.18 | 0.20 | 0.22 | 0.25 | 0.26 | 0.25 |

Table G-135. Typical jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500S) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 11.51 | 12.90 |
| Fish < 2 g | 183 [a] | 15.80 | 18.86 |
| Fish without swim bladder | 216 [c] | 0.39 | 0.40 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.54 | 2.61 |
| Fish with swim bladder involved in hearing | 203 [c] | 2.54 | 2.61 |
| Sea turtles | 204 [d] | 2.23 | 2.32 |

## G.2.5. Jacket Foundation, 4 m Diameter Pin Pile (Difficult-to-drive)

### G.2.5.1. 4 Pin Piles, Pre-piled

Table G-136. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.11 | 0.13 | 0.15 | 0.29 | 0.28 | 0.10 | NA | 0.12 | 0.13 | 0.14 | 0.28 | 0.27 | 0.09 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.69 | 8.45 | 9.46 | 10.42 | 11.10 | 13.59 | 11.48 | 6.53 | 9.94 | 11.76 | 13.11 | 13.82 | 18.39 | 13.41 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.11 | 0.13 | 0.15 | 0.29 | 0.28 | 0.10 | NA | 0.12 | 0.13 | 0.14 | 0.28 | 0.27 | 0.09 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.69 | 8.45 | 9.46 | 10.42 | 11.10 | 13.59 | 11.48 | 6.53 | 9.94 | 11.76 | 13.11 | 13.82 | 18.39 | 13.41 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.02 | NA | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.11 | 0.12 | 0.13 | 0.26 | 0.25 | 0.06 | NA | 0.11 | 0.12 | 0.13 | 0.20 | 0.23 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.11 | 0.12 | 0.13 | 0.26 | 0.25 | 0.06 | NA | 0.11 | 0.12 | 0.13 | 0.20 | 0.23 | 0.06 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.55 | 1.14 | 1.45 | 1.64 | 2.07 | 2.29 | 1.14 | 0.60 | 1.19 | 1.51 | 1.72 | 2.19 | 2.41 | 1.13 |

Table G-137. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 $\mu Pa^2 \cdot s$) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187[a] | 13.09 | 17.20 |
| Fish < 2 g | 183[a] | 16.79 | 25.40 |
| Fish without swim bladder | 216[c] | 1.35 | 1.40 |
| Fish with swim bladder not involved in hearing | 203[c] | 4.45 | 4.80 |
| Fish with swim bladder involved in hearing | 203[c] | 4.45 | 4.80 |
| Sea turtles | 204[d] | 4.14 | 4.44 |

Table G-138. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 $\mu Pa^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$[a] | 206 | NA | - | - | - | 0.02 | 0.05 | - | NA | - | - | - | 0.02 | 0.05 | - |
| Fish ≥ 2g | $L_{p}$[b] | 150 | 2.13 | 3.86 | 4.39 | 4.73 | 5.24 | 6.32 | 4.36 | 2.35 | 4.12 | 4.77 | 5.14 | 5.74 | 7.35 | 4.31 |
| Fish < 2 g | $L_{pk}$[a] | 206 | NA | - | - | - | 0.02 | 0.05 | - | NA | - | - | - | 0.02 | 0.05 | - |
| Fish < 2 g | $L_{p}$[b] | 150 | 2.13 | 3.86 | 4.39 | 4.73 | 5.24 | 6.32 | 4.36 | 2.35 | 4.12 | 4.77 | 5.14 | 5.74 | 7.35 | 4.31 |
| Fish without swim bladder | $L_{pk}$[c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$[c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$[c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{Pk}$[d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$[e] | 175 | 0.09 | 0.18 | 0.28 | 0.38 | 0.52 | 0.50 | 0.23 | 0.09 | 0.18 | 0.29 | 0.38 | 0.54 | 0.51 | 0.22 |

Table G-139. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 5.85 | 6.49 |
| Fish < 2 g | 183 [a] | 7.68 | 8.84 |
| Fish without swim bladder | 216 [c] | 0.25 | 0.26 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.49 | 1.55 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.49 | 1.55 |
| Sea turtles | 204 [d] | 1.35 | 1.40 |

Table G-140. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.66 | 3.01 | 3.57 | 3.89 | 4.39 | 5.17 | 3.34 | 1.73 | 3.23 | 3.82 | 4.15 | 4.71 | 5.81 | 3.25 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.66 | 3.01 | 3.57 | 3.89 | 4.39 | 5.17 | 3.34 | 1.73 | 3.23 | 3.82 | 4.15 | 4.71 | 5.81 | 3.25 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.05 | 0.11 | 0.15 | 0.21 | 0.34 | 0.30 | 0.15 | 0.05 | 0.12 | 0.15 | 0.22 | 0.34 | 0.30 | 0.14 |

Table G-141. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 4.77 | 5.18 |
| Fish < 2 g | 183 [a] | 6.24 | 7.04 |
| Fish without swim bladder | 216 [c] | 0.14 | 0.14 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.06 | 1.10 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.06 | 1.10 |
| Sea turtles | 204 [d] | 0.93 | 0.95 |

Table G-142. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.16 | 0.17 | 0.17 | 0.17 | 0.16 | 0.06 | NA | 0.17 | 0.18 | 0.17 | 0.17 | 0.16 | 0.06 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 8.85 | 10.08 | 12.06 | 15.00 | 22.42 | 27.59 | 14.24 | 9.60 | 11.16 | 13.58 | 20.45 | 34.13 | 46.85 | 13.28 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.16 | 0.17 | 0.17 | 0.17 | 0.16 | 0.06 | NA | 0.17 | 0.18 | 0.17 | 0.17 | 0.16 | 0.06 |
| Fish < 2 g | $L_p$ [b] | 150 | 8.85 | 10.08 | 12.06 | 15.00 | 22.42 | 27.59 | 14.24 | 9.60 | 11.16 | 13.58 | 20.45 | 34.13 | 46.85 | 13.28 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.02 | 0.08 | 0.09 | 0.09 | 0.09 | 0.02 | NA | 0.02 | 0.05 | 0.09 | 0.09 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.15 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 | NA | 0.16 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.15 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 | NA | 0.16 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.66 | 1.60 | 1.98 | 2.14 | 2.33 | 2.22 | 1.10 | 0.67 | 1.66 | 2.04 | 2.14 | 2.40 | 2.19 | 1.11 |

Table G-143. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 22.87 | 33.10 |
| Fish < 2 g | 183 [a] | 31.82 | 67.09 |
| Fish without swim bladder | 216 [c] | 1.54 | 1.57 |
| Fish with swim bladder not involved in hearing | 203 [c] | 6.14 | 6.46 |
| Fish with swim bladder involved in hearing | 203 [c] | 6.14 | 6.46 |
| Sea turtles | 204 [d] | 5.64 | 5.90 |

Table G-144. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.02 | 0.05 | - | NA | - | - | - | 0.02 | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.98 | 4.95 | 6.00 | 6.86 | 8.61 | 9.51 | 4.37 | 3.11 | 5.19 | 6.36 | 7.51 | 9.60 | 10.35 | 4.15 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.02 | 0.05 | - | NA | - | - | - | 0.02 | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.98 | 4.95 | 6.00 | 6.86 | 8.61 | 9.51 | 4.37 | 3.11 | 5.19 | 6.36 | 7.51 | 9.60 | 10.35 | 4.15 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.11 | 0.28 | 0.32 | 0.42 | 0.47 | 0.42 | 0.21 | 0.11 | 0.21 | 0.31 | 0.44 | 0.48 | 0.43 | 0.20 |

Table G-145. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 8.60 | 9.30 |
| Fish < 2 g | 183 [a] | 12.06 | 13.87 |
| Fish without swim bladder | 216 [c] | 0.23 | 0.22 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.75 | 1.77 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.75 | 1.77 |
| Sea turtles | 204 [d] | 1.54 | 1.57 |

Table G-146. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.22 | 4.09 | 4.96 | 5.44 | 6.62 | 7.32 | 3.12 | 2.31 | 4.28 | 5.22 | 5.72 | 7.26 | 7.47 | 3.01 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.22 | 4.09 | 4.96 | 5.44 | 6.62 | 7.32 | 3.12 | 2.31 | 4.28 | 5.22 | 5.72 | 7.26 | 7.47 | 3.01 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.05 | 0.16 | 0.17 | 0.17 | 0.26 | 0.24 | 0.16 | 0.05 | 0.17 | 0.18 | 0.17 | 0.25 | 0.23 | 0.16 |

Table G-147. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 6.66 | 7.12 |
| Fish < 2 g | 183 [a] | 9.23 | 10.33 |
| Fish without swim bladder | 216 [c] | 0.15 | 0.15 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.17 | 1.19 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.17 | 1.19 |
| Sea turtles | 204 [d] | 0.99 | 1.02 |

## G.2.5.2. 4 Pin Piles, Post-piled

Table G-148. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.11 | 0.13 | 0.15 | 0.29 | 0.28 | 0.10 | NA | 0.12 | 0.13 | 0.14 | 0.28 | 0.27 | 0.09 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.69 | 8.45 | 9.46 | 10.42 | 11.10 | 13.59 | 11.48 | 6.53 | 9.94 | 11.76 | 13.11 | 13.82 | 18.39 | 13.41 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.11 | 0.13 | 0.15 | 0.29 | 0.28 | 0.10 | NA | 0.12 | 0.13 | 0.14 | 0.28 | 0.27 | 0.09 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.69 | 8.45 | 9.46 | 10.42 | 11.10 | 13.59 | 11.48 | 6.53 | 9.94 | 11.76 | 13.11 | 13.82 | 18.39 | 13.41 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.02 | NA | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.11 | 0.12 | 0.13 | 0.26 | 0.25 | 0.06 | NA | 0.11 | 0.12 | 0.13 | 0.20 | 0.23 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.11 | 0.12 | 0.13 | 0.26 | 0.25 | 0.06 | NA | 0.11 | 0.12 | 0.13 | 0.20 | 0.23 | 0.06 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.55 | 1.14 | 1.45 | 1.64 | 2.07 | 2.29 | 1.14 | 0.60 | 1.19 | 1.51 | 1.72 | 2.19 | 2.41 | 1.13 |

Table G-149. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 14.82 | 20.80 |
| Fish < 2 g | 183 [a] | 18.87 | 31.22 |
| Fish without swim bladder | 216 [c] | 1.67 | 1.73 |
| Fish with swim bladder not involved in hearing | 203 [c] | 5.10 | 5.58 |
| Fish with swim bladder involved in hearing | 203 [c] | 5.10 | 5.58 |
| Sea turtles | 204 [d] | 4.77 | 5.18 |

Table G-150. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.02 | 0.05 | - | NA | - | - | - | 0.02 | 0.05 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.13 | 3.86 | 4.39 | 4.73 | 5.24 | 6.32 | 4.36 | 2.35 | 4.12 | 4.77 | 5.14 | 5.74 | 7.35 | 4.31 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.02 | 0.05 | - | NA | - | - | - | 0.02 | 0.05 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.13 | 3.86 | 4.39 | 4.73 | 5.24 | 6.32 | 4.36 | 2.35 | 4.12 | 4.77 | 5.14 | 5.74 | 7.35 | 4.31 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.09 | 0.18 | 0.28 | 0.38 | 0.52 | 0.50 | 0.23 | 0.09 | 0.18 | 0.29 | 0.38 | 0.54 | 0.51 | 0.22 |

Table G-151. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 μPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 6.67 | 7.63 |
| Fish < 2 g | 183 [a] | 8.71 | 10.46 |
| Fish without swim bladder | 216 [c] | 0.35 | 0.35 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.83 | 1.90 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.83 | 1.90 |
| Sea turtles | 204 [d] | 1.67 | 1.73 |

Table G-152. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 μPa²) and SPL (dB re 1 μPa) thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.66 | 3.01 | 3.57 | 3.89 | 4.39 | 5.17 | 3.34 | 1.73 | 3.23 | 3.82 | 4.15 | 4.71 | 5.81 | 3.25 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish < 2 g | $L_p$ [b] | 150 | 1.66 | 3.01 | 3.57 | 3.89 | 4.39 | 5.17 | 3.34 | 1.73 | 3.23 | 3.82 | 4.15 | 4.71 | 5.81 | 3.25 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.05 | 0.11 | 0.15 | 0.21 | 0.34 | 0.30 | 0.15 | 0.05 | 0.12 | 0.15 | 0.22 | 0.34 | 0.30 | 0.14 |

Table G-153. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 5.46 | 6.03 |
| Fish < 2 g | 183 [a] | 7.17 | 8.23 |
| Fish without swim bladder | 216 [c] | 0.21 | 0.21 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.35 | 1.40 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.35 | 1.40 |
| Sea turtles | 204 [d] | 1.20 | 1.24 |

Table G-154. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.16 | 0.17 | 0.17 | 0.17 | 0.16 | 0.06 | NA | 0.17 | 0.18 | 0.17 | 0.17 | 0.16 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 8.85 | 10.08 | 12.06 | 15.00 | 22.42 | 27.59 | 14.24 | 9.60 | 11.16 | 13.58 | 20.45 | 34.13 | 46.85 | 13.28 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.16 | 0.17 | 0.17 | 0.17 | 0.16 | 0.06 | NA | 0.17 | 0.18 | 0.17 | 0.17 | 0.16 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 8.85 | 10.08 | 12.06 | 15.00 | 22.42 | 27.59 | 14.24 | 9.60 | 11.16 | 13.58 | 20.45 | 34.13 | 46.85 | 13.28 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.02 | 0.08 | 0.09 | 0.09 | 0.09 | 0.02 | NA | 0.02 | 0.05 | 0.09 | 0.09 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.15 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 | NA | 0.16 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.15 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 | NA | 0.16 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.66 | 1.60 | 1.98 | 2.14 | 2.33 | 2.22 | 1.10 | 0.67 | 1.66 | 2.04 | 2.14 | 2.40 | 2.19 | 1.11 |

Table G-155. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 26.89 | 45.99 |
| Fish < 2 g | 183 [a] | 38.72 | 84.15 |
| Fish without swim bladder | 216 [c] | 1.95 | 1.99 |
| Fish with swim bladder not involved in hearing | 203 [c] | 7.29 | 7.84 |
| Fish with swim bladder involved in hearing | 203 [c] | 7.29 | 7.84 |
| Sea turtles | 204 [d] | 6.66 | 7.12 |

Table G-156. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.02 | 0.05 | - | NA | - | - | - | 0.02 | 0.05 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.98 | 4.95 | 6.00 | 6.86 | 8.61 | 9.51 | 4.37 | 3.11 | 5.19 | 6.36 | 7.51 | 9.60 | 10.35 | 4.15 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.02 | 0.05 | - | NA | - | - | - | 0.02 | 0.05 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.98 | 4.95 | 6.00 | 6.86 | 8.61 | 9.51 | 4.37 | 3.11 | 5.19 | 6.36 | 7.51 | 9.60 | 10.35 | 4.15 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.11 | 0.28 | 0.32 | 0.42 | 0.47 | 0.42 | 0.21 | 0.11 | 0.21 | 0.31 | 0.44 | 0.48 | 0.43 | 0.20 |

Table G-157. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 μPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 10.08 | 11.49 |
| Fish < 2 g | 183 [a] | 14.09 | 16.74 |
| Fish without swim bladder | 216 [c] | 0.33 | 0.33 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.23 | 2.29 |
| Fish with swim bladder involved in hearing | 203 [c] | 2.23 | 2.29 |
| Sea turtles | 204 [d] | 1.95 | 1.99 |

Table G-158. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 μPa2) and SPL (dB re 1 μPa) thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.22 | 4.09 | 4.96 | 5.44 | 6.62 | 7.32 | 3.12 | 2.31 | 4.28 | 5.22 | 5.72 | 7.26 | 7.47 | 3.01 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.22 | 4.09 | 4.96 | 5.44 | 6.62 | 7.32 | 3.12 | 2.31 | 4.28 | 5.22 | 5.72 | 7.26 | 7.47 | 3.01 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.05 | 0.16 | 0.17 | 0.17 | 0.26 | 0.24 | 0.16 | 0.05 | 0.17 | 0.18 | 0.17 | 0.25 | 0.23 | 0.16 |

Table G-159. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 7.94 | 8.59 |
| Fish < 2 g | 183 [a] | 11.10 | 12.64 |
| Fish without swim bladder | 216 [c] | 0.19 | 0.19 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.54 | 1.57 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.54 | 1.57 |
| Sea turtles | 204 [d] | 1.35 | 1.37 |

### G.2.5.3. 8 Pin Piles, Pre-piled

Table G-160. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.11 | 0.13 | 0.15 | 0.29 | 0.28 | 0.10 | NA | 0.12 | 0.13 | 0.14 | 0.28 | 0.27 | 0.09 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 5.69 | 8.45 | 9.46 | 10.42 | 11.10 | 13.59 | 11.48 | 6.53 | 9.94 | 11.76 | 13.11 | 13.82 | 18.39 | 13.41 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.11 | 0.13 | 0.15 | 0.29 | 0.28 | 0.10 | NA | 0.12 | 0.13 | 0.14 | 0.28 | 0.27 | 0.09 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 5.69 | 8.45 | 9.46 | 10.42 | 11.10 | 13.59 | 11.48 | 6.53 | 9.94 | 11.76 | 13.11 | 13.82 | 18.39 | 13.41 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.02 | NA | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.11 | 0.12 | 0.13 | 0.26 | 0.25 | 0.06 | NA | 0.11 | 0.12 | 0.13 | 0.20 | 0.23 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.11 | 0.12 | 0.13 | 0.26 | 0.25 | 0.06 | NA | 0.11 | 0.12 | 0.13 | 0.20 | 0.23 | 0.06 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.55 | 1.14 | 1.45 | 1.64 | 2.07 | 2.29 | 1.14 | 0.60 | 1.19 | 1.51 | 1.72 | 2.19 | 2.41 | 1.13 |

Table G-161. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 μPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 15.79 | 23.11 |
| Fish < 2 g | 183 [a] | 20.52 | 35.14 |
| Fish without swim bladder | 216 [c] | 1.83 | 1.90 |
| Fish with swim bladder not involved in hearing | 203 [c] | 5.46 | 6.03 |
| Fish with swim bladder involved in hearing | 203 [c] | 5.46 | 6.03 |
| Sea turtles | 204 [d] | 5.11 | 5.59 |

Table G-162. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 μPa²) and SPL (dB re 1 μPa) thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.02 | 0.05 | - | NA | - | - | - | 0.02 | 0.05 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.13 | 3.86 | 4.39 | 4.73 | 5.24 | 6.32 | 4.36 | 2.35 | 4.12 | 4.77 | 5.14 | 5.74 | 7.35 | 4.31 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.02 | 0.05 | - | NA | - | - | - | 0.02 | 0.05 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.13 | 3.86 | 4.39 | 4.73 | 5.24 | 6.32 | 4.36 | 2.35 | 4.12 | 4.77 | 5.14 | 5.74 | 7.35 | 4.31 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.09 | 0.18 | 0.28 | 0.38 | 0.52 | 0.50 | 0.23 | 0.09 | 0.18 | 0.29 | 0.38 | 0.54 | 0.51 | 0.22 |

Table G-163. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 7.17 | 8.24 |
| Fish < 2 g | 183 [a] | 9.24 | 11.45 |
| Fish without swim bladder | 216 [c] | 0.41 | 0.42 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.03 | 2.15 |
| Fish with swim bladder involved in hearing | 203 [c] | 2.03 | 2.15 |
| Sea turtles | 204 [d] | 1.83 | 1.90 |

Table G-164. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.66 | 3.01 | 3.57 | 3.89 | 4.39 | 5.17 | 3.34 | 1.73 | 3.23 | 3.82 | 4.15 | 4.71 | 5.81 | 3.25 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.66 | 3.01 | 3.57 | 3.89 | 4.39 | 5.17 | 3.34 | 1.73 | 3.23 | 3.82 | 4.15 | 4.71 | 5.81 | 3.25 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.05 | 0.11 | 0.15 | 0.21 | 0.34 | 0.30 | 0.15 | 0.05 | 0.12 | 0.15 | 0.22 | 0.34 | 0.30 | 0.14 |

Table G-165. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 5.85 | 6.50 |
| Fish < 2 g | 183 [a] | 7.68 | 8.85 |
| Fish without swim bladder | 216 [c] | 0.25 | 0.26 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.50 | 1.55 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.50 | 1.55 |
| Sea turtles | 204 [d] | 1.35 | 1.40 |

Table G-166. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.16 | 0.17 | 0.17 | 0.17 | 0.16 | 0.06 | NA | 0.17 | 0.18 | 0.17 | 0.17 | 0.16 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 8.85 | 10.08 | 12.06 | 15.00 | 22.42 | 27.59 | 14.24 | 9.60 | 11.16 | 13.58 | 20.45 | 34.13 | 46.85 | 13.28 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.16 | 0.17 | 0.17 | 0.17 | 0.16 | 0.06 | NA | 0.17 | 0.18 | 0.17 | 0.17 | 0.16 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 8.85 | 10.08 | 12.06 | 15.00 | 22.42 | 27.59 | 14.24 | 9.60 | 11.16 | 13.58 | 20.45 | 34.13 | 46.85 | 13.28 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.02 | 0.08 | 0.09 | 0.09 | 0.09 | 0.02 | NA | 0.02 | 0.05 | 0.09 | 0.09 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.15 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 | NA | 0.16 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.15 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 | NA | 0.16 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.66 | 1.60 | 1.98 | 2.14 | 2.33 | 2.22 | 1.10 | 0.67 | 1.66 | 2.04 | 2.14 | 2.40 | 2.19 | 1.11 |

Table G-167. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 29.21 | 55.26 |
| Fish < 2 g | 183 [a] | 43.58 | 84.62 |
| Fish without swim bladder | 216 [c] | 2.23 | 2.29 |
| Fish with swim bladder not involved in hearing | 203 [c] | 7.94 | 8.59 |
| Fish with swim bladder involved in hearing | 203 [c] | 7.94 | 8.59 |
| Sea turtles | 204 [d] | 7.29 | 7.85 |

Table G-168. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.02 | 0.05 | - | NA | - | - | - | 0.02 | 0.05 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.98 | 4.95 | 6.00 | 6.86 | 8.61 | 9.51 | 4.37 | 3.11 | 5.19 | 6.36 | 7.51 | 9.60 | 10.35 | 4.15 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.02 | 0.05 | - | NA | - | - | - | 0.02 | 0.05 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.98 | 4.95 | 6.00 | 6.86 | 8.61 | 9.51 | 4.37 | 3.11 | 5.19 | 6.36 | 7.51 | 9.60 | 10.35 | 4.15 |
| Fish without swim bladder not involved in hearing | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish without swim bladder involved in hearing | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.11 | 0.28 | 0.32 | 0.42 | 0.47 | 0.42 | 0.21 | 0.11 | 0.21 | 0.31 | 0.44 | 0.48 | 0.43 | 0.20 |

Table G-169. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 μPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 11.11 | 12.65 |
| Fish < 2 g | 183 [a] | 15.22 | 18.28 |
| Fish without swim bladder | 216 [c] | 0.42 | 0.42 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.52 | 2.58 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.52 | 2.58 |
| Sea turtles | 204 [d] | 2.23 | 2.29 |

Table G-170. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 μPa²) and SPL (dB re 1 μPa) thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.22 | 4.09 | 4.96 | 5.44 | 6.62 | 7.32 | 3.12 | 2.31 | 4.28 | 5.22 | 5.72 | 7.26 | 7.47 | 3.01 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.22 | 4.09 | 4.96 | 5.44 | 6.62 | 7.32 | 3.12 | 2.31 | 4.28 | 5.22 | 5.72 | 7.26 | 7.47 | 3.01 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.05 | 0.16 | 0.17 | 0.17 | 0.26 | 0.24 | 0.16 | 0.05 | 0.17 | 0.18 | 0.17 | 0.25 | 0.23 | 0.16 |

Table G-171. Difficult-to-drive jacket foundation (pre-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 8.60 | 9.31 |
| Fish < 2 g | 183 [a] | 12.07 | 13.89 |
| Fish without swim bladder | 216 [c] | 0.24 | 0.22 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.75 | 1.77 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.75 | 1.77 |
| Sea turtles | 204 [d] | 1.54 | 1.57 |

### G.2.5.4. 8 Pin Piles, Post-piled

Table G-172. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.11 | 0.13 | 0.15 | 0.29 | 0.28 | 0.10 | NA | 0.12 | 0.13 | 0.14 | 0.28 | 0.27 | 0.09 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.69 | 8.45 | 9.46 | 10.42 | 11.10 | 13.59 | 11.48 | 6.53 | 9.94 | 11.76 | 13.11 | 13.82 | 18.39 | 13.41 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.11 | 0.13 | 0.15 | 0.29 | 0.28 | 0.10 | NA | 0.12 | 0.13 | 0.14 | 0.28 | 0.27 | 0.09 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.69 | 8.45 | 9.46 | 10.42 | 11.10 | 13.59 | 11.48 | 6.53 | 9.94 | 11.76 | 13.11 | 13.82 | 18.39 | 13.41 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.02 | NA | 0.06 | 0.07 | 0.08 | 0.09 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.11 | 0.12 | 0.13 | 0.26 | 0.25 | 0.06 | NA | 0.11 | 0.12 | 0.13 | 0.20 | 0.23 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.11 | 0.12 | 0.13 | 0.26 | 0.25 | 0.06 | NA | 0.11 | 0.12 | 0.13 | 0.20 | 0.23 | 0.06 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.55 | 1.14 | 1.45 | 1.64 | 2.07 | 2.29 | 1.14 | 0.60 | 1.19 | 1.51 | 1.72 | 2.19 | 2.41 | 1.13 |

Table G-173. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 17.78 | 28.10 |
| Fish < 2 g | 183 [a] | 23.70 | 45.92 |
| Fish without swim bladder | 216 [c] | 2.28 | 2.40 |
| Fish with swim bladder not involved in hearing | 203 [c] | 6.25 | 7.05 |
| Fish with swim bladder involved in hearing | 203 [c] | 6.25 | 7.05 |
| Sea turtles | 204 [d] | 5.85 | 6.50 |

Table G-174. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.02 | 0.05 | - | NA | - | - | - | 0.02 | 0.05 | - |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.13 | 3.86 | 4.39 | 4.73 | 5.24 | 6.32 | 4.36 | 2.35 | 4.12 | 4.77 | 5.14 | 5.74 | 7.35 | 4.31 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.02 | 0.05 | - | NA | - | - | - | 0.02 | 0.05 | - |
| Fish < 2 g | $L_p$ [b] | 150 | 2.13 | 3.86 | 4.39 | 4.73 | 5.24 | 6.32 | 4.36 | 2.35 | 4.12 | 4.77 | 5.14 | 5.74 | 7.35 | 4.31 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.09 | 0.18 | 0.28 | 0.38 | 0.52 | 0.50 | 0.23 | 0.09 | 0.18 | 0.29 | 0.38 | 0.54 | 0.51 | 0.22 |

Table G-175. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 8.20 | 9.52 |
| Fish < 2 g | 183 [a] | 10.74 | 13.46 |
| Fish without swim bladder | 216 [c] | 0.55 | 0.57 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.50 | 2.62 |
| Fish with swim bladder involved in hearing | 203 [c] | 2.50 | 2.62 |
| Sea turtles | 204 [d] | 2.28 | 2.40 |

Table G-176. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.66 | 3.01 | 3.57 | 3.89 | 4.39 | 5.17 | 3.34 | 1.73 | 3.23 | 3.82 | 4.15 | 4.71 | 5.81 | 3.25 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.66 | 3.01 | 3.57 | 3.89 | 4.39 | 5.17 | 3.34 | 1.73 | 3.23 | 3.82 | 4.15 | 4.71 | 5.81 | 3.25 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.05 | 0.11 | 0.15 | 0.21 | 0.34 | 0.30 | 0.15 | 0.05 | 0.12 | 0.15 | 0.22 | 0.34 | 0.30 | 0.14 |

Table G-177. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 6.67 | 7.63 |
| Fish < 2 g | 183 [a] | 8.71 | 10.47 |
| Fish without swim bladder | 216 [c] | 0.35 | 0.36 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.83 | 1.90 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.83 | 1.90 |
| Sea turtles | 204 [d] | 1.67 | 1.73 |

Table G-178. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.16 | 0.17 | 0.17 | 0.17 | 0.16 | 0.06 | NA | 0.17 | 0.18 | 0.17 | 0.17 | 0.16 | 0.06 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 8.85 | 10.08 | 12.06 | 15.00 | 22.42 | 27.59 | 14.24 | 9.60 | 11.16 | 13.58 | 20.45 | 34.13 | 46.85 | 13.28 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.16 | 0.17 | 0.17 | 0.17 | 0.16 | 0.06 | NA | 0.17 | 0.18 | 0.17 | 0.17 | 0.16 | 0.06 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 8.85 | 10.08 | 12.06 | 15.00 | 22.42 | 27.59 | 14.24 | 9.60 | 11.16 | 13.58 | 20.45 | 34.13 | 46.85 | 13.28 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.02 | 0.08 | 0.09 | 0.09 | 0.09 | 0.02 | NA | 0.02 | 0.05 | 0.09 | 0.09 | 0.09 | 0.03 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.15 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 | NA | 0.16 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.15 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 | NA | 0.16 | 0.17 | 0.16 | 0.16 | 0.14 | 0.06 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.66 | 1.60 | 1.98 | 2.14 | 2.33 | 2.22 | 1.10 | 0.67 | 1.66 | 2.04 | 2.14 | 2.40 | 2.19 | 1.11 |

Table G-179. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 34.95 | 81.51 |
| Fish < 2 g | 183 [a] | 53.05 | 85.15 |
| Fish without swim bladder | 216 [c] | 2.78 | 2.84 |
| Fish with swim bladder not involved in hearing | 203 [c] | 9.24 | 10.34 |
| Fish with swim bladder involved in hearing | 203 [c] | 9.24 | 10.34 |
| Sea turtles | 204 [d] | 8.60 | 9.31 |

Table G-180. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.02 | 0.05 | - | NA | - | - | - | 0.02 | 0.05 | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.98 | 4.95 | 6.00 | 6.86 | 8.61 | 9.51 | 4.37 | 3.11 | 5.19 | 6.36 | 7.51 | 9.60 | 10.35 | 4.15 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.02 | 0.05 | - | NA | - | - | - | 0.02 | 0.05 | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.98 | 4.95 | 6.00 | 6.86 | 8.61 | 9.51 | 4.37 | 3.11 | 5.19 | 6.36 | 7.51 | 9.60 | 10.35 | 4.15 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | 0.03 | - | NA | - | - | - | - | 0.03 | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.11 | 0.28 | 0.32 | 0.42 | 0.47 | 0.42 | 0.21 | 0.11 | 0.21 | 0.31 | 0.44 | 0.48 | 0.43 | 0.20 |

Table G-181. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 13.05 | 15.26 |
| Fish < 2 g | 183 [a] | 17.61 | 23.22 |
| Fish without swim bladder | 216 [c] | 0.54 | 0.54 |
| Fish with swim bladder not involved in hearing | 203 [c] | 3.09 | 3.23 |
| Fish with swim bladder involved in hearing | 203 [c] | 3.09 | 3.23 |
| Sea turtles | 204 [d] | 2.78 | 2.84 |

Table G-182. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.22 | 4.09 | 4.96 | 5.44 | 6.62 | 7.32 | 3.12 | 2.31 | 4.28 | 5.22 | 5.72 | 7.26 | 7.47 | 3.01 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.22 | 4.09 | 4.96 | 5.44 | 6.62 | 7.32 | 3.12 | 2.31 | 4.28 | 5.22 | 5.72 | 7.26 | 7.47 | 3.01 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.05 | 0.16 | 0.17 | 0.17 | 0.26 | 0.24 | 0.16 | 0.05 | 0.17 | 0.18 | 0.17 | 0.25 | 0.23 | 0.16 |

Table G-183. Difficult-to-drive jacket foundation (post-piled 4 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 10.09 | 11.50 |
| Fish < 2 g | 183 [a] | 14.10 | 16.76 |
| Fish without swim bladder | 216 [c] | 0.33 | 0.33 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.23 | 2.29 |
| Fish with swim bladder involved in hearing | 203 [c] | 2.23 | 2.29 |
| Sea turtles | 204 [d] | 1.95 | 2.00 |

## G.2.6. Jacket Foundation, 4.25 m Diameter Pin Pile (Difficult-to-drive)

### G.2.6.1. 4 Pin Piles, Pre-piled

Table G-184. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 | NA | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.13 | 8.89 | 9.90 | 10.99 | 12.45 | 13.35 | 16.12 | 5.75 | 10.78 | 12.40 | 13.68 | 16.15 | 17.80 | 25.79 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 | NA | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.13 | 8.89 | 9.90 | 10.99 | 12.45 | 13.35 | 16.12 | 5.75 | 10.78 | 12.40 | 13.68 | 16.15 | 17.80 | 25.79 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.06 | 0.07 | 0.09 | 0.09 | 0.09 | 0.07 | NA | 0.06 | 0.08 | 0.09 | 0.11 | 0.10 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.11 | 0.13 | 0.15 | 0.24 | 0.29 | 0.15 | NA | 0.11 | 0.13 | 0.14 | 0.20 | 0.28 | 0.18 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.11 | 0.13 | 0.15 | 0.24 | 0.29 | 0.15 | NA | 0.11 | 0.13 | 0.14 | 0.20 | 0.28 | 0.18 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.36 | 1.28 | 1.58 | 1.78 | 2.11 | 2.43 | 2.37 | 0.36 | 1.33 | 1.66 | 1.85 | 2.22 | 2.54 | 2.45 |

Table G-185. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 15.21 | 23.09 |
| Fish < 2 g | 183 [a] | 19.24 | 34.73 |
| Fish without swim bladder | 216 [c] | 1.70 | 1.77 |
| Fish with swim bladder not involved in hearing | 203 [c] | 5.34 | 5.97 |
| Fish with swim bladder involved in hearing | 203 [c] | 5.34 | 5.97 |
| Sea turtles | 204 [d] | 4.98 | 5.51 |

Table G-186. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) hresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | 0.05 | 0.06 | 0.06 | 0.04 | NA | - | - | 0.04 | 0.06 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.73 | 4.10 | 4.65 | 5.05 | 5.63 | 6.34 | 7.18 | 1.82 | 4.40 | 5.11 | 5.56 | 6.29 | 7.28 | 8.39 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | 0.05 | 0.06 | 0.06 | 0.04 | NA | - | - | 0.04 | 0.06 | 0.06 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.73 | 4.10 | 4.65 | 5.05 | 5.63 | 6.34 | 7.18 | 1.82 | 4.40 | 5.11 | 5.56 | 6.29 | 7.28 | 8.39 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | 0.05 | 0.05 | 0.03 | NA | - | - | - | 0.05 | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | 0.05 | 0.05 | 0.03 | NA | - | - | - | 0.05 | 0.05 | 0.03 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.05 | 0.23 | 0.32 | 0.41 | 0.55 | 0.58 | 0.46 | 0.05 | 0.24 | 0.33 | 0.42 | 0.58 | 0.59 | 0.46 |

Table G-187. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL behavioral thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 7.00 | 8.19 |
| Fish < 2 g | 183 [a] | 9.03 | 11.41 |
| Fish without swim bladder | 216 [c] | 0.34 | 0.35 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.88 | 1.98 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.88 | 1.98 |
| Sea turtles | 204 [d] | 1.70 | 1.77 |

Table G-188. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.34 | 3.27 | 3.78 | 4.15 | 4.62 | 5.24 | 5.75 | 1.40 | 3.51 | 4.09 | 4.46 | 5.02 | 5.83 | 6.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.34 | 3.27 | 3.78 | 4.15 | 4.62 | 5.24 | 5.75 | 1.40 | 3.51 | 4.09 | 4.46 | 5.02 | 5.83 | 6.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.02 | 0.12 | 0.18 | 0.23 | 0.34 | 0.37 | 0.30 | 0.02 | 0.13 | 0.18 | 0.24 | 0.35 | 0.37 | 0.29 |

Table G-189. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 5.72 | 6.43 |
| Fish < 2 g | 183 [a] | 7.51 | 8.81 |
| Fish without swim bladder | 216 [c] | 0.19 | 0.20 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.36 | 1.41 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.36 | 1.41 |
| Sea turtles | 204 [d] | 1.22 | 1.26 |

Table G-190. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.17 | 0.19 | 0.32 | 0.33 | 0.25 | 0.15 | NA | 0.18 | 0.20 | 0.20 | 0.32 | 0.25 | 0.15 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 7.35 | 11.14 | 12.18 | 12.84 | 17.24 | 27.61 | 29.30 | 7.96 | 12.58 | 13.44 | 14.65 | 24.17 | 50.59 | 41.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.17 | 0.19 | 0.32 | 0.33 | 0.25 | 0.15 | NA | 0.18 | 0.20 | 0.20 | 0.32 | 0.25 | 0.15 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 7.35 | 11.14 | 12.18 | 12.84 | 17.24 | 27.61 | 29.30 | 7.96 | 12.58 | 13.44 | 14.65 | 24.17 | 50.59 | 41.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.04 | 0.10 | 0.11 | 0.12 | 0.09 | 0.07 | NA | 0.04 | 0.10 | 0.11 | 0.13 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.16 | 0.18 | 0.19 | 0.28 | 0.17 | 0.13 | NA | 0.17 | 0.18 | 0.20 | 0.20 | 0.16 | 0.13 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.16 | 0.18 | 0.19 | 0.28 | 0.17 | 0.13 | NA | 0.17 | 0.18 | 0.20 | 0.20 | 0.16 | 0.13 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.38 | 1.71 | 2.14 | 2.55 | 2.81 | 2.50 | 2.08 | 0.46 | 1.77 | 2.28 | 2.64 | 2.84 | 2.42 | 2.10 |

Table G-191. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 μPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 27.92 | 48.13 |
| Fish < 2 g | 183 [a] | 41.31 | 84.40 |
| Fish without swim bladder | 216 [c] | 1.96 | 2.04 |
| Fish with swim bladder not involved in hearing | 203 [c] | 7.45 | 7.89 |
| Fish with swim bladder involved in hearing | 203 [c] | 7.45 | 7.89 |
| Sea turtles | 204 [d] | 6.80 | 7.18 |

Table G-192. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 μPa²) and SPL (dB re 1 μPa) thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.03 | 0.06 | 0.04 | NA | - | - | - | 0.03 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.65 | 5.30 | 5.78 | 6.61 | 8.19 | 10.00 | 9.37 | 2.73 | 5.56 | 6.08 | 7.07 | 8.89 | 11.12 | 9.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.03 | 0.06 | 0.04 | NA | - | - | - | 0.03 | 0.06 | 0.04 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.65 | 5.30 | 5.78 | 6.61 | 8.19 | 10.00 | 9.37 | 2.73 | 5.56 | 6.08 | 7.07 | 8.89 | 11.12 | 9.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | 0.02 | 0.05 | 0.03 | NA | - | - | - | 0.02 | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | 0.02 | 0.05 | 0.03 | NA | - | - | - | 0.02 | 0.05 | 0.03 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.04 | 0.31 | 0.47 | 0.51 | 0.56 | 0.45 | 0.39 | 0.04 | 0.30 | 0.47 | 0.51 | 0.57 | 0.46 | 0.40 |

Table G-193. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 μPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 10.37 | 11.52 |
| Fish < 2 g | 183 [a] | 14.42 | 16.80 |
| Fish without swim bladder | 216 [c] | 0.31 | 0.31 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.24 | 2.32 |
| Fish with swim bladder involved in hearing | 203 [c] | 2.24 | 2.32 |
| Sea turtles | 204 [d] | 1.96 | 2.04 |

Table G-194. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 μPa²) and SPL (dB re 1 μPa) thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.83 | 4.37 | 4.82 | 5.58 | 6.66 | 7.60 | 6.91 | 1.87 | 4.55 | 5.06 | 5.89 | 7.16 | 8.06 | 6.53 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.83 | 4.37 | 4.82 | 5.58 | 6.66 | 7.60 | 6.91 | 1.87 | 4.55 | 5.06 | 5.89 | 7.16 | 8.06 | 6.53 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.02 | 0.17 | 0.20 | 0.30 | 0.39 | 0.27 | 0.24 | 0.02 | 0.17 | 0.20 | 0.27 | 0.40 | 0.26 | 0.25 |

Table G-195. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 8.11 | 8.62 |
| Fish < 2 g | 183 [a] | 11.38 | 12.64 |
| Fish without swim bladder | 216 [c] | 0.18 | 0.18 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.56 | 1.60 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.56 | 1.60 |
| Sea turtles | 204 [d] | 1.35 | 1.39 |

### G.2.6.2. 4 Pin Piles, Post-piled

Table G-196. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 | NA | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.13 | 8.89 | 9.90 | 10.99 | 12.45 | 13.35 | 16.12 | 5.75 | 10.78 | 12.40 | 13.68 | 16.15 | 17.80 | 25.79 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 | NA | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.13 | 8.89 | 9.90 | 10.99 | 12.45 | 13.35 | 16.12 | 5.75 | 10.78 | 12.40 | 13.68 | 16.15 | 17.80 | 25.79 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.06 | 0.07 | 0.09 | 0.09 | 0.09 | 0.07 | NA | 0.06 | 0.08 | 0.09 | 0.11 | 0.10 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.11 | 0.13 | 0.15 | 0.24 | 0.29 | 0.15 | NA | 0.11 | 0.13 | 0.14 | 0.20 | 0.28 | 0.18 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.11 | 0.13 | 0.15 | 0.24 | 0.29 | 0.15 | NA | 0.11 | 0.13 | 0.14 | 0.20 | 0.28 | 0.18 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.36 | 1.28 | 1.58 | 1.78 | 2.11 | 2.43 | 2.37 | 0.36 | 1.33 | 1.66 | 1.85 | 2.22 | 2.54 | 2.45 |

Table G-197. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 17.13 | 27.96 |
| Fish < 2 g | 183 [a] | 22.37 | 44.99 |
| Fish without swim bladder | 216 [c] | 2.11 | 2.24 |
| Fish with swim bladder not involved in hearing | 203 [c] | 6.12 | 6.98 |
| Fish with swim bladder involved in hearing | 203 [c] | 6.12 | 6.98 |
| Sea turtles | 204 [d] | 5.72 | 6.43 |

Table G-198. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | 0.05 | 0.06 | 0.06 | 0.04 | NA | - | - | 0.04 | 0.06 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.73 | 4.10 | 4.65 | 5.05 | 5.63 | 6.34 | 7.18 | 1.82 | 4.40 | 5.11 | 5.56 | 6.29 | 7.28 | 8.39 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | 0.05 | 0.06 | 0.06 | 0.04 | NA | - | - | 0.04 | 0.06 | 0.06 | 0.04 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.73 | 4.10 | 4.65 | 5.05 | 5.63 | 6.34 | 7.18 | 1.82 | 4.40 | 5.11 | 5.56 | 6.29 | 7.28 | 8.39 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | 0.05 | 0.05 | 0.03 | NA | - | - | - | 0.05 | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | 0.05 | 0.05 | 0.03 | NA | - | - | - | 0.05 | 0.05 | 0.03 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.05 | 0.23 | 0.32 | 0.41 | 0.55 | 0.58 | 0.46 | 0.05 | 0.24 | 0.33 | 0.42 | 0.58 | 0.59 | 0.46 |

Table G-199. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 8.02 | 9.49 |
| Fish < 2 g | 183 [a] | 10.41 | 13.44 |
| Fish without swim bladder | 216 [c] | 0.46 | 0.47 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.36 | 2.49 |
| Fish with swim bladder involved in hearing | 203 [c] | 2.36 | 2.49 |
| Sea turtles | 204 [d] | 2.11 | 2.24 |

Table G-200. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.34 | 3.27 | 3.78 | 4.15 | 4.62 | 5.24 | 5.75 | 1.40 | 3.51 | 4.09 | 4.46 | 5.02 | 5.83 | 6.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.34 | 3.27 | 3.78 | 4.15 | 4.62 | 5.24 | 5.75 | 1.40 | 3.51 | 4.09 | 4.46 | 5.02 | 5.83 | 6.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.02 | 0.12 | 0.18 | 0.23 | 0.34 | 0.37 | 0.30 | 0.02 | 0.13 | 0.18 | 0.24 | 0.35 | 0.37 | 0.29 |

Table G-201. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 6.52 | 7.58 |
| Fish < 2 g | 183 [a] | 8.53 | 10.43 |
| Fish without swim bladder | 216 [c] | 0.29 | 0.30 |
| Fish with swim bladder not involved | 203 [c] | 1.70 | 1.77 |
| Fish with swim bladder involved | 203 [c] | 1.70 | 1.77 |
| Sea turtles | 204 [d] | 1.54 | 1.60 |

Table G-202. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.17 | 0.19 | 0.32 | 0.33 | 0.25 | 0.15 | NA | 0.18 | 0.20 | 0.20 | 0.32 | 0.25 | 0.15 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 7.35 | 11.14 | 12.18 | 12.84 | 17.24 | 27.61 | 29.30 | 7.96 | 12.58 | 13.44 | 14.65 | 24.17 | 50.59 | 41.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.17 | 0.19 | 0.32 | 0.33 | 0.25 | 0.15 | NA | 0.18 | 0.20 | 0.20 | 0.32 | 0.25 | 0.15 |
| Fish < 2 g | $L_p$ [b] | 150 | 7.35 | 11.14 | 12.18 | 12.84 | 17.24 | 27.61 | 29.30 | 7.96 | 12.58 | 13.44 | 14.65 | 24.17 | 50.59 | 41.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.04 | 0.10 | 0.11 | 0.12 | 0.09 | 0.07 | NA | 0.04 | 0.10 | 0.11 | 0.13 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.16 | 0.18 | 0.19 | 0.28 | 0.17 | 0.13 | NA | 0.17 | 0.18 | 0.20 | 0.20 | 0.16 | 0.13 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.16 | 0.18 | 0.19 | 0.28 | 0.17 | 0.13 | NA | 0.17 | 0.18 | 0.20 | 0.20 | 0.16 | 0.13 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.38 | 1.71 | 2.14 | 2.55 | 2.81 | 2.50 | 2.08 | 0.46 | 1.77 | 2.28 | 2.64 | 2.84 | 2.42 | 2.10 |

Table G-203. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 μPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 33.36 | 70.95 |
| Fish < 2 g | 183 [a] | 51.45 | 85.05 |
| Fish without swim bladder | 216 [c] | 2.55 | 2.61 |
| Fish with swim bladder not involved in hearing | 203 [c] | 8.77 | 9.33 |
| Fish with swim bladder involved in hearing | 203 [c] | 8.77 | 9.33 |
| Sea turtles | 204 [d] | 8.11 | 8.62 |

Table G-204. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 μPa²) and SPL (dB re 1 μPa) thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.03 | 0.06 | 0.04 | NA | - | - | - | 0.03 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 2.65 | 5.30 | 5.78 | 6.61 | 8.19 | 10.00 | 9.37 | 2.73 | 5.56 | 6.08 | 7.07 | 8.89 | 11.12 | 9.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.03 | 0.06 | 0.04 | NA | - | - | - | 0.03 | 0.06 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 2.65 | 5.30 | 5.78 | 6.61 | 8.19 | 10.00 | 9.37 | 2.73 | 5.56 | 6.08 | 7.07 | 8.89 | 11.12 | 9.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | 0.02 | 0.05 | 0.03 | NA | - | - | - | 0.02 | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | 0.02 | 0.05 | 0.03 | NA | - | - | - | 0.02 | 0.05 | 0.03 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.04 | 0.31 | 0.47 | 0.51 | 0.56 | 0.45 | 0.39 | 0.04 | 0.30 | 0.47 | 0.51 | 0.57 | 0.46 | 0.40 |

Table G-205. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 12.34 | 13.88 |
| Fish < 2 g | 183 [a] | 16.82 | 20.80 |
| Fish without swim bladder | 216 [c] | 0.46 | 0.47 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.79 | 2.86 |
| Fish with swim bladder involved in hearing | 203 [c] | 2.79 | 2.86 |
| Sea turtles | 204 [d] | 2.55 | 2.61 |

Table G-206. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.83 | 4.37 | 4.82 | 5.58 | 6.66 | 7.60 | 6.91 | 1.87 | 4.55 | 5.06 | 5.89 | 7.16 | 8.06 | 6.53 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.83 | 4.37 | 4.82 | 5.58 | 6.66 | 7.60 | 6.91 | 1.87 | 4.55 | 5.06 | 5.89 | 7.16 | 8.06 | 6.53 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.02 | 0.17 | 0.20 | 0.30 | 0.39 | 0.27 | 0.24 | 0.02 | 0.17 | 0.20 | 0.27 | 0.40 | 0.26 | 0.25 |

Table G-207. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 9.40 | 10.37 |
| Fish < 2 g | 183 [a] | 13.34 | 15.26 |
| Fish without swim bladder | 216 [c] | 0.28 | 0.26 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.96 | 2.04 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.96 | 2.04 |
| Sea turtles | 204 [d] | 1.76 | 1.81 |

### G.2.6.3. 8 Pin Piles, Pre-piled

Table G-208. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 μPa$^2$) and SPL (dB re 1 μPa) thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 | NA | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.13 | 8.89 | 9.90 | 10.99 | 12.45 | 13.35 | 16.12 | 5.75 | 10.78 | 12.40 | 13.68 | 16.15 | 17.80 | 25.79 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 | NA | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.13 | 8.89 | 9.90 | 10.99 | 12.45 | 13.35 | 16.12 | 5.75 | 10.78 | 12.40 | 13.68 | 16.15 | 17.80 | 25.79 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.06 | 0.07 | 0.09 | 0.09 | 0.09 | 0.07 | NA | 0.06 | 0.08 | 0.09 | 0.11 | 0.10 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.11 | 0.13 | 0.15 | 0.24 | 0.29 | 0.15 | NA | 0.11 | 0.13 | 0.14 | 0.20 | 0.28 | 0.18 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.11 | 0.13 | 0.15 | 0.24 | 0.29 | 0.15 | NA | 0.11 | 0.13 | 0.14 | 0.20 | 0.28 | 0.18 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.36 | 1.28 | 1.58 | 1.78 | 2.11 | 2.43 | 2.37 | 0.36 | 1.33 | 1.66 | 1.85 | 2.22 | 2.54 | 2.45 |

Table G-209. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 18.08 | 31.05 |
| Fish < 2 g | 183 [a] | 23.85 | 52.08 |
| Fish without swim bladder | 216 [c] | 2.37 | 2.49 |
| Fish with swim bladder not involved in hearing | 203 [c] | 6.53 | 7.59 |
| Fish with swim bladder involved in hearing | 203 [c] | 6.53 | 7.59 |
| Sea turtles | 204 [d] | 6.12 | 6.99 |

Table G-210. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | 0.05 | 0.06 | 0.06 | 0.04 | NA | - | - | 0.04 | 0.06 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.73 | 4.10 | 4.65 | 5.05 | 5.63 | 6.34 | 7.18 | 1.82 | 4.40 | 5.11 | 5.56 | 6.29 | 7.28 | 8.39 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | 0.05 | 0.06 | 0.06 | 0.04 | NA | - | - | 0.04 | 0.06 | 0.06 | 0.04 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.73 | 4.10 | 4.65 | 5.05 | 5.63 | 6.34 | 7.18 | 1.82 | 4.40 | 5.11 | 5.56 | 6.29 | 7.28 | 8.39 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | 0.05 | 0.05 | 0.03 | NA | - | - | - | 0.05 | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | 0.05 | 0.05 | 0.03 | NA | - | - | - | 0.05 | 0.05 | 0.03 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.05 | 0.23 | 0.32 | 0.41 | 0.55 | 0.58 | 0.46 | 0.05 | 0.24 | 0.33 | 0.42 | 0.58 | 0.59 | 0.46 |

Table G-211. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 8.54 | 10.44 |
| Fish < 2 g | 183 [a] | 11.18 | 14.60 |
| Fish without swim bladder | 216 [c] | 0.54 | 0.56 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.59 | 2.72 |
| Fish with swim bladder involved in hearing | 203 [c] | 2.59 | 2.72 |
| Sea turtles | 204 [d] | 2.37 | 2.49 |

Table G-212. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.34 | 3.27 | 3.78 | 4.15 | 4.62 | 5.24 | 5.75 | 1.40 | 3.51 | 4.09 | 4.46 | 5.02 | 5.83 | 6.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.34 | 3.27 | 3.78 | 4.15 | 4.62 | 5.24 | 5.75 | 1.40 | 3.51 | 4.09 | 4.46 | 5.02 | 5.83 | 6.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.02 | 0.12 | 0.18 | 0.23 | 0.34 | 0.37 | 0.30 | 0.02 | 0.13 | 0.18 | 0.24 | 0.35 | 0.37 | 0.29 |

Table G-213. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 7.01 | 8.20 |
| Fish < 2 g | 183 [a] | 9.04 | 11.42 |
| Fish without swim bladder | 216 [c] | 0.34 | 0.35 |
| Fish with swim bladder not involved in hearing | 203 [c] | 1.88 | 1.98 |
| Fish with swim bladder involved in hearing | 203 [c] | 1.88 | 1.98 |
| Sea turtles | 204 [d] | 1.70 | 1.77 |

Table G-214. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.17 | 0.19 | 0.32 | 0.33 | 0.25 | 0.15 | NA | 0.18 | 0.20 | 0.20 | 0.32 | 0.25 | 0.15 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 7.35 | 11.14 | 12.18 | 12.84 | 17.24 | 27.61 | 29.30 | 7.96 | 12.58 | 13.44 | 14.65 | 24.17 | 50.59 | 41.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.17 | 0.19 | 0.32 | 0.33 | 0.25 | 0.15 | NA | 0.18 | 0.20 | 0.20 | 0.32 | 0.25 | 0.15 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 7.35 | 11.14 | 12.18 | 12.84 | 17.24 | 27.61 | 29.30 | 7.96 | 12.58 | 13.44 | 14.65 | 24.17 | 50.59 | 41.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.04 | 0.10 | 0.11 | 0.12 | 0.09 | 0.07 | NA | 0.04 | 0.10 | 0.11 | 0.13 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.16 | 0.18 | 0.19 | 0.28 | 0.17 | 0.13 | NA | 0.17 | 0.18 | 0.20 | 0.20 | 0.16 | 0.13 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.16 | 0.18 | 0.19 | 0.28 | 0.17 | 0.13 | NA | 0.17 | 0.18 | 0.20 | 0.20 | 0.16 | 0.13 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.38 | 1.71 | 2.14 | 2.55 | 2.81 | 2.50 | 2.08 | 0.46 | 1.77 | 2.28 | 2.64 | 2.84 | 2.42 | 2.10 |

Table G-215. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 μPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 36.92 | 83.09 |
| Fish < 2 g | 183 [a] | 55.35 | 85.22 |
| Fish without swim bladder | 216 [c] | 2.79 | 2.86 |
| Fish with swim bladder not involved in hearing | 203 [c] | 9.41 | 10.38 |
| Fish with swim bladder involved in hearing | 203 [c] | 9.41 | 10.38 |
| Sea turtles | 204 [d] | 8.78 | 9.34 |

Table G-216. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 μPa²) and SPL (dB re 1 μPa) thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.03 | 0.06 | 0.04 | NA | - | - | - | 0.03 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.65 | 5.30 | 5.78 | 6.61 | 8.19 | 10.00 | 9.37 | 2.73 | 5.56 | 6.08 | 7.07 | 8.89 | 11.12 | 9.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.03 | 0.06 | 0.04 | NA | - | - | - | 0.03 | 0.06 | 0.04 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.65 | 5.30 | 5.78 | 6.61 | 8.19 | 10.00 | 9.37 | 2.73 | 5.56 | 6.08 | 7.07 | 8.89 | 11.12 | 9.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | 0.02 | 0.05 | 0.03 | NA | - | - | - | 0.02 | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | 0.02 | 0.05 | 0.03 | NA | - | - | - | 0.02 | 0.05 | 0.03 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.04 | 0.31 | 0.47 | 0.51 | 0.56 | 0.45 | 0.39 | 0.04 | 0.30 | 0.47 | 0.51 | 0.57 | 0.46 | 0.40 |

Table G-217. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 13.35 | 15.28 |
| Fish < 2 g | 183 [a] | 18.04 | 23.47 |
| Fish without swim bladder | 216 [c] | 0.55 | 0.56 |
| Fish with swim bladder not involved in hearing | 203 [c] | 3.20 | 3.27 |
| Fish with swim bladder involved in hearing | 203 [c] | 3.20 | 3.27 |
| Sea turtles | 204 [d] | 2.79 | 2.86 |

Table G-218. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.83 | 4.37 | 4.82 | 5.58 | 6.66 | 7.60 | 6.91 | 1.87 | 4.55 | 5.06 | 5.89 | 7.16 | 8.06 | 6.53 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.83 | 4.37 | 4.82 | 5.58 | 6.66 | 7.60 | 6.91 | 1.87 | 4.55 | 5.06 | 5.89 | 7.16 | 8.06 | 6.53 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.02 | 0.17 | 0.20 | 0.30 | 0.39 | 0.27 | 0.24 | 0.02 | 0.17 | 0.20 | 0.27 | 0.40 | 0.26 | 0.25 |

Table G-219. Difficult-to-drive jacket foundation (pre-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 10.38 | 11.53 |
| Fish < 2 g | 183 [a] | 14.43 | 16.82 |
| Fish without swim bladder | 216 [c] | 0.32 | 0.32 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.25 | 2.32 |
| Fish with swim bladder involved in hearing | 203 [c] | 2.25 | 2.32 |
| Sea turtles | 204 [d] | 1.97 | 2.05 |

## G.2.6.4. 8 Pin Piles, Post-piled

Table G-220. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa$^2$) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 | NA | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 5.13 | 8.89 | 9.90 | 10.99 | 12.45 | 13.35 | 16.12 | 5.75 | 10.78 | 12.40 | 13.68 | 16.15 | 17.80 | 25.79 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.12 | 0.13 | 0.18 | 0.28 | 0.31 | 0.24 | NA | 0.12 | 0.13 | 0.18 | 0.27 | 0.30 | 0.24 |
| Fish < 2 g | $L_p$ [b] | 150 | 5.13 | 8.89 | 9.90 | 10.99 | 12.45 | 13.35 | 16.12 | 5.75 | 10.78 | 12.40 | 13.68 | 16.15 | 17.80 | 25.79 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.06 | 0.07 | 0.09 | 0.09 | 0.09 | 0.07 | NA | 0.06 | 0.08 | 0.09 | 0.11 | 0.10 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.11 | 0.13 | 0.15 | 0.24 | 0.29 | 0.15 | NA | 0.11 | 0.13 | 0.14 | 0.20 | 0.28 | 0.18 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.11 | 0.13 | 0.15 | 0.24 | 0.29 | 0.15 | NA | 0.11 | 0.13 | 0.14 | 0.20 | 0.28 | 0.18 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.36 | 1.28 | 1.58 | 1.78 | 2.11 | 2.43 | 2.37 | 0.36 | 1.33 | 1.66 | 1.85 | 2.22 | 2.54 | 2.45 |

Table G-221. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 μPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 20.87 | 39.36 |
| Fish < 2 g | 183 [a] | 26.90 | 74.62 |
| Fish without swim bladder | 216 [c] | 2.80 | 2.99 |
| Fish with swim bladder not involved in hearing | 203 [c] | 7.52 | 8.82 |
| Fish with swim bladder involved in hearing | 203 [c] | 7.52 | 8.82 |
| Sea turtles | 204 [d] | 7.01 | 8.20 |

Table G-222. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea PK (dB re 1 μPa²) and SPL (dB re 1 μPa) thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | 0.05 | 0.06 | 0.06 | 0.04 | NA | - | - | 0.04 | 0.06 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 1.73 | 4.10 | 4.65 | 5.05 | 5.63 | 6.34 | 7.18 | 1.82 | 4.40 | 5.11 | 5.56 | 6.29 | 7.28 | 8.39 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | 0.05 | 0.06 | 0.06 | 0.04 | NA | - | - | 0.04 | 0.06 | 0.06 | 0.04 |
| Fish < 2 g | $L_p$ [b] | 150 | 1.73 | 4.10 | 4.65 | 5.05 | 5.63 | 6.34 | 7.18 | 1.82 | 4.40 | 5.11 | 5.56 | 6.29 | 7.28 | 8.39 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | 0.05 | 0.05 | 0.03 | NA | - | - | - | 0.05 | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | 0.05 | 0.05 | 0.03 | NA | - | - | - | 0.05 | 0.05 | 0.03 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.05 | 0.23 | 0.32 | 0.41 | 0.55 | 0.58 | 0.46 | 0.05 | 0.24 | 0.33 | 0.42 | 0.58 | 0.59 | 0.46 |

Table G-223. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 9.63 | 12.40 |
| Fish < 2 g | 183 [a] | 12.70 | 17.23 |
| Fish without swim bladder | 216 [c] | 0.72 | 0.74 |
| Fish with swim bladder not involved in hearing | 203 [c] | 3.10 | 3.35 |
| Fish with swim bladder involved in hearing | 203 [c] | 3.10 | 3.35 |
| Sea turtles | 204 [d] | 2.80 | 2.99 |

Table G-224. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.34 | 3.27 | 3.78 | 4.15 | 4.62 | 5.24 | 5.75 | 1.40 | 3.51 | 4.09 | 4.46 | 5.02 | 5.83 | 6.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.34 | 3.27 | 3.78 | 4.15 | 4.62 | 5.24 | 5.75 | 1.40 | 3.51 | 4.09 | 4.46 | 5.02 | 5.83 | 6.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.02 | 0.12 | 0.18 | 0.23 | 0.34 | 0.37 | 0.30 | 0.02 | 0.13 | 0.18 | 0.24 | 0.35 | 0.37 | 0.29 |

Table G-225. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L01 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 8.03 | 9.50 |
| Fish < 2 g | 183 [a] | 10.42 | 13.45 |
| Fish without swim bladder | 216 [c] | 0.46 | 0.47 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.37 | 2.49 |
| Fish with swim bladder involved in hearing | 203 [c] | 2.37 | 2.49 |
| Sea turtles | 204 [d] | 2.11 | 2.24 |

Table G-226. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | 0.17 | 0.19 | 0.32 | 0.33 | 0.25 | 0.15 | NA | 0.18 | 0.20 | 0.20 | 0.32 | 0.25 | 0.15 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 7.35 | 11.14 | 12.18 | 12.84 | 17.24 | 27.61 | 29.30 | 7.96 | 12.58 | 13.44 | 14.65 | 24.17 | 50.59 | 41.46 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | 0.17 | 0.19 | 0.32 | 0.33 | 0.25 | 0.15 | NA | 0.18 | 0.20 | 0.20 | 0.32 | 0.25 | 0.15 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 7.35 | 11.14 | 12.18 | 12.84 | 17.24 | 27.61 | 29.30 | 7.96 | 12.58 | 13.44 | 14.65 | 24.17 | 50.59 | 41.46 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | 0.04 | 0.10 | 0.11 | 0.12 | 0.09 | 0.07 | NA | 0.04 | 0.10 | 0.11 | 0.13 | 0.09 | 0.07 |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.16 | 0.18 | 0.19 | 0.28 | 0.17 | 0.13 | NA | 0.17 | 0.18 | 0.20 | 0.20 | 0.16 | 0.13 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | 0.16 | 0.18 | 0.19 | 0.28 | 0.17 | 0.13 | NA | 0.17 | 0.18 | 0.20 | 0.20 | 0.16 | 0.13 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.38 | 1.71 | 2.14 | 2.55 | 2.81 | 2.50 | 2.08 | 0.46 | 1.77 | 2.28 | 2.64 | 2.84 | 2.42 | 2.10 |

Table G-227. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 0 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 46.66 | 84.75 |
| Fish < 2 g | 183 [a] | 62.16 | 85.31 |
| Fish without swim bladder | 216 [c] | 3.58 | 3.68 |
| Fish with swim bladder not involved in hearing | 203 [c] | 11.39 | 12.66 |
| Fish with swim bladder involved in hearing | 203 [c] | 11.39 | 12.66 |
| Sea turtles | 204 [d] | 10.38 | 11.53 |

Table G-228. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.03 | 0.06 | 0.04 | NA | - | - | - | 0.03 | 0.06 | 0.04 |
| Fish ≥ 2g | $L_p$ [b] | 150 | 2.65 | 5.30 | 5.78 | 6.61 | 8.19 | 10.00 | 9.37 | 2.73 | 5.56 | 6.08 | 7.07 | 8.89 | 11.12 | 9.12 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | 0.03 | 0.06 | 0.04 | NA | - | - | - | 0.03 | 0.06 | 0.04 |
| Fish < 2 g | $L_p$ [b] | 150 | 2.65 | 5.30 | 5.78 | 6.61 | 8.19 | 10.00 | 9.37 | 2.73 | 5.56 | 6.08 | 7.07 | 8.89 | 11.12 | 9.12 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | 0.02 | 0.05 | 0.03 | NA | - | - | - | 0.02 | 0.05 | 0.03 |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | 0.02 | 0.05 | 0.03 | NA | - | - | - | 0.02 | 0.05 | 0.03 |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_p$ [e] | 175 | 0.04 | 0.31 | 0.47 | 0.51 | 0.56 | 0.45 | 0.39 | 0.04 | 0.30 | 0.47 | 0.51 | 0.57 | 0.46 | 0.40 |

Table G-229. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 12 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 15.59 | 18.38 |
| Fish < 2 g | 183 [a] | 21.73 | 29.70 |
| Fish without swim bladder | 216 [c] | 0.73 | 0.73 |
| Fish with swim bladder not involved in hearing | 203 [c] | 3.97 | 4.07 |
| Fish with swim bladder involved in hearing | 203 [c] | 3.97 | 4.07 |
| Sea turtles | 204 [d] | 3.58 | 3.68 |

Table G-230. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle PK (dB re 1 µPa²) and SPL (dB re 1 µPa) thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Metric | Threshold | Summer Vibr. | Summer 1000 kJ | Summer 1500 kJ | Summer 2000 kJ | Summer 3000 kJ | Summer 3500 (a) kJ | Summer 3500 (b) kJ | Winter Vibr. | Winter 1000 kJ | Winter 1500 kJ | Winter 2000 kJ | Winter 3000 kJ | Winter 3500 (a) kJ | Winter 3500 (b) kJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish ≥ 2g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | 0.02 |
| Fish ≥ 2g | $L_{p}$ [b] | 150 | 1.83 | 4.37 | 4.82 | 5.58 | 6.66 | 7.60 | 6.91 | 1.87 | 4.55 | 5.06 | 5.89 | 7.16 | 8.06 | 6.53 |
| Fish < 2 g | $L_{pk}$ [a] | 206 | NA | - | - | - | - | - | 0.02 | NA | - | - | - | - | - | 0.02 |
| Fish < 2 g | $L_{p}$ [b] | 150 | 1.83 | 4.37 | 4.82 | 5.58 | 6.66 | 7.60 | 6.91 | 1.87 | 4.55 | 5.06 | 5.89 | 7.16 | 8.06 | 6.53 |
| Fish without swim bladder | $L_{pk}$ [c] | 213 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder not involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Fish with swim bladder involved in hearing | $L_{pk}$ [c] | 207 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{Pk}$ [d] | 232 | NA | - | - | - | - | - | - | NA | - | - | - | - | - | - |
| Sea turtles | $L_{p}$ [e] | 175 | 0.02 | 0.17 | 0.20 | 0.30 | 0.39 | 0.27 | 0.24 | 0.02 | 0.17 | 0.20 | 0.27 | 0.40 | 0.26 | 0.25 |

Table G-231. Difficult-to-drive jacket foundation (post-piled 4.25 m diameter, TRC V320 and MHU3500SMP) acoustic ranges ($R_{95\%}$ in km) to fish and sea turtle SEL thresholds at location L02 for different energy levels with 15 dB attenuation.

| Faunal group | Threshold (dB re 1 µPa²·s) | Summer Vibratory + Impact Piling | Winter Vibratory + Impact Piling |
|---|---|---|---|
| Fish ≥ 2g | 187 [a] | 12.35 | 13.89 |
| Fish < 2 g | 183 [a] | 16.83 | 20.83 |
| Fish without swim bladder | 216 [c] | 0.46 | 0.47 |
| Fish with swim bladder not involved in hearing | 203 [c] | 2.79 | 2.86 |
| Fish with swim bladder involved in hearing | 203 [c] | 2.79 | 2.86 |
| Sea turtles | 204 [d] | 2.55 | 2.61 |

# Appendix H. Animal Movement and Exposure Modeling

## H.1. Animal Movement Parameters

### H.1.1. Exposure Integration Time

The interval over which acoustic exposure ($L_E$) should be integrated and maximal exposure (*SPL*) determined is not well defined. Both Southall et al. (2007) and the NMFS (2018) recommend a 24 h baseline accumulation period but state that there may be situations where this is not appropriate (e.g., a high-level source and confined population). Resetting the integration after 24 h can lead to overestimating the number of individual animals exposed because individuals can be counted multiple times during an operation. The type of animal movement engine used in this study simulates realistic movement using swimming behavior collected over relatively short periods (hours to days) and does not include large-scale movement such as migratory circulation patterns. Therefore, the simulation time should be limited to a few weeks, the approximate scale of the collected data (e.g., marine mammal tag data) (Houser 2006). For this study, one-week simulations (i.e., 7 days) were modeled.

Ideally, a simulation area is large enough to encompass the entire range of a population so that any animal that might be present in the Offshore Development Area during sound-producing activities is included. However, there are limits to the simulation area, and computational overhead increases with area. For practical reasons, the simulation area is limited in this analysis to a maximum distance of 70 km from the OCS-A 0522 Lease Area (see figures in Section 3). In the simulation, every animat that reaches and leaves a border of the simulation area is replaced by another animat entering at an opposite border—e.g., an animat departing at the northern border of the simulation area is replaced by an animat entering the simulation area at the southern border at the same longitude. When this action places the animat in an inappropriate water depth, the animat is randomly placed on the map at a depth suited to its species definition. The exposures of all animats (including those leaving the simulation and those entering) are kept for analysis. This approach maintains a consistent animat density and allows for longer integration periods with finite simulation areas.

### H.1.2. Aversion

Aversion is a common response of animals to sound, particularly at relatively high sound exposure levels (Ellison et al. 2012). As received sound level generally decreases with distance from a source, this aspect of natural behavior can strongly influence the estimated maximum sound levels an animal is predicted to receive and significantly affects the probability of more pronounced direct or subsequent behavioral effects. Additionally, animals are less likely to respond to sound levels distant from a source, even when those same levels elicit response at closer distances; both proximity and received levels are important factors in aversive responses (Dunlop et al. 2017). As a supplement to this modeling study for comparison purposes only, parameters determining aversion at specified sound levels were implemented for the North Atlantic right whale, in recognition of its Endangered status, and harbor porpoise, a species known to have a strong aversive response to loud sounds.

Aversion is implemented in JASMINE by defining a new behavioral state that an animat may transition in to when a received level is exceeded. There are very few data on which aversive behavior can be based. Because of the dearth of information and to be consistent within this report, aversion probability is based on the Wood et al. (2012) step function that was used to estimate potential behavioral disruption. Animats will be assumed to avert by changing their headings by a fixed amount away from the source, with greater deflections associated with higher received levels (Tables H-1 and H-2). Aversion thresholds for marine mammals are based on the Wood et al. (2012) step function. Animats remain in the aversive state for a specified amount of time, depending on the level of exposure that triggered aversion (Tables H-1 and

H-2). During this time, travel parameters are recalculated periodically as with normal behaviors. At the end of the aversion interval, the animat model parameters are changed (see Tables H-1 and H-2), depending on the current level of exposure and the animat either begins another aversion interval or transitions to a non-aversive behavior; while if aversion begins immediately, transition to a regular behavior occurs at the end of the next surface interval, consistent with regular behavior transitions.

Table H-1. North Atlantic right whales: Aversion parameters for the animal movement simulation based on Wood et al. (2012) behavioral response criteria.

| Probability of aversion (%) | Received sound level $L_p$ (dB re 1 µPa$^2$) | Change in course (°) | Duration of aversion (s) |
|---|---|---|---|
| 10 | 140 | 10 | 300 |
| 50 | 160 | 20 | 60 |
| 90 | 180 | 30 | 30 |

Table H-2. Harbor porpoises: Aversion parameters for the animal movement simulation based on Wood et al. (2012) behavioral response criteria.

| Probability of aversion (%) | Received sound level $L_p$ (dB re 1 µPa$^2$) | Change in course (°) | Duration of aversion (s) |
|---|---|---|---|
| 50 | 120 | 20 | 60 |
| 90 | 140 | 30 | 30 |

### H.1.3. Simulation Area: Animat Seeding

The exposure criteria for impulsive sounds were used to determine the number of animats exceeding exposure thresholds. To generate statistically reliable probability density functions, all simulations were seeded with an animat density of 0.5 animats/km$^2$ over the entire simulation area. Some species have depth preference restrictions, e.g., sperm whales prefer water greater than 1000 m (Aoki et al. 2007), and the simulation location contained a relatively high portion of shallow water areas.

## H.2. Animal Movement Modeling Supplemental Results

### H.2.1. Exposure Estimates – Based on Construction Schedules

#### H.2.1.1. Marine Mammals

This section contains marine mammal mean exposure estimates for each of the proposed construction schedules described in Section 1.2.2. Exposure estimates are shown in Tables H-3 to H-10, assuming 0, 10, 12, and 15 dB of broadband attenuation. Each construction schedule includes a combination of foundations installed with vibratory setting of piles followed by impact pile driving and foundations installed with impact pile driving alone.

Table H-3. Construction Schedule A, year 1 (14 m monopile, 2 year schedule): Mean number of marine mammals predicted to receive sound levels above exposure criteria with sound attenuation. Construction schedule assumptions are summarized in Section 1.2.2.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 57.52 | 15.46 | 10.84 | 6.50 | 0.29 | 0.10 | 0.10 | 0.02 | 725.18 | 256.43 | 212.79 | 152.34 | 146.28 | 49.16 | 39.92 | 28.73 |
| LF | Minke whale (migrating) | 136.37 | 42.37 | 29.56 | 14.11 | 0.67 | 0.18 | 0.18 | 0.04 | 1001.12 | 455.64 | 398.38 | 312.07 | 1307.40 | 736.46 | 641.66 | 530.75 |
| LF | Humpback whale | 31.60 | 10.05 | 7.77 | 5.40 | 0.16 | 0.04 | 0.04 | <0.01 | 331.11 | 126.13 | 104.61 | 77.46 | 78.82 | 29.77 | 25.33 | 18.63 |
| LF | North Atlantic right whale [c] | 13.97 | 3.57 | 2.59 | 1.45 | 0.03 | <0.01 | <0.01 | 0 | 137.74 | 68.76 | 57.82 | 42.78 | 41.74 | 15.06 | 11.36 | 8.30 |
| LF | Sei whale [c] (migrating) | 2.61 | 0.80 | 0.60 | 0.39 | 0.03 | <0.01 | <0.01 | <0.01 | 45.33 | 16.12 | 13.41 | 9.49 | 50.54 | 21.60 | 17.69 | 13.77 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0.09 | 0 | 0 | 0 | 3727.28 | 1567.87 | 1344.92 | 1013.85 | 457.45 | 182.54 | 151.79 | 113.65 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 456.84 | 107.06 | 85.00 | 45.54 | 14.45 | 4.68 | 3.83 | 2.73 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | 1.17 | 0 | 0 | 0 | 59195.90 | 25442.19 | 21597.21 | 16367.20 | 7594.43 | 3202.32 | 2707.82 | 2051.44 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0.06 | 0 | 0 | 0 | 3239.38 | 1146.66 | 924.81 | 695.57 | 329.24 | 135.75 | 111.51 | 80.89 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | 0.10 | 0 | 0 | 0 | 2848.10 | 436.89 | 362.44 | 164.59 | 37.87 | 13.78 | 11.39 | 8.58 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | 0.05 | 0 | 0 | 0 | 700.91 | 227.67 | 172.65 | 128.84 | 51.03 | 20.0 | 16.51 | 12.33 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 192.59 | 58.95 | 49.70 | 32.77 | 12.67 | 4.80 | 3.98 | 2.99 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 209.67 | 72.90 | 60.35 | 43.26 | 17.34 | 5.90 | 4.73 | 3.40 |
| HF | Harbor porpoise (sensitive) | 4.16 | 0 | 0 | 0 | 27.04 | 2.62 | 1.92 | 1.46 | 3379.00 | 1373.58 | 1107.69 | 838.74 | 5700.19 | 2198.45 | 1800.52 | 1278.55 |
| PW | Gray seal | 0.92 | 0.08 | 0.08 | 0.01 | <0.01 | 0 | 0 | 0 | 2077.06 | 353.48 | 290.52 | 153.95 | 63.46 | 16.87 | 13.04 | 9.19 |
| PW | Harbor seal | 2.89 | 0.06 | 0.01 | 0 | 0.14 | <0.01 | 0 | 0 | 2740.40 | 493.31 | 411.48 | 219.61 | 95.53 | 29.89 | 23.95 | 17.03 |
| PW | Harp seal | 3.32 | 0.10 | 0.07 | 0 | 0.10 | 0.06 | 0.06 | 0.06 | 2565.50 | 441.05 | 363.08 | 193.70 | 82.11 | 25.22 | 20.07 | 14.41 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-4. Construction Schedule A, year 2 (14 m monopile, 2 year schedule): The mean number of marine mammals predicted to receive sound levels above exposure criteria with sound attenuation. Construction schedule assumptions are summarized in Section 1.2.2.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 57.16 | 15.37 | 10.78 | 6.47 | 0.29 | 0.10 | 0.10 | 0.02 | 717.86 | 253.85 | 210.65 | 150.85 | 145.19 | 48.79 | 39.62 | 28.51 |
| LF | Minke whale (migrating) | 135.48 | 42.12 | 29.39 | 14.04 | 0.66 | 0.18 | 0.18 | 0.04 | 991.79 | 451.39 | 394.60 | 309.13 | 1297.75 | 730.65 | 636.64 | 526.58 |
| LF | Humpback whale | 31.34 | 9.97 | 7.71 | 5.36 | 0.16 | 0.04 | 0.04 | <0.01 | 327.74 | 124.76 | 103.48 | 76.61 | 78.12 | 29.49 | 25.09 | 18.45 |
| LF | North Atlantic right whale [c] | 13.86 | 3.54 | 2.57 | 1.44 | 0.02 | <0.01 | <0.01 | 0 | 136.46 | 68.10 | 57.28 | 42.37 | 41.38 | 14.93 | 11.26 | 8.23 |
| LF | Sei whale [c] (migrating) | 2.59 | 0.80 | 0.60 | 0.39 | 0.03 | <0.01 | <0.01 | <0.01 | 44.95 | 15.96 | 13.28 | 9.39 | 50.16 | 21.42 | 17.53 | 13.65 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0.09 | 0 | 0 | 0 | 3688.75 | 1550.65 | 1329.43 | 1002.30 | 453.08 | 180.76 | 150.32 | 112.53 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 445.80 | 104.34 | 82.84 | 44.36 | 14.14 | 4.57 | 3.74 | 2.67 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | 1.17 | 0 | 0 | 0 | 58345.24 | 25042.97 | 21258.67 | 16097.53 | 7494.83 | 3159.26 | 2671.13 | 2023.81 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0.06 | 0 | 0 | 0 | 3197.21 | 1132.35 | 913.45 | 687.11 | 326.05 | 134.48 | 110.49 | 80.16 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | 0.10 | 0 | 0 | 0 | 2804.22 | 429.15 | 356.03 | 161.61 | 37.37 | 13.59 | 11.23 | 8.46 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | 0.05 | 0 | 0 | 0 | 692.25 | 224.93 | 170.64 | 127.31 | 50.58 | 19.82 | 16.36 | 12.22 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 190.16 | 58.23 | 49.09 | 32.37 | 12.56 | 4.76 | 3.95 | 2.96 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 206.99 | 72.04 | 59.64 | 42.74 | 17.19 | 5.85 | 4.68 | 3.37 |
| HF | Harbor porpoise (sensitive) | 4.16 | 0 | 0 | 0 | 26.79 | 2.61 | 1.91 | 1.44 | 3347.02 | 1359.86 | 1095.98 | 829.85 | 5660.17 | 2182.97 | 1787.79 | 1268.90 |
| PW | Gray seal | 0.91 | 0.08 | 0.08 | 0.01 | <0.01 | 0 | 0 | 0 | 2054.61 | 350.20 | 287.79 | 152.61 | 63.05 | 16.76 | 12.95 | 9.13 |
| PW | Harbor seal | 2.88 | 0.06 | 0.01 | 0 | 0.14 | <0.01 | 0 | 0 | 2710.73 | 488.73 | 407.65 | 217.71 | 94.90 | 29.69 | 23.79 | 16.92 |
| PW | Harp seal | 3.30 | 0.10 | 0.07 | 0 | 0.10 | 0.06 | 0.06 | 0.06 | 2537.65 | 436.96 | 359.67 | 192.01 | 81.58 | 25.05 | 19.94 | 14.31 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-5. Construction Schedule A, years 1 and 2 combined (14 m monopile, 2 year schedule): The mean number of marine mammals predicted to receive sound levels above exposure criteria with sound attenuation. Construction schedule assumptions are summarized in Section 1.2.2.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 114.68 | 30.84 | 21.61 | 12.98 | 0.58 | 0.20 | 0.20 | 0.04 | 1443.03 | 510.28 | 423.45 | 303.20 | 291.47 | 97.94 | 79.54 | 57.24 |
| LF | Minke whale (migrating) | 271.85 | 84.49 | 58.95 | 28.15 | 1.33 | 0.36 | 0.36 | 0.07 | 1992.92 | 907.03 | 792.98 | 621.20 | 2605.15 | 1467.11 | 1278.31 | 1057.33 |
| LF | Humpback whale | 62.94 | 20.01 | 15.48 | 10.75 | 0.32 | 0.08 | 0.08 | 0.01 | 658.85 | 250.89 | 208.09 | 154.07 | 156.95 | 59.26 | 50.42 | 37.08 |
| LF | North Atlantic right whale [c] | 27.84 | 7.11 | 5.16 | 2.89 | 0.05 | <0.01 | <0.01 | 0 | 274.20 | 136.86 | 115.10 | 85.15 | 83.11 | 29.99 | 22.61 | 16.53 |
| LF | Sei whale [c] (migrating) | 5.20 | 1.60 | 1.20 | 0.78 | 0.06 | 0.01 | <0.01 | <0.01 | 90.28 | 32.08 | 26.68 | 18.87 | 100.69 | 43.01 | 35.22 | 27.42 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0.17 | 0 | 0 | 0 | 7416.04 | 3118.52 | 2674.35 | 2016.15 | 910.53 | 363.29 | 302.11 | 226.18 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 902.63 | 211.40 | 167.84 | 89.90 | 28.59 | 9.26 | 7.57 | 5.40 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | 2.35 | 0 | 0 | 0 | 117541.14 | 50485.16 | 42855.88 | 32464.73 | 15089.26 | 6361.58 | 5378.95 | 4075.25 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0.11 | 0 | 0 | 0 | 6436.59 | 2279.01 | 1838.26 | 1382.68 | 655.29 | 270.23 | 222.00 | 161.05 |
| MF | Risso’s dolphin | 0 | 0 | 0 | 0 | 0.19 | 0 | 0 | 0 | 5652.32 | 866.04 | 718.47 | 326.20 | 75.24 | 27.37 | 22.62 | 17.04 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | 0.10 | 0 | 0 | 0 | 1393.16 | 452.60 | 343.28 | 256.15 | 101.60 | 39.82 | 32.87 | 24.56 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 382.75 | 117.18 | 98.79 | 65.14 | 25.22 | 9.56 | 7.93 | 5.95 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 416.66 | 144.94 | 119.99 | 86.01 | 34.53 | 11.75 | 9.41 | 6.77 |
| HF | Harbor porpoise (sensitive) | 8.33 | 0 | 0 | 0 | 53.83 | 5.23 | 3.83 | 2.90 | 6726.02 | 2733.45 | 2203.66 | 1668.59 | 11360.36 | 4381.42 | 3588.31 | 2547.45 |
| PW | Gray seal | 1.83 | 0.16 | 0.16 | 0.02 | 0.01 | 0 | 0 | 0 | 4131.66 | 703.68 | 578.32 | 306.56 | 126.51 | 33.63 | 25.99 | 18.32 |
| PW | Harbor seal | 5.77 | 0.12 | 0.02 | 0 | 0.27 | 0.01 | 0 | 0 | 5451.13 | 982.03 | 819.13 | 437.32 | 190.43 | 59.58 | 47.75 | 33.95 |
| PW | Harp seal | 6.62 | 0.20 | 0.15 | 0 | 0.20 | 0.13 | 0.13 | 0.13 | 5103.15 | 878.01 | 722.75 | 385.70 | 163.69 | 50.27 | 40.02 | 28.72 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-6. Construction schedule B, year 1 (all jackets, 4 year schedule): The mean number of marine mammals predicted to receive sound levels above exposure criteria with sound attenuation. Construction schedule assumptions are summarized in Section 1.2.2.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 55.04 | 16.69 | 12.49 | 7.86 | 0.28 | 0.12 | 0.07 | 0.01 | 379.29 | 145.93 | 119.99 | 90.88 | 115.50 | 34.01 | 26.62 | 18.35 |
| LF | Minke whale (migrating) | 150.47 | 48.09 | 32.97 | 14.65 | 0.40 | 0.07 | 0.07 | 0.01 | 718.12 | 378.32 | 326.74 | 275.52 | 1050.28 | 573.24 | 512.13 | 418.59 |
| LF | Humpback whale | 28.65 | 10.25 | 8.08 | 5.61 | 0.04 | 0 | 0 | 0 | 190.81 | 81.16 | 67.70 | 52.25 | 59.29 | 20.61 | 16.61 | 11.93 |
| LF | North Atlantic right whale [c] | 16.81 | 4.99 | 3.74 | 2.01 | 0.01 | <0.01 | <0.01 | 0 | 115.69 | 64.09 | 56.18 | 45.93 | 39.14 | 12.00 | 9.69 | 7.12 |
| LF | Sei whale [c] (migrating) | 3.21 | 1.02 | 0.80 | 0.55 | 0.02 | <0.01 | <0.01 | <0.01 | 35.34 | 13.68 | 11.40 | 8.67 | 48.13 | 21.35 | 17.91 | 13.78 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 2896.83 | 1344.04 | 1149.65 | 932.17 | 467.60 | 167.26 | 137.73 | 103.87 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 406.78 | 111.15 | 89.25 | 64.34 | 18.99 | 4.64 | 3.58 | 2.27 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | 5.99 | 0 | 0 | 0 | 53576.80 | 27460.48 | 23746.77 | 18679.68 | 9760.47 | 3778.53 | 3137.48 | 2361.96 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0.21 | 0 | 0 | 0 | 2541.37 | 1013.99 | 871.83 | 688.29 | 359.31 | 150.04 | 124.97 | 90.25 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | 0.01 | 0 | 0 | 0 | 1799.85 | 345.70 | 288.36 | 153.92 | 50.82 | 15.94 | 12.57 | 9.08 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | 0.07 | 0 | 0 | 0 | 555.11 | 214.25 | 182.01 | 129.28 | 62.17 | 22.36 | 18.53 | 13.77 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 138.63 | 52.29 | 44.37 | 31.16 | 15.16 | 5.26 | 4.31 | 3.15 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 164.15 | 67.70 | 56.77 | 44.00 | 25.52 | 7.53 | 5.99 | 4.23 |
| HF | Harbor porpoise (sensitive) | 13.42 | 0 | 0 | 0 | 29.58 | 4.63 | 3.65 | 1.87 | 2671.32 | 1174.82 | 1004.41 | 779.77 | 7037.67 | 3385.74 | 2779.97 | 1921.59 |
| PW | Gray seal | 3.28 | 0.25 | 0.15 | 0.05 | 0.05 | 0 | 0 | 0 | 1384.11 | 302.85 | 242.74 | 179.83 | 112.64 | 20.51 | 15.32 | 10.09 |
| PW | Harbor seal | 10.69 | 0.19 | 0.14 | <0.01 | 0.29 | <0.01 | <0.01 | <0.01 | 2149.64 | 532.09 | 443.09 | 281.07 | 175.89 | 44.60 | 34.99 | 24.79 |
| PW | Harp seal | 8.82 | 0.28 | 0.01 | <0.01 | 0.26 | 0 | 0 | 0 | 1815.67 | 433.28 | 357.38 | 230.79 | 157.19 | 35.91 | 27.76 | 19.35 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-7. Construction schedule B, year 2 (all jackets, 4 year schedule): The mean number of marine mammals predicted to receive sound levels above exposure criteria with sound attenuation. Construction schedule assumptions are summarized in Section 1.2.2.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 52.90 | 15.97 | 11.95 | 7.39 | 0.21 | 0.12 | 0.05 | 0 | 446.20 | 173.30 | 142.39 | 108.40 | 113.81 | 33.67 | 26.22 | 18.08 |
| LF | Minke whale (migrating) | 148.74 | 45.74 | 30.90 | 13.01 | 0.37 | 0.07 | 0.07 | 0 | 788.99 | 418.18 | 361.22 | 305.80 | 1021.47 | 561.76 | 505.43 | 413.55 |
| LF | Humpback whale | 27.97 | 10.03 | 7.87 | 5.45 | 0.03 | 0 | 0 | 0 | 212.56 | 91.16 | 76.08 | 58.92 | 58.12 | 20.41 | 16.46 | 11.79 |
| LF | North Atlantic right whale [c] | 16.77 | 4.84 | 3.64 | 1.88 | 0.01 | <0.01 | <0.01 | 0 | 123.14 | 69.09 | 60.46 | 49.33 | 39.46 | 11.86 | 9.57 | 7.02 |
| LF | Sei whale [c] (migrating) | 3.16 | 1.01 | 0.78 | 0.53 | 0.02 | <0.01 | <0.01 | 0 | 37.31 | 14.52 | 12.11 | 9.23 | 47.59 | 21.12 | 17.74 | 13.69 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 3077.41 | 1435.12 | 1227.82 | 1000.97 | 461.64 | 165.77 | 136.08 | 103.25 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 449.10 | 120.30 | 96.54 | 69.67 | 18.51 | 4.57 | 3.52 | 2.22 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | 6.10 | 0 | 0 | 0 | 59395.07 | 30475.98 | 26351.78 | 20737.54 | 9620.06 | 3731.20 | 3087.46 | 2330.17 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0.18 | 0 | 0 | 0 | 2871.42 | 1141.06 | 982.24 | 780.02 | 355.64 | 147.76 | 122.86 | 87.61 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2191.10 | 412.73 | 344.75 | 179.99 | 49.54 | 15.75 | 12.26 | 8.84 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | 0.07 | 0 | 0 | 0 | 637.38 | 244.84 | 208.03 | 147.13 | 60.89 | 22.09 | 18.30 | 13.58 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 159.40 | 59.72 | 50.70 | 35.50 | 14.80 | 5.20 | 4.24 | 3.09 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 193.14 | 81.20 | 68.05 | 52.94 | 24.40 | 7.31 | 5.83 | 4.07 |
| HF | Harbor porpoise (sensitive) | 11.51 | 0 | 0 | 0 | 29.09 | 4.29 | 3.52 | 1.80 | 2975.70 | 1317.19 | 1125.82 | 870.28 | 7040.26 | 3354.80 | 2746.85 | 1889.32 |
| PW | Gray seal | 3.19 | 0.25 | 0.15 | 0.05 | 0.05 | 0 | 0 | 0 | 1549.49 | 326.32 | 262.01 | 194.48 | 112.26 | 20.26 | 15.13 | 9.98 |
| PW | Harbor seal | 10.42 | 0.16 | 0.14 | <0.01 | 0.28 | <0.01 | <0.01 | <0.01 | 2411.32 | 573.82 | 478.37 | 295.62 | 175.98 | 44.23 | 34.71 | 24.59 |
| PW | Harp seal | 8.62 | 0.26 | <0.01 | <0.01 | 0.25 | 0 | 0 | 0 | 2033.52 | 467.15 | 385.80 | 242.52 | 156.91 | 35.55 | 27.46 | 19.16 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-8. Construction schedule B, year 3 (all jackets, 4 year schedule): The mean number of marine mammals predicted to receive sound levels above exposure criteria with sound attenuation. Construction schedule assumptions are summarized in Section 1.2.2.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 54.77 | 16.65 | 12.43 | 7.83 | 0.28 | 0.11 | 0.07 | 0.01 | 368.36 | 141.84 | 116.51 | 88.12 | 112.96 | 33.25 | 26.01 | 17.92 |
| LF | Minke whale (migrating) | 148.33 | 47.73 | 32.79 | 14.76 | 0.39 | 0.07 | 0.06 | 0.01 | 702.49 | 370.13 | 319.77 | 269.68 | 1032.27 | 562.85 | 502.11 | 410.61 |
| LF | Humpback whale | 28.41 | 10.17 | 8.01 | 5.56 | 0.04 | 0 | 0 | 0 | 186.88 | 79.40 | 66.22 | 51.09 | 58.28 | 20.23 | 16.29 | 11.70 |
| LF | North Atlantic right whale [c] | 16.70 | 4.97 | 3.72 | 2.02 | 0.01 | <0.01 | <0.01 | 0 | 114.21 | 63.20 | 55.41 | 45.34 | 38.70 | 11.88 | 9.59 | 7.04 |
| LF | Sei whale [c] (migrating) | 3.19 | 1.02 | 0.79 | 0.55 | 0.02 | <0.01 | <0.01 | <0.01 | 35.01 | 13.54 | 11.28 | 8.58 | 47.68 | 21.14 | 17.74 | 13.65 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0.01 | 0 | 0 | 0 | 2859.54 | 1325.68 | 1133.82 | 918.70 | 460.76 | 164.54 | 135.48 | 102.03 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 400.96 | 110.13 | 88.48 | 63.82 | 18.77 | 4.59 | 3.54 | 2.24 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | 5.85 | 0 | 0 | 0 | 52383.71 | 26854.24 | 23227.04 | 18273.01 | 9552.66 | 3690.02 | 3063.80 | 2304.47 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0.20 | 0 | 0 | 0 | 2477.89 | 990.92 | 850.59 | 671.83 | 350.76 | 146.27 | 121.63 | 87.97 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | 0.01 | 0 | 0 | 0 | 1739.84 | 335.21 | 279.54 | 154.16 | 49.70 | 15.57 | 12.32 | 8.88 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | 0.07 | 0 | 0 | 0 | 541.19 | 208.89 | 177.49 | 126.18 | 60.92 | 21.87 | 18.11 | 13.45 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 135.09 | 51.01 | 43.26 | 30.41 | 14.86 | 5.14 | 4.22 | 3.08 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 158.95 | 65.41 | 54.86 | 42.52 | 24.97 | 7.35 | 5.85 | 4.14 |
| HF | Harbor porpoise (sensitive) | 13.50 | 0 | 0 | 0 | 28.93 | 4.53 | 3.56 | 1.82 | 2615.49 | 1150.50 | 983.45 | 764.13 | 6909.69 | 3332.79 | 2736.60 | 1890.90 |
| PW | Gray seal | 3.28 | 0.25 | 0.15 | 0.05 | 0.05 | 0 | 0 | 0 | 1362.20 | 299.85 | 240.32 | 178.01 | 112.26 | 20.45 | 15.27 | 10.06 |
| PW | Harbor seal | 10.69 | 0.19 | 0.14 | <0.01 | 0.29 | <0.01 | <0.01 | <0.01 | 2108.95 | 525.38 | 437.50 | 278.75 | 175.10 | 44.40 | 34.83 | 24.67 |
| PW | Harp seal | 8.82 | 0.28 | 0.01 | <0.01 | 0.26 | 0 | 0 | 0 | 1783.43 | 428.08 | 353.06 | 231.53 | 156.54 | 35.75 | 27.64 | 19.27 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-9. Construction schedule B, year 4 (all jackets, 4 year schedule): The mean number of marine mammals predicted to receive sound levels above exposure criteria with sound attenuation. Construction schedule assumptions are summarized in Section 1.2.2.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 53.77 | 16.21 | 12.14 | 7.51 | 0.22 | 0.12 | 0.05 | 0 | 443.94 | 172.26 | 141.49 | 107.68 | 115.50 | 34.14 | 26.58 | 18.33 |
| LF | Minke whale (migrating) | 152.00 | 46.69 | 31.51 | 13.25 | 0.37 | 0.08 | 0.07 | 0 | 794.83 | 421.38 | 363.94 | 308.11 | 1046.81 | 574.93 | 517.14 | 423.06 |
| LF | Humpback whale | 28.66 | 10.27 | 8.06 | 5.58 | 0.04 | 0 | 0 | 0 | 214.18 | 91.93 | 76.73 | 59.44 | 59.54 | 20.89 | 16.85 | 12.07 |
| LF | North Atlantic right whale [c] | 17.08 | 4.94 | 3.71 | 1.92 | 0.01 | <0.01 | <0.01 | 0 | 124.05 | 69.64 | 60.93 | 49.75 | 40.08 | 12.09 | 9.76 | 7.16 |
| LF | Sei whale [c] (migrating) | 3.22 | 1.03 | 0.80 | 0.55 | 0.02 | <0.01 | <0.01 | 0 | 37.56 | 14.64 | 12.21 | 9.30 | 48.36 | 21.48 | 18.04 | 13.93 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 3134.10 | 1465.51 | 1254.04 | 1023.02 | 475.57 | 170.98 | 140.36 | 106.41 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 473.47 | 128.16 | 102.84 | 74.21 | 19.81 | 4.89 | 3.77 | 2.37 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | 6.31 | 0 | 0 | 0 | 60373.96 | 31118.80 | 26906.66 | 21228.14 | 9954.49 | 3862.95 | 3196.32 | 2409.36 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0.18 | 0 | 0 | 0 | 2896.74 | 1149.29 | 989.00 | 784.70 | 363.89 | 151.23 | 125.74 | 89.73 |
| MF | Risso’s dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2190.95 | 415.59 | 347.16 | 181.63 | 50.89 | 16.19 | 12.60 | 9.09 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | 0.07 | 0 | 0 | 0 | 639.81 | 245.98 | 209.00 | 147.89 | 62.21 | 22.58 | 18.70 | 13.88 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 159.99 | 60.00 | 50.93 | 35.68 | 15.12 | 5.31 | 4.33 | 3.16 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 191.94 | 80.22 | 67.20 | 52.30 | 24.82 | 7.43 | 5.92 | 4.16 |
| HF | Harbor porpoise (sensitive) | 11.78 | 0 | 0 | 0 | 29.79 | 4.40 | 3.60 | 1.84 | 2975.69 | 1318.97 | 1127.28 | 873.30 | 7154.11 | 3402.54 | 2784.75 | 1914.96 |
| PW | Gray seal | 3.22 | 0.25 | 0.15 | 0.05 | 0.05 | 0 | 0 | 0 | 1551.28 | 327.04 | 262.60 | 194.91 | 113.11 | 20.46 | 15.28 | 10.08 |
| PW | Harbor seal | 10.53 | 0.16 | 0.14 | <0.01 | 0.28 | <0.01 | <0.01 | <0.01 | 2414.35 | 575.24 | 479.55 | 296.98 | 177.37 | 44.66 | 35.06 | 24.84 |
| PW | Harp seal | 8.71 | 0.26 | <0.01 | <0.01 | 0.26 | 0 | 0 | 0 | 2036.06 | 468.30 | 386.76 | 243.61 | 158.16 | 35.91 | 27.74 | 19.36 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-10. Construction schedule B, years 1 through 4 combined (all jackets, 4 year schedule): The mean number of marine mammals predicted to receive sound levels above exposure criteria with sound attenuation. Construction schedule assumptions are summarized in Section 1.2.2.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 216.48 | 65.51 | 49.01 | 30.59 | 0.99 | 0.47 | 0.23 | 0.02 | 1637.78 | 633.34 | 520.38 | 395.08 | 457.77 | 135.07 | 105.43 | 72.68 |
| LF | Minke whale (migrating) | 599.55 | 188.25 | 128.17 | 55.68 | 1.53 | 0.29 | 0.26 | 0.03 | 3004.42 | 1588.01 | 1371.66 | 1159.11 | 4150.83 | 2272.78 | 2036.81 | 1665.80 |
| LF | Humpback whale | 113.68 | 40.71 | 32.02 | 22.20 | 0.16 | 0 | 0 | 0 | 804.43 | 343.64 | 286.73 | 221.70 | 235.22 | 82.14 | 66.22 | 47.49 |
| LF | North Atlantic right whale [c] | 67.37 | 19.74 | 14.81 | 7.83 | 0.05 | 0.04 | 0.01 | 0 | 477.09 | 266.02 | 232.98 | 190.35 | 157.38 | 47.82 | 38.61 | 28.34 |
| LF | Sei whale [c] (migrating) | 12.77 | 4.07 | 3.17 | 2.17 | 0.08 | 0.02 | <0.01 | <0.01 | 145.22 | 56.38 | 47.00 | 35.78 | 191.76 | 85.10 | 71.42 | 55.06 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0.04 | 0 | 0 | 0 | 11967.87 | 5570.34 | 4765.33 | 3874.86 | 1865.56 | 668.55 | 549.65 | 415.57 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1730.31 | 469.75 | 377.11 | 272.05 | 76.09 | 18.69 | 14.40 | 9.10 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | 24.24 | 0 | 0 | 0 | 225729.55 | 115909.50 | 100232.25 | 78918.37 | 38887.67 | 15062.70 | 12485.06 | 9405.96 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0.77 | 0 | 0 | 0 | 10787.42 | 4295.26 | 3693.66 | 2924.84 | 1429.60 | 595.30 | 495.21 | 355.56 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | 0.03 | 0 | 0 | 0 | 7921.74 | 1509.22 | 1259.81 | 669.69 | 200.95 | 63.44 | 49.75 | 35.88 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | 0.28 | 0 | 0 | 0 | 2373.49 | 913.97 | 776.53 | 550.48 | 246.20 | 88.90 | 73.64 | 54.68 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 593.12 | 223.02 | 189.26 | 132.76 | 59.95 | 20.91 | 17.09 | 12.48 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 708.18 | 294.52 | 246.88 | 191.76 | 99.71 | 29.62 | 23.60 | 16.60 |
| HF | Harbor porpoise (sensitive) | 50.21 | 0 | 0 | 0 | 117.39 | 17.86 | 14.33 | 7.34 | 11238.20 | 4961.48 | 4240.96 | 3287.49 | 28141.71 | 13475.85 | 11048.17 | 7616.77 |
| PW | Gray seal | 12.97 | 0.99 | 0.60 | 0.21 | 0.19 | 0 | 0 | 0 | 5847.08 | 1256.06 | 1007.66 | 747.23 | 450.27 | 81.67 | 60.99 | 40.21 |
| PW | Harbor seal | 42.33 | 0.70 | 0.57 | <0.01 | 1.13 | 0.01 | <0.01 | <0.01 | 9084.25 | 2206.53 | 1838.51 | 1152.41 | 704.34 | 177.89 | 139.60 | 98.89 |
| PW | Harp seal | 34.97 | 1.09 | 0.03 | <0.01 | 1.03 | 0 | 0 | 0 | 7668.68 | 1796.80 | 1483.01 | 948.44 | 628.80 | 143.13 | 110.60 | 77.15 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

### H.2.1.2. Sea Turtles

This section contains sea turtle mean exposure estimates predicted by the animal movement modeling using the proposed construction schedules described in Section 1.2.2. Exposure estimates are shown in Tables H-11 to H-18, assuming 0, 10, 12, and 15 dB of broadband attenuation. Each construction schedule includes a combination of foundations installed with vibratory setting of piles followed by impact pile driving and foundations installed with impact pile driving alone.

Table H-11. Construction Schedule A, year 1 (14 m monopile, 2 year schedule): The mean number of sea turtles predicted to receive sound levels above exposure criteria with sound attenuation. Construction schedule assumptions are summarized in Section 1.2.2.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 0.06 | <0.01 | <0.01 | 0 | <0.01 | 0 | 0 | 0 | 0.18 | 0.04 | 0.03 | 0.02 |
| Leatherback turtle [a] | 6.35 | 0.44 | 0.28 | 0.06 | 0 | 0 | 0 | 0 | 13.65 | 1.45 | 0.90 | 0.36 |
| Loggerhead turtle | 0.26 | <0.01 | 0 | 0 | 0 | 0 | 0 | 0 | 1.45 | 0.35 | 0.25 | 0.17 |
| Green turtle | 2.74 | 0.26 | 0.10 | <0.01 | 0 | 0 | 0 | 0 | 6.39 | 1.48 | 0.97 | 0.58 |

[a] Listed as Endangered under the ESA.

Table H-12. Construction Schedule A, year 2 (14 m monopile, 2 year schedule): The mean number of sea turtles predicted to receive sound levels above exposure criteria with sound attenuation. Construction schedule assumptions are summarized in Section 1.2.2.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 0.06 | <0.01 | <0.01 | 0 | <0.01 | 0 | 0 | 0 | 0.18 | 0.04 | 0.03 | 0.02 |
| Leatherback turtle [a] | 6.27 | 0.43 | 0.28 | 0.06 | 0 | 0 | 0 | 0 | 13.42 | 1.43 | 0.88 | 0.36 |
| Loggerhead turtle | 0.25 | <0.01 | 0 | 0 | 0 | 0 | 0 | 0 | 1.43 | 0.35 | 0.25 | 0.17 |
| Green turtle | 2.71 | 0.26 | 0.10 | <0.01 | 0 | 0 | 0 | 0 | 6.32 | 1.46 | 0.96 | 0.58 |

[a] Listed as Endangered under the ESA.

Table H-13. Construction Schedule A, years 1 and 2 combined (14 m monopile, 2 year schedule): The mean number of sea turtles predicted to receive sound levels above exposure criteria with sound attenuation. Construction schedule assumptions are summarized in Section 1.2.2.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 0.11 | <0.01 | <0.01 | 0 | <0.01 | 0 | 0 | 0 | 0.35 | 0.08 | 0.06 | 0.04 |
| Leatherback turtle [a] | 12.62 | 0.87 | 0.56 | 0.12 | 0 | 0 | 0 | 0 | 27.07 | 2.88 | 1.78 | 0.72 |
| Loggerhead turtle | 0.51 | <0.01 | 0 | 0 | 0 | 0 | 0 | 0 | 2.88 | 0.70 | 0.50 | 0.35 |
| Green turtle | 5.45 | 0.52 | 0.20 | 0.01 | 0 | 0 | 0 | 0 | 12.72 | 2.94 | 1.94 | 1.16 |

[a] Listed as Endangered under the ESA.

Table H-14. Construction Schedule B, year 1 (all jackets, 4 year schedule): The mean number of sea turtles predicted to receive sound levels above exposure criteria with sound attenuation. Construction schedule assumptions are summarized in Section 1.2.2.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 0.07 | <0.01 | <0.01 | 0 | 0 | 0 | 0 | 0 | 0.11 | 0.03 | 0.02 | 0.01 |
| Leatherback turtle [a] | 7.05 | 0.52 | 0.35 | 0.15 | 0 | 0 | 0 | 0 | 4.90 | 0.43 | 0.23 | 0.13 |
| Loggerhead turtle | 0.37 | <0.01 | 0 | 0 | 0 | 0 | 0 | 0 | 1.03 | 0.31 | 0.22 | 0.14 |
| Green turtle | 3.39 | 0.38 | 0.13 | <0.01 | 0 | 0 | 0 | 0 | 4.27 | 1.09 | 0.77 | 0.54 |

[a] Listed as Endangered under the ESA.

Table H-15. Construction Schedule B, year 2 (all jackets, 4 year schedule): The mean number of sea turtles predicted to receive sound levels above exposure criteria with sound attenuation. Construction schedule assumptions are summarized in Section 1.2.2.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 0.06 | <0.01 | <0.01 | 0 | 0 | 0 | 0 | 0 | 0.10 | 0.03 | 0.02 | 0.01 |
| Leatherback turtle [a] | 6.70 | 0.45 | 0.33 | 0.15 | 0 | 0 | 0 | 0 | 4.76 | 0.44 | 0.21 | 0.13 |
| Loggerhead turtle | 0.34 | <0.01 | 0 | 0 | 0 | 0 | 0 | 0 | 1.01 | 0.29 | 0.21 | 0.14 |
| Green turtle | 3.21 | 0.31 | 0.08 | <0.01 | 0 | 0 | 0 | 0 | 4.18 | 1.00 | 0.75 | 0.52 |

[a] Listed as Endangered under the ESA.

Table H-16. Construction Schedule B, year 3 (all jackets, 4 year schedule): The mean number of sea turtles predicted to receive sound levels above exposure criteria with sound attenuation. Construction schedule assumptions are summarized in Section 1.2.2.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 0.06 | <0.01 | <0.01 | 0 | 0 | 0 | 0 | 0 | 0.10 | 0.03 | 0.02 | 0.01 |
| Leatherback turtle [a] | 7.08 | 0.52 | 0.35 | 0.15 | 0 | 0 | 0 | 0 | 4.82 | 0.42 | 0.23 | 0.13 |
| Loggerhead turtle | 0.37 | <0.01 | 0 | 0 | 0 | 0 | 0 | 0 | 1.01 | 0.30 | 0.22 | 0.14 |
| Green turtle | 3.36 | 0.38 | 0.14 | <0.01 | 0 | 0 | 0 | 0 | 4.16 | 1.06 | 0.75 | 0.52 |

[a] Listed as Endangered under the ESA.

Table H-17. Construction Schedule B, year 4 (all jackets, 4 year schedule): The mean number of sea turtles predicted to receive sound levels above exposure criteria with sound attenuation. Construction schedule assumptions are summarized in Section 1.2.2.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 0.06 | <0.01 | <0.01 | 0 | 0 | 0 | 0 | 0 | 0.11 | 0.03 | 0.02 | 0.01 |
| Leatherback turtle [a] | 6.92 | 0.46 | 0.34 | 0.15 | 0 | 0 | 0 | 0 | 4.90 | 0.45 | 0.21 | 0.14 |
| Loggerhead turtle | 0.35 | <0.01 | 0 | 0 | 0 | 0 | 0 | 0 | 1.03 | 0.30 | 0.22 | 0.14 |
| Green turtle | 3.27 | 0.31 | 0.09 | <0.01 | 0 | 0 | 0 | 0 | 4.27 | 1.02 | 0.77 | 0.53 |

[a] Listed as Endangered under the ESA.

Table H-18. Construction Schedule B, years 1 through 4 combined (all jackets, 4 year schedule): The mean number of sea turtles predicted to receive sound levels above exposure criteria with sound attenuation. Construction schedule assumptions are summarized in Section 1.2.2.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 0.25 | <0.01 | <0.01 | 0 | 0 | 0 | 0 | 0 | 0.42 | 0.12 | 0.09 | 0.05 |
| Leatherback turtle [a] | 27.75 | 1.95 | 1.37 | 0.60 | 0 | 0 | 0 | 0 | 19.38 | 1.75 | 0.89 | 0.54 |
| Loggerhead turtle | 1.43 | <0.01 | 0 | 0 | 0 | 0 | 0 | 0 | 4.08 | 1.21 | 0.88 | 0.56 |
| Green turtle | 13.22 | 1.38 | 0.44 | 0.01 | 0 | 0 | 0 | 0 | 16.88 | 4.17 | 3.03 | 2.09 |

[a] Listed as Endangered under the ESA.

## H.2.2. Exposure Ranges – Impact Pile Driving

### H.2.2.1. Marine Mammals

This section contains marine mammal exposure ranges for each of the modeled foundation types and seasons assuming 0, 10, 12, and 15 dB broadband attenuation.

Table H-19. Monopile foundation (14 m diameter, typical, 5500 kJ hammer, one per day, summer): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 7.10 | 3.27 | 2.44 | 1.65 | <0.01 | <0.01 | <0.01 | <0.01 | 11.19 | 5.54 | 4.76 | 3.76 | 11.15 | 5.50 | 4.75 | 3.77 |
| LF | Minke whale (migrating) | 4.75 | 1.85 | 1.35 | 0.68 | <0.01 | <0.01 | <0.01 | 0 | 10.41 | 4.84 | 4.16 | 3.31 | 39.99 | 19.87 | 17.25 | 14.08 |
| LF | Humpback whale | 6.17 | 2.57 | 1.93 | 1.19 | 0.02 | <0.01 | <0.01 | <0.01 | 10.67 | 5.43 | 4.37 | 3.38 | 10.74 | 5.48 | 4.35 | 3.40 |
| LF | North Atlantic right whale [c] | 5.58 | 2.02 | 1.50 | 0.88 | <0.01 | <0.01 | 0 | 0 | 10.85 | 4.94 | 4.48 | 3.59 | 10.92 | 4.99 | 4.43 | 3.61 |
| LF | Sei whale [c] (migrating) | 5.69 | 2.28 | 1.64 | 0.75 | 0.05 | <0.01 | 0 | 0 | 11.03 | 5.49 | 4.46 | 3.67 | 47.75 | 21.17 | 18.03 | 15.01 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.12 | 4.67 | 4.10 | 3.27 | 4.14 | 1.83 | 1.43 | 0.97 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.97 | 5.37 | 4.59 | 3.80 | 4.69 | 2.09 | 1.54 | 1.09 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.28 | 4.80 | 4.26 | 3.19 | 4.35 | 1.74 | 1.47 | 1.08 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8.61 | 4.41 | 3.67 | 3.00 | 4.03 | 1.79 | 1.49 | 0.95 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.74 | 5.46 | 4.66 | 3.44 | 4.66 | 1.90 | 1.38 | 1.10 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.08 | 5.09 | 4.28 | 3.48 | 4.49 | 1.83 | 1.41 | 1.05 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.45 | 5.13 | 4.28 | 3.53 | 4.31 | 1.73 | 1.49 | 0.99 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.82 | 5.31 | 4.35 | 3.52 | 4.40 | 1.82 | 1.56 | 1.02 |
| HF | Harbor porpoise (sensitive) | 0 | 0 | 0 | 0 | 0.46 | 0.01 | 0.01 | 0.01 | 10.28 | 4.87 | 4.43 | 3.26 | 52.75 | 24.28 | 21.05 | 17.06 |
| PW | Gray seal | 0.84 | 0.04 | 0.04 | 0 | 0 | 0 | 0 | 0 | 11.38 | 5.70 | 4.83 | 3.87 | 7.62 | 3.85 | 3.32 | 2.47 |
| PW | Harbor seal | 0.72 | 0 | 0 | 0 | 0.01 | 0 | 0 | 0 | 10.84 | 4.95 | 4.55 | 3.72 | 6.69 | 3.49 | 3.10 | 2.24 |
| PW | Harp seal | 0.65 | <0.01 | <0.01 | 0 | <0.01 | <0.01 | <0.01 | <0.01 | 10.92 | 5.01 | 4.58 | 3.68 | 7.00 | 3.62 | 3.07 | 2.00 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-20. Monopile foundation (14 m diameter, typical, 5500 kJ hammer, two per day, summer): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 7.31 | 3.18 | 2.61 | 1.59 | 0.02 | 0 | 0 | 0 | 11.05 | 5.63 | 4.79 | 3.86 | 11.05 | 5.62 | 4.69 | 3.87 |
| LF | Minke whale (migrating) | 4.90 | 1.79 | 1.18 | 0.67 | 0.02 | <0.01 | <0.01 | 0 | 10.36 | 4.91 | 4.35 | 3.46 | 40.90 | 19.89 | 17.23 | 14.26 |
| LF | Humpback whale | 6.52 | 2.67 | 2.32 | 1.35 | 0.03 | 0 | 0 | 0 | 10.70 | 5.10 | 4.45 | 3.45 | 10.75 | 5.16 | 4.46 | 3.49 |
| LF | North Atlantic right whale [c] | 5.75 | 2.14 | 1.77 | 0.96 | 0.03 | <0.01 | <0.01 | 0 | 10.83 | 5.14 | 4.48 | 3.75 | 10.91 | 5.18 | 4.48 | 3.77 |
| LF | Sei whale [c] (migrating) | 6.05 | 2.40 | 1.77 | 1.13 | 0.03 | <0.01 | <0.01 | 0 | 11.05 | 5.21 | 4.71 | 3.54 | 48.81 | 21.49 | 18.43 | 15.04 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.45 | 5.08 | 4.21 | 3.25 | 4.44 | 1.96 | 1.51 | 1.04 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.17 | 5.44 | 4.96 | 3.72 | 5.01 | 2.07 | 1.64 | 1.22 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.14 | 5.03 | 4.20 | 3.35 | 4.33 | 1.94 | 1.52 | 1.04 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8.25 | 4.42 | 3.80 | 3.11 | 4.32 | 1.83 | 1.50 | 0.91 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.88 | 5.22 | 4.41 | 3.40 | 4.54 | 1.84 | 1.50 | 1.05 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.39 | 5.13 | 4.36 | 3.43 | 4.39 | 1.83 | 1.49 | 1.05 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.46 | 5.02 | 4.50 | 3.50 | 4.51 | 1.87 | 1.52 | 1.04 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.77 | 5.32 | 4.55 | 3.42 | 4.54 | 1.96 | 1.57 | 1.01 |
| HF | Harbor porpoise (sensitive) | 0 | 0 | 0 | 0 | 0.62 | 0.07 | 0.04 | 0.02 | 10.36 | 4.96 | 4.43 | 3.48 | 54.43 | 24.52 | 21.32 | 17.22 |
| PW | Gray seal | 1.13 | 0.06 | 0.06 | 0 | <0.01 | 0 | 0 | 0 | 11.56 | 5.64 | 4.99 | 4.02 | 7.64 | 3.89 | 3.18 | 2.44 |
| PW | Harbor seal | 0.99 | 0 | 0 | 0 | 0.05 | <0.01 | <0.01 | 0 | 10.88 | 5.05 | 4.43 | 3.68 | 6.90 | 3.67 | 3.04 | 2.21 |
| PW | Harp seal | 0.76 | <0.01 | 0 | 0 | 0.07 | 0 | 0 | 0 | 10.80 | 5.51 | 4.52 | 3.58 | 7.14 | 3.52 | 3.08 | 2.23 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-21. Monopile foundation (14 m diameter, typical, 5500 kJ hammer, one per day, winter): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 7.77 | 3.29 | 2.79 | 1.83 | <0.01 | <0.01 | <0.01 | <0.01 | 12.69 | 5.84 | 4.88 | 3.93 | 12.62 | 5.88 | 4.83 | 3.96 |
| LF | Minke whale (migrating) | 5.21 | 1.87 | 1.10 | 0.76 | <0.01 | <0.01 | <0.01 | 0 | 11.72 | 5.23 | 4.48 | 3.46 | 73.12 | 28.44 | 23.74 | 17.92 |
| LF | Humpback whale | 6.57 | 2.63 | 2.13 | 1.20 | 0.02 | <0.01 | <0.01 | <0.01 | 12.52 | 5.61 | 4.75 | 3.62 | 12.53 | 5.60 | 4.78 | 3.63 |
| LF | North Atlantic right whale [c] | 6.20 | 2.09 | 1.63 | 1.00 | <0.01 | <0.01 | 0 | 0 | 12.23 | 5.58 | 4.71 | 3.72 | 12.25 | 5.61 | 4.70 | 3.74 |
| LF | Sei whale [c] (migrating) | 6.40 | 2.29 | 1.68 | 0.92 | 0.01 | <0.01 | 0 | 0 | 12.44 | 5.86 | 4.86 | 3.78 | 86.52 | 30.61 | 25.21 | 18.61 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.87 | 5.01 | 4.27 | 3.42 | 4.44 | 1.86 | 1.43 | 1.03 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.78 | 5.57 | 4.81 | 4.03 | 4.93 | 2.09 | 1.54 | 1.12 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.64 | 5.21 | 4.44 | 3.46 | 4.61 | 1.84 | 1.51 | 1.08 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.22 | 4.63 | 3.93 | 3.30 | 4.31 | 1.79 | 1.49 | 0.98 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 12.34 | 5.77 | 4.94 | 3.69 | 4.89 | 1.90 | 1.53 | 1.13 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 11.79 | 5.46 | 4.59 | 3.53 | 4.68 | 1.90 | 1.46 | 1.06 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.08 | 5.55 | 4.58 | 3.72 | 4.61 | 1.79 | 1.53 | 1.02 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.31 | 5.68 | 4.63 | 3.60 | 4.69 | 1.89 | 1.62 | 1.11 |
| HF | Harbor porpoise (sensitive) | 0 | 0 | 0 | 0 | 0.46 | 0.01 | 0.01 | 0.01 | 12.10 | 5.34 | 4.59 | 3.49 | 97.49 | 47.34 | 33.92 | 24.26 |
| PW | Gray seal | 1.06 | 0.04 | 0.04 | 0 | 0 | 0 | 0 | 0 | 13.03 | 6.23 | 5.24 | 4.13 | 8.12 | 4.09 | 3.44 | 2.45 |
| PW | Harbor seal | 0.77 | 0 | 0 | 0 | 0.01 | 0 | 0 | 0 | 12.13 | 5.40 | 4.65 | 3.80 | 7.39 | 3.80 | 3.07 | 2.25 |
| PW | Harp seal | 0.74 | <0.01 | <0.01 | 0 | <0.01 | <0.01 | <0.01 | <0.01 | 12.38 | 5.71 | 4.81 | 3.83 | 7.75 | 3.78 | 3.26 | 2.16 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-22. Monopile foundation (14 m diameter, typical, 5500 kJ hammer, two per day, winter): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 8.23 | 3.57 | 2.71 | 1.87 | 0.02 | 0 | 0 | 0 | 12.83 | 5.99 | 5.14 | 3.96 | 12.83 | 5.97 | 5.11 | 4.01 |
| LF | Minke whale (migrating) | 5.22 | 1.91 | 1.27 | 0.70 | 0.02 | <0.01 | <0.01 | 0 | 11.95 | 5.33 | 4.53 | 3.57 | 79.91 | 28.67 | 23.82 | 18.11 |
| LF | Humpback whale | 7.43 | 3.01 | 2.44 | 1.43 | 0.03 | 0 | 0 | 0 | 12.58 | 5.64 | 4.67 | 3.61 | 12.54 | 5.64 | 4.68 | 3.65 |
| LF | North Atlantic right whale [c] | 6.41 | 2.29 | 1.89 | 1.01 | 0.03 | <0.01 | <0.01 | 0 | 12.48 | 5.52 | 4.74 | 3.81 | 12.48 | 5.58 | 4.82 | 3.83 |
| LF | Sei whale [c] (migrating) | 6.65 | 2.52 | 1.98 | 1.26 | 0.03 | <0.01 | <0.01 | 0 | 12.80 | 6.01 | 4.79 | 3.74 | 92.93 | 31.39 | 25.49 | 19.16 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 12.11 | 5.47 | 4.55 | 3.41 | 4.64 | 1.99 | 1.53 | 1.05 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.82 | 5.76 | 5.15 | 3.80 | 5.21 | 2.14 | 1.68 | 1.26 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 11.67 | 5.33 | 4.68 | 3.51 | 4.71 | 1.97 | 1.53 | 1.07 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9.78 | 4.77 | 4.21 | 3.29 | 4.53 | 1.83 | 1.50 | 0.91 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 12.44 | 5.66 | 4.84 | 3.67 | 4.82 | 1.93 | 1.56 | 1.09 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.73 | 5.45 | 4.65 | 3.65 | 4.68 | 1.84 | 1.52 | 1.07 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 12.00 | 5.48 | 4.65 | 3.71 | 4.66 | 1.92 | 1.53 | 1.09 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.45 | 5.76 | 4.85 | 3.61 | 4.77 | 1.99 | 1.70 | 1.10 |
| HF | Harbor porpoise (sensitive) | 0 | 0 | 0 | 0 | 0.59 | 0.07 | 0.07 | 0.02 | 12.25 | 5.33 | 4.63 | 3.71 | 98.73 | 49.68 | 34.44 | 24.36 |
| PW | Gray seal | 1.11 | 0.06 | 0.06 | 0 | <0.01 | 0 | 0 | 0 | 12.98 | 6.24 | 5.25 | 4.17 | 8.17 | 4.16 | 3.36 | 2.46 |
| PW | Harbor seal | 1.17 | 0.02 | 0 | 0 | 0.05 | <0.01 | <0.01 | 0 | 12.04 | 5.30 | 4.64 | 3.91 | 7.50 | 3.75 | 3.05 | 2.23 |
| PW | Harp seal | 0.71 | <0.01 | 0 | 0 | 0.07 | 0 | 0 | 0 | 12.50 | 5.80 | 4.85 | 3.74 | 7.70 | 3.70 | 3.15 | 2.37 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-23. Monopile foundation (14 m diameter, difficult to drive, 6600 kJ hammer, one per day, summer): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 7.92 | 3.80 | 3.28 | 2.13 | <0.01 | <0.01 | <0.01 | <0.01 | 12.54 | 6.45 | 5.38 | 4.41 | 12.58 | 6.30 | 5.31 | 4.42 |
| LF | Minke whale (migrating) | 5.40 | 2.37 | 1.84 | 1.07 | <0.01 | <0.01 | <0.01 | <0.01 | 11.68 | 5.63 | 4.82 | 3.92 | 47.20 | 22.27 | 20.05 | 16.15 |
| LF | Humpback whale | 7.05 | 3.42 | 2.58 | 1.46 | 0.05 | <0.01 | <0.01 | <0.01 | 12.24 | 6.14 | 5.45 | 4.14 | 12.33 | 6.15 | 5.46 | 4.16 |
| LF | North Atlantic right whale [c] | 6.52 | 2.55 | 2.06 | 1.45 | <0.01 | <0.01 | 0 | 0 | 12.01 | 6.14 | 4.87 | 4.18 | 12.06 | 6.24 | 4.87 | 4.18 |
| LF | Sei whale [c] (migrating) | 7.18 | 2.88 | 2.29 | 1.51 | 0.08 | <0.01 | <0.01 | <0.01 | 12.31 | 6.49 | 5.48 | 4.10 | 53.70 | 24.19 | 21.16 | 16.77 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.53 | 5.83 | 4.80 | 3.76 | 4.88 | 2.22 | 1.87 | 1.43 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.47 | 6.33 | 5.30 | 4.24 | 5.52 | 2.48 | 2.12 | 1.46 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.60 | 5.67 | 4.91 | 3.93 | 4.97 | 2.16 | 1.76 | 1.34 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9.93 | 5.14 | 4.42 | 3.60 | 4.75 | 2.08 | 1.79 | 1.18 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 12.32 | 6.31 | 5.20 | 4.15 | 5.19 | 2.26 | 1.98 | 1.24 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 11.56 | 5.96 | 5.05 | 3.92 | 5.08 | 2.28 | 1.77 | 1.26 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.75 | 6.12 | 5.17 | 3.97 | 5.17 | 2.21 | 1.78 | 1.28 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.12 | 6.39 | 5.00 | 4.15 | 4.99 | 2.44 | 1.84 | 1.53 |
| HF | Harbor porpoise (sensitive) | 0 | 0 | 0 | 0 | 0.69 | 0.13 | 0.02 | 0.01 | 11.91 | 5.70 | 4.87 | 3.93 | 58.78 | 27.89 | 24.41 | 19.76 |
| PW | Gray seal | 1.25 | 0.27 | 0.04 | 0.04 | 0 | 0 | 0 | 0 | 12.81 | 6.84 | 5.69 | 4.62 | 8.37 | 4.35 | 3.84 | 3.06 |
| PW | Harbor seal | 1.20 | 0.09 | 0 | 0 | 0.01 | 0 | 0 | 0 | 12.01 | 6.07 | 5.02 | 4.01 | 7.59 | 3.98 | 3.66 | 2.67 |
| PW | Harp seal | 1.14 | <0.01 | <0.01 | 0 | 0.04 | <0.01 | <0.01 | <0.01 | 12.36 | 6.23 | 5.29 | 4.12 | 8.12 | 4.09 | 3.52 | 2.96 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-24. Monopile foundation (14 m diameter, difficult to drive, 6600 kJ hammer, two per day, summer): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 8.45 | 4.29 | 3.31 | 2.54 | 0.05 | <0.01 | <0.01 | 0 | 12.69 | 6.37 | 5.62 | 4.50 | 12.71 | 6.37 | 5.55 | 4.49 |
| LF | Minke whale (migrating) | 5.69 | 2.38 | 1.79 | 1.11 | 0.03 | <0.01 | <0.01 | <0.01 | 11.86 | 5.78 | 4.95 | 3.95 | 47.37 | 22.70 | 19.89 | 16.20 |
| LF | Humpback whale | 7.70 | 3.60 | 2.88 | 2.03 | 0.03 | 0 | 0 | 0 | 12.48 | 6.13 | 5.27 | 4.04 | 12.53 | 6.18 | 5.28 | 4.04 |
| LF | North Atlantic right whale [c] | 6.82 | 2.77 | 2.20 | 1.52 | 0.03 | <0.01 | <0.01 | 0 | 12.24 | 6.09 | 5.23 | 4.15 | 12.40 | 6.13 | 5.22 | 4.20 |
| LF | Sei whale [c] (migrating) | 7.14 | 3.22 | 2.47 | 1.66 | 0.06 | <0.01 | <0.01 | <0.01 | 12.69 | 6.18 | 5.17 | 4.23 | 54.89 | 24.43 | 21.43 | 17.16 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 11.97 | 5.82 | 5.09 | 3.88 | 5.20 | 2.26 | 1.97 | 1.43 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.60 | 6.37 | 5.45 | 4.30 | 5.64 | 2.38 | 2.13 | 1.56 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 11.66 | 5.86 | 5.08 | 3.92 | 5.16 | 2.24 | 1.96 | 1.49 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9.71 | 5.09 | 4.44 | 3.53 | 4.85 | 2.23 | 1.89 | 1.33 |
| MF | Risso’s dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 12.38 | 6.28 | 5.23 | 4.09 | 5.30 | 2.49 | 1.83 | 1.39 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.64 | 5.94 | 5.05 | 3.99 | 5.19 | 2.22 | 1.91 | 1.40 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 11.85 | 6.08 | 5.07 | 4.11 | 5.07 | 2.30 | 1.89 | 1.38 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.31 | 6.18 | 5.47 | 4.09 | 5.43 | 2.19 | 1.95 | 1.51 |
| HF | Harbor porpoise (sensitive) | 0 | 0 | 0 | 0 | 0.68 | 0.11 | 0.07 | 0.02 | 12.08 | 5.84 | 5.09 | 3.97 | 60.55 | 28.54 | 24.53 | 19.97 |
| PW | Gray seal | 1.43 | 0.25 | 0.06 | 0.06 | <0.01 | 0 | 0 | 0 | 12.89 | 6.66 | 5.64 | 4.74 | 8.50 | 4.53 | 3.88 | 2.98 |
| PW | Harbor seal | 1.54 | 0.12 | 0.02 | 0 | 0.05 | <0.01 | <0.01 | 0 | 11.98 | 5.86 | 5.02 | 4.13 | 7.83 | 4.10 | 3.67 | 2.80 |
| PW | Harp seal | 1.31 | 0.18 | <0.01 | 0 | 0.07 | 0 | 0 | 0 | 12.35 | 6.16 | 5.52 | 4.13 | 8.15 | 4.08 | 3.64 | 2.88 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-25. Monopile foundation (14 m diameter, difficult to drive, 6600 kJ hammer, one per day, winter): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 9.11 | 4.38 | 3.40 | 2.55 | <0.01 | <0.01 | <0.01 | <0.01 | 14.85 | 6.99 | 5.77 | 4.58 | 14.88 | 6.98 | 5.77 | 4.57 |
| LF | Minke whale (migrating) | 6.56 | 2.45 | 1.93 | 1.32 | <0.01 | <0.01 | <0.01 | <0.01 | 13.74 | 6.17 | 5.23 | 4.11 | 72.99 | 35.86 | 28.22 | 21.45 |
| LF | Humpback whale | 8.58 | 3.74 | 2.63 | 2.09 | 0.02 | <0.01 | <0.01 | <0.01 | 14.37 | 6.38 | 5.59 | 4.19 | 14.30 | 6.39 | 5.60 | 4.27 |
| LF | North Atlantic right whale [c] | 7.78 | 2.67 | 2.21 | 1.49 | <0.01 | <0.01 | 0 | 0 | 14.34 | 6.52 | 5.58 | 4.41 | 14.35 | 6.61 | 5.59 | 4.39 |
| LF | Sei whale [c] (migrating) | 7.57 | 2.96 | 2.48 | 1.60 | 0.05 | <0.01 | <0.01 | <0.01 | 14.45 | 6.90 | 5.70 | 4.43 | 87.03 | 38.67 | 30.38 | 22.38 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13.67 | 6.16 | 5.27 | 3.98 | 5.35 | 2.34 | 1.89 | 1.43 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14.80 | 6.71 | 5.83 | 4.42 | 5.82 | 2.48 | 2.12 | 1.46 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13.51 | 6.10 | 5.32 | 4.23 | 5.41 | 2.31 | 1.86 | 1.36 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.56 | 5.55 | 4.65 | 3.69 | 4.99 | 2.22 | 1.81 | 1.21 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 14.11 | 6.68 | 5.60 | 4.57 | 5.58 | 2.43 | 1.99 | 1.27 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 13.50 | 6.25 | 5.40 | 4.22 | 5.43 | 2.37 | 1.89 | 1.36 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14.02 | 6.43 | 5.56 | 4.20 | 5.54 | 2.40 | 1.82 | 1.36 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14.52 | 6.72 | 5.51 | 4.24 | 5.44 | 2.61 | 1.86 | 1.52 |
| HF | Harbor porpoise (sensitive) | 0 | 0 | 0 | 0 | 0.51 | 0.13 | 0.01 | 0.01 | 13.98 | 6.43 | 5.35 | 4.16 | 100.40 | 68.16 | 46.43 | 29.69 |
| PW | Gray seal | 1.44 | 0.27 | 0.04 | 0.04 | 0.04 | 0 | 0 | 0 | 14.72 | 7.25 | 6.22 | 4.80 | 9.06 | 4.46 | 4.07 | 3.17 |
| PW | Harbor seal | 1.24 | 0.09 | 0 | 0 | 0.01 | 0 | 0 | 0 | 13.99 | 6.38 | 5.38 | 4.35 | 8.59 | 4.25 | 3.77 | 2.80 |
| PW | Harp seal | 1.14 | <0.01 | <0.01 | 0 | 0.04 | <0.01 | <0.01 | <0.01 | 14.33 | 6.43 | 5.72 | 4.47 | 8.76 | 4.39 | 3.73 | 3.01 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-26. Monopile foundation (14 m diameter, difficult to drive, 6600 kJ hammer, two per day, winter): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 9.91 | 4.49 | 3.94 | 2.66 | 0.03 | <0.01 | <0.01 | 0 | 14.79 | 6.87 | 5.96 | 4.68 | 14.87 | 6.84 | 5.98 | 4.66 |
| LF | Minke whale (migrating) | 6.38 | 2.60 | 2.19 | 1.12 | 0.03 | <0.01 | <0.01 | <0.01 | 13.69 | 6.12 | 5.38 | 4.18 | 80.09 | 36.19 | 28.63 | 21.69 |
| LF | Humpback whale | 8.76 | 3.98 | 3.19 | 2.29 | 0.03 | 0 | 0 | 0 | 14.33 | 6.83 | 5.65 | 4.26 | 14.35 | 6.79 | 5.72 | 4.26 |
| LF | North Atlantic right whale [c] | 7.91 | 3.00 | 2.43 | 1.70 | 0.03 | <0.01 | <0.01 | 0 | 14.27 | 6.74 | 5.52 | 4.35 | 14.38 | 6.76 | 5.53 | 4.34 |
| LF | Sei whale [c] (migrating) | 8.08 | 3.34 | 2.66 | 1.78 | 0.05 | <0.01 | <0.01 | <0.01 | 14.50 | 6.77 | 5.98 | 4.48 | 94.26 | 39.71 | 31.15 | 22.92 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 13.77 | 6.23 | 5.47 | 4.18 | 5.54 | 2.30 | 1.99 | 1.43 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14.88 | 6.99 | 5.76 | 4.71 | 5.85 | 2.52 | 2.16 | 1.57 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 13.74 | 6.30 | 5.41 | 4.16 | 5.44 | 2.37 | 2.00 | 1.48 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.28 | 5.50 | 4.77 | 3.76 | 5.02 | 2.28 | 1.86 | 1.34 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 14.32 | 6.66 | 5.56 | 4.31 | 5.53 | 2.57 | 1.93 | 1.43 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13.74 | 6.37 | 5.49 | 4.25 | 5.53 | 2.31 | 1.92 | 1.40 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 14.10 | 6.50 | 5.45 | 4.27 | 5.46 | 2.44 | 1.94 | 1.40 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14.24 | 6.80 | 5.72 | 4.32 | 5.60 | 2.45 | 1.97 | 1.54 |
| HF | Harbor porpoise (sensitive) | 0 | 0 | 0 | 0 | 0.68 | 0.11 | 0.07 | 0.02 | 13.92 | 6.28 | 5.35 | 4.17 | 101.88 | 72.91 | 48.79 | 30.06 |
| PW | Gray seal | 1.62 | 0.25 | 0.06 | 0.06 | <0.01 | 0 | 0 | 0 | 14.89 | 7.15 | 6.25 | 4.82 | 9.16 | 4.74 | 4.15 | 3.09 |
| PW | Harbor seal | 1.58 | 0.12 | 0.12 | 0 | 0.05 | <0.01 | <0.01 | 0 | 14.11 | 6.50 | 5.34 | 4.30 | 8.57 | 4.20 | 3.93 | 2.89 |
| PW | Harp seal | 1.37 | 0.18 | <0.01 | 0 | 0.07 | 0 | 0 | 0 | 14.48 | 6.71 | 5.76 | 4.31 | 8.84 | 4.12 | 3.75 | 2.97 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-27. Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, 4 per day, summer): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 10.19 | 3.56 | 2.91 | 1.85 | 0.04 | <0.01 | <0.01 | 0 | 11.12 | 4.06 | 3.09 | 2.27 | 11.09 | 4.07 | 3.13 | 2.27 |
| LF | Minke whale (migrating) | 4.53 | 1.37 | 0.92 | 0.51 | 0.01 | <0.01 | <0.01 | 0 | 9.23 | 3.50 | 2.93 | 2.18 | 57.30 | 23.25 | 19.81 | 15.10 |
| LF | Humpback whale | 7.59 | 2.55 | 2.05 | 1.21 | 0.02 | 0 | 0 | 0 | 10.36 | 3.85 | 3.06 | 2.22 | 10.41 | 3.87 | 3.09 | 2.21 |
| LF | North Atlantic right whale [c] | 6.43 | 1.78 | 1.39 | 0.82 | <0.01 | <0.01 | <0.01 | 0 | 10.34 | 3.70 | 3.00 | 2.14 | 10.49 | 3.68 | 3.00 | 2.08 |
| LF | Sei whale [c] (migrating) | 7.66 | 2.42 | 1.73 | 1.11 | 0.04 | <0.01 | 0 | 0 | 10.83 | 3.82 | 3.05 | 2.20 | 70.13 | 27.00 | 22.42 | 16.51 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9.59 | 3.60 | 2.91 | 2.14 | 3.84 | 1.34 | 1.07 | 0.72 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.79 | 3.92 | 3.32 | 2.06 | 4.01 | 1.32 | 0.98 | 0.62 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 9.11 | 3.56 | 2.98 | 2.14 | 3.82 | 1.40 | 1.09 | 0.73 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6.89 | 2.93 | 2.41 | 1.71 | 3.45 | 1.24 | 0.97 | 0.67 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.29 | 3.71 | 3.05 | 2.24 | 3.95 | 1.35 | 1.04 | 0.71 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 9.54 | 3.58 | 2.94 | 2.12 | 3.73 | 1.33 | 1.06 | 0.73 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9.76 | 3.59 | 2.96 | 2.12 | 3.76 | 1.38 | 1.07 | 0.66 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.42 | 3.71 | 2.97 | 2.15 | 3.83 | 1.35 | 1.05 | 0.69 |
| HF | Harbor porpoise (sensitive) | 0.19 | 0 | 0 | 0 | 0.33 | 0.04 | 0.04 | 0.03 | 9.72 | 3.52 | 3.01 | 2.13 | 90.36 | 74.45 | 64.38 | 44.10 |
| PW | Gray seal | 1.99 | 0.46 | 0.39 | <0.01 | <0.01 | 0 | 0 | 0 | 11.52 | 4.24 | 3.33 | 2.38 | 7.43 | 2.53 | 2.06 | 1.38 |
| PW | Harbor seal | 0.93 | 0.10 | 0.01 | 0 | 0.04 | 0 | 0 | 0 | 10.21 | 3.77 | 3.02 | 2.15 | 6.52 | 2.28 | 1.84 | 1.33 |
| PW | Harp seal | 0.93 | 0.03 | 0 | 0 | 0.03 | 0 | 0 | 0 | 10.71 | 3.76 | 3.18 | 2.28 | 6.80 | 2.41 | 1.90 | 1.29 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-28. Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, 8 per day, summer): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 12.38 | 4.35 | 3.66 | 2.67 | 0.03 | <0.01 | <0.01 | 0 | 11.21 | 4.07 | 3.21 | 2.34 | 11.19 | 4.07 | 3.20 | 2.35 |
| LF | Minke whale (migrating) | 6.28 | 2.09 | 1.65 | 0.86 | 0.02 | <0.01 | <0.01 | 0 | 9.81 | 3.62 | 2.90 | 2.18 | 58.45 | 23.77 | 20.10 | 15.32 |
| LF | Humpback whale | 9.42 | 3.56 | 2.68 | 2.03 | 0 | 0 | 0 | 0 | 10.68 | 3.82 | 3.08 | 2.30 | 10.75 | 3.81 | 3.08 | 2.30 |
| LF | North Atlantic right whale [c] | 8.40 | 2.63 | 2.11 | 1.38 | 0.03 | 0 | 0 | 0 | 10.63 | 3.70 | 2.95 | 2.16 | 10.67 | 3.69 | 2.89 | 2.14 |
| LF | Sei whale [c] (migrating) | 9.23 | 3.17 | 2.58 | 1.73 | 0.03 | <0.01 | 0 | 0 | 10.86 | 3.82 | 3.05 | 2.20 | 70.94 | 27.95 | 23.02 | 16.93 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 9.89 | 3.57 | 2.95 | 2.15 | 3.76 | 1.31 | 1.06 | 0.72 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.00 | 3.76 | 3.22 | 2.10 | 3.84 | 1.30 | 0.96 | 0.63 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 9.75 | 3.67 | 3.01 | 2.13 | 3.88 | 1.38 | 1.07 | 0.73 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 7.15 | 2.98 | 2.50 | 1.79 | 3.53 | 1.26 | 0.97 | 0.65 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.70 | 3.76 | 2.96 | 2.18 | 3.96 | 1.27 | 1.02 | 0.71 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 9.89 | 3.60 | 2.95 | 2.13 | 3.86 | 1.32 | 1.10 | 0.73 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.00 | 3.60 | 2.95 | 2.08 | 3.85 | 1.33 | 1.02 | 0.69 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.67 | 3.72 | 3.06 | 2.10 | 3.90 | 1.23 | 1.06 | 0.74 |
| HF | Harbor porpoise (sensitive) | 0.44 | 0 | 0 | 0 | 0.35 | 0.06 | 0.03 | <0.01 | 10.01 | 3.73 | 2.99 | 2.12 | 92.99 | 75.47 | 64.71 | 43.97 |
| PW | Gray seal | 2.18 | 0.49 | 0.26 | 0.03 | 0 | 0 | 0 | 0 | 11.65 | 4.28 | 3.45 | 2.47 | 7.34 | 2.60 | 2.23 | 1.47 |
| PW | Harbor seal | 1.72 | 0.20 | 0.12 | 0.01 | 0.01 | <0.01 | <0.01 | <0.01 | 10.73 | 3.82 | 3.15 | 2.26 | 6.54 | 2.37 | 1.82 | 1.27 |
| PW | Harp seal | 1.37 | 0.11 | 0.03 | 0 | 0.01 | 0 | 0 | 0 | 10.94 | 3.85 | 3.21 | 2.31 | 6.85 | 2.39 | 1.95 | 1.30 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-29. Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, 4 per day, winter): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 13.08 | 4.08 | 3.15 | 2.02 | 0.04 | <0.01 | <0.01 | 0 | 12.50 | 4.08 | 3.29 | 2.32 | 12.41 | 4.08 | 3.30 | 2.33 |
| LF | Minke whale (migrating) | 6.20 | 1.64 | 1.07 | 0.53 | 0.01 | <0.01 | <0.01 | 0 | 10.51 | 3.80 | 3.08 | 2.20 | 90.16 | 42.19 | 28.31 | 18.75 |
| LF | Humpback whale | 10.19 | 2.89 | 2.24 | 1.30 | 0.02 | 0 | 0 | 0 | 11.77 | 3.99 | 3.26 | 2.26 | 11.78 | 3.99 | 3.27 | 2.25 |
| LF | North Atlantic right whale [c] | 8.18 | 2.06 | 1.47 | 0.98 | <0.01 | <0.01 | <0.01 | 0 | 11.61 | 3.81 | 3.20 | 2.17 | 11.72 | 3.82 | 3.13 | 2.16 |
| LF | Sei whale [c] (migrating) | 9.22 | 2.66 | 1.93 | 1.30 | 0.04 | <0.01 | 0 | 0 | 12.02 | 3.94 | 3.19 | 2.25 | 96.47 | 46.54 | 31.37 | 20.41 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.45 | 3.78 | 2.99 | 2.18 | 4.10 | 1.39 | 1.11 | 0.76 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.57 | 3.92 | 3.37 | 2.13 | 4.03 | 1.34 | 1.02 | 0.63 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.11 | 3.79 | 3.07 | 2.21 | 4.12 | 1.44 | 1.12 | 0.79 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8.31 | 3.03 | 2.50 | 1.78 | 3.69 | 1.27 | 1.00 | 0.67 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.51 | 3.86 | 3.18 | 2.28 | 4.28 | 1.41 | 1.09 | 0.73 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.66 | 3.70 | 3.08 | 2.18 | 4.15 | 1.37 | 1.08 | 0.76 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.84 | 3.70 | 3.08 | 2.17 | 4.15 | 1.43 | 1.13 | 0.68 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.43 | 3.84 | 3.14 | 2.22 | 4.16 | 1.43 | 1.06 | 0.70 |
| HF | Harbor porpoise (sensitive) | 0.21 | 0 | 0 | 0 | 0.30 | 0.04 | 0.04 | 0.03 | 11.14 | 3.81 | 3.13 | 2.22 | 103.99 | 100.85 | 101.47 | 82.38 |
| PW | Gray seal | 2.07 | 0.46 | 0.39 | <0.01 | <0.01 | 0 | 0 | 0 | 12.93 | 4.34 | 3.39 | 2.41 | 7.96 | 2.60 | 2.12 | 1.40 |
| PW | Harbor seal | 1.01 | 0.10 | 0.10 | 0 | 0.02 | 0 | 0 | 0 | 11.46 | 3.90 | 3.16 | 2.25 | 6.99 | 2.47 | 1.95 | 1.35 |
| PW | Harp seal | 0.95 | 0.03 | 0 | 0 | 0.06 | 0 | 0 | 0 | 11.95 | 3.90 | 3.29 | 2.30 | 7.44 | 2.59 | 1.95 | 1.38 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-30. Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, 8 per day, winter): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 16.90 | 4.82 | 4.08 | 2.87 | 0.03 | <0.01 | <0.01 | 0 | 12.62 | 4.14 | 3.42 | 2.35 | 12.53 | 4.16 | 3.36 | 2.36 |
| LF | Minke whale (migrating) | 8.71 | 2.33 | 1.76 | 1.13 | 0.02 | <0.01 | <0.01 | 0 | 11.09 | 3.82 | 3.08 | 2.25 | 91.90 | 43.95 | 29.79 | 19.48 |
| LF | Humpback whale | 14.14 | 3.95 | 3.14 | 2.24 | 0 | 0 | 0 | 0 | 12.24 | 3.97 | 3.29 | 2.36 | 12.25 | 3.97 | 3.24 | 2.34 |
| LF | North Atlantic right whale [c] | 11.43 | 3.25 | 2.31 | 1.53 | 0.03 | 0 | 0 | 0 | 11.88 | 3.84 | 3.09 | 2.20 | 12.00 | 3.89 | 3.05 | 2.17 |
| LF | Sei whale [c] (migrating) | 12.34 | 3.57 | 2.66 | 1.91 | 0.03 | <0.01 | 0 | 0 | 12.48 | 3.90 | 3.24 | 2.24 | 97.97 | 48.22 | 32.60 | 21.04 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 11.16 | 3.75 | 3.05 | 2.20 | 4.10 | 1.36 | 1.09 | 0.78 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.05 | 3.79 | 3.22 | 2.12 | 3.92 | 1.36 | 0.96 | 0.63 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.75 | 3.81 | 3.15 | 2.22 | 4.13 | 1.42 | 1.10 | 0.78 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 8.49 | 3.14 | 2.59 | 1.88 | 3.71 | 1.30 | 0.98 | 0.67 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 12.05 | 3.87 | 3.13 | 2.21 | 4.24 | 1.34 | 1.05 | 0.72 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 11.05 | 3.84 | 3.04 | 2.20 | 4.04 | 1.32 | 1.12 | 0.76 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.35 | 3.77 | 3.06 | 2.16 | 4.11 | 1.40 | 1.05 | 0.72 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.02 | 3.89 | 3.20 | 2.18 | 4.25 | 1.30 | 1.07 | 0.75 |
| HF | Harbor porpoise (sensitive) | 0.49 | 0 | 0 | 0 | 0.35 | 0.08 | 0.06 | <0.01 | 11.54 | 3.88 | 3.12 | 2.23 | 103.91 | 101.21 | 101.75 | 84.26 |
| PW | Gray seal | 2.31 | 0.49 | 0.40 | 0.03 | 0 | 0 | 0 | 0 | 12.97 | 4.36 | 3.55 | 2.47 | 7.87 | 2.65 | 2.23 | 1.53 |
| PW | Harbor seal | 1.96 | 0.27 | 0.12 | 0.01 | 0.01 | <0.01 | <0.01 | <0.01 | 11.84 | 3.90 | 3.25 | 2.36 | 7.28 | 2.45 | 1.94 | 1.31 |
| PW | Harp seal | 1.47 | 0.17 | 0.05 | 0 | 0.01 | 0 | 0 | 0 | 12.34 | 3.90 | 3.25 | 2.33 | 7.29 | 2.48 | 2.08 | 1.34 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-31. Pre-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, 4 per day, summer): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 11.05 | 4.08 | 3.23 | 2.24 | 0.04 | <0.01 | <0.01 | 0 | 11.30 | 4.09 | 3.24 | 2.52 | 11.26 | 4.09 | 3.25 | 2.55 |
| LF | Minke whale (migrating) | 5.18 | 1.59 | 1.10 | 0.54 | 0.02 | <0.01 | <0.01 | 0 | 9.47 | 3.63 | 3.08 | 2.29 | 57.27 | 23.50 | 20.20 | 15.42 |
| LF | Humpback whale | 8.02 | 2.89 | 2.31 | 1.41 | 0.02 | 0 | 0 | 0 | 10.70 | 3.89 | 3.14 | 2.35 | 10.72 | 3.92 | 3.15 | 2.34 |
| LF | North Atlantic right whale [c] | 6.88 | 2.16 | 1.56 | 1.03 | 0.06 | <0.01 | <0.01 | 0 | 10.57 | 3.78 | 3.18 | 2.26 | 10.65 | 3.77 | 3.20 | 2.22 |
| LF | Sei whale [c] (migrating) | 8.19 | 2.67 | 1.94 | 1.34 | 0.04 | <0.01 | <0.01 | 0 | 11.00 | 3.96 | 3.12 | 2.29 | 70.13 | 27.05 | 22.55 | 16.62 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9.85 | 3.72 | 2.99 | 2.24 | 3.92 | 1.47 | 1.20 | 0.79 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.87 | 4.04 | 3.42 | 2.28 | 4.10 | 1.49 | 1.14 | 0.70 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 9.40 | 3.74 | 3.09 | 2.24 | 3.97 | 1.49 | 1.23 | 0.85 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 7.14 | 3.02 | 2.59 | 1.87 | 3.57 | 1.38 | 1.10 | 0.75 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.54 | 3.83 | 3.10 | 2.36 | 4.04 | 1.48 | 1.12 | 0.79 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 9.86 | 3.66 | 3.07 | 2.22 | 3.91 | 1.44 | 1.17 | 0.80 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.02 | 3.74 | 3.12 | 2.22 | 3.96 | 1.48 | 1.16 | 0.76 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.70 | 3.78 | 3.13 | 2.30 | 3.94 | 1.46 | 1.18 | 0.74 |
| HF | Harbor porpoise (sensitive) | 0.22 | 0 | 0 | 0 | 0.37 | 0.04 | 0.05 | 0.03 | 10.00 | 3.67 | 3.05 | 2.31 | 90.72 | 74.56 | 64.53 | 43.18 |
| PW | Gray seal | 2.06 | 0.46 | 0.41 | 0.28 | <0.01 | 0 | 0 | 0 | 11.54 | 4.23 | 3.36 | 2.59 | 7.44 | 2.76 | 2.18 | 1.51 |
| PW | Harbor seal | 1.10 | 0.10 | 0.10 | 0 | 0.04 | 0 | 0 | 0 | 10.55 | 3.85 | 3.12 | 2.31 | 6.52 | 2.47 | 2.04 | 1.49 |
| PW | Harp seal | 1.01 | 0.03 | 0 | 0 | 0.06 | 0 | 0 | 0 | 10.84 | 3.90 | 3.23 | 2.35 | 6.78 | 2.51 | 2.13 | 1.40 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-32. Pre-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, 8 per day, summer): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 13.27 | 4.70 | 4.11 | 2.90 | 0.04 | <0.01 | <0.01 | 0 | 11.28 | 4.15 | 3.28 | 2.48 | 11.29 | 4.17 | 3.27 | 2.53 |
| LF | Minke whale (migrating) | 6.70 | 2.33 | 1.79 | 1.18 | 0.02 | <0.01 | <0.01 | 0 | 10.06 | 3.69 | 3.05 | 2.28 | 58.74 | 23.98 | 20.51 | 15.60 |
| LF | Humpback whale | 9.95 | 3.82 | 3.08 | 2.25 | 0 | 0 | 0 | 0 | 10.83 | 3.88 | 3.20 | 2.37 | 10.86 | 3.89 | 3.20 | 2.36 |
| LF | North Atlantic right whale [c] | 9.07 | 3.16 | 2.27 | 1.65 | 0.03 | 0 | 0 | 0 | 10.84 | 3.81 | 3.14 | 2.28 | 11.00 | 3.81 | 3.08 | 2.26 |
| LF | Sei whale [c] (migrating) | 9.87 | 3.55 | 2.70 | 1.90 | 0.04 | <0.01 | <0.01 | 0 | 11.07 | 3.95 | 3.20 | 2.34 | 71.06 | 27.96 | 23.08 | 17.10 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.15 | 3.74 | 3.01 | 2.28 | 3.88 | 1.47 | 1.19 | 0.81 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.17 | 3.99 | 3.36 | 2.30 | 4.07 | 1.48 | 1.08 | 0.67 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 9.98 | 3.77 | 3.16 | 2.26 | 3.94 | 1.51 | 1.16 | 0.79 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 7.38 | 3.13 | 2.62 | 1.95 | 3.69 | 1.42 | 1.07 | 0.75 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.82 | 3.83 | 3.14 | 2.28 | 4.02 | 1.45 | 1.13 | 0.78 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.09 | 3.78 | 3.09 | 2.23 | 3.93 | 1.41 | 1.18 | 0.79 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.28 | 3.80 | 3.06 | 2.22 | 3.95 | 1.43 | 1.15 | 0.76 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.80 | 3.80 | 3.12 | 2.33 | 3.96 | 1.49 | 1.14 | 0.82 |
| HF | Harbor porpoise (sensitive) | 0.52 | 0 | 0 | 0 | 0.36 | 0.06 | 0.06 | 0.01 | 10.17 | 3.79 | 3.13 | 2.27 | 93.31 | 75.41 | 65.02 | 43.26 |
| PW | Gray seal | 2.41 | 0.69 | 0.44 | 0.26 | 0 | 0 | 0 | 0 | 11.65 | 4.31 | 3.54 | 2.65 | 7.36 | 2.80 | 2.38 | 1.79 |
| PW | Harbor seal | 1.95 | 0.26 | 0.11 | 0.01 | 0.02 | <0.01 | <0.01 | <0.01 | 10.87 | 3.89 | 3.22 | 2.29 | 6.62 | 2.45 | 2.04 | 1.49 |
| PW | Harp seal | 1.66 | 0.16 | 0.06 | 0 | 0.02 | 0 | 0 | 0 | 11.10 | 3.93 | 3.26 | 2.42 | 7.02 | 2.47 | 2.13 | 1.42 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-33. Pre-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, 4 per day, winter): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 14.19 | 4.25 | 3.53 | 2.56 | 0.04 | <0.01 | <0.01 | 0 | 12.69 | 4.22 | 3.52 | 2.52 | 12.59 | 4.24 | 3.46 | 2.51 |
| LF | Minke whale (migrating) | 6.81 | 1.78 | 1.25 | 0.65 | 0.02 | <0.01 | <0.01 | 0 | 10.86 | 3.86 | 3.23 | 2.35 | 90.23 | 43.29 | 29.14 | 19.27 |
| LF | Humpback whale | 10.89 | 3.28 | 2.55 | 1.53 | 0.02 | 0 | 0 | 0 | 11.90 | 4.03 | 3.40 | 2.42 | 11.95 | 4.03 | 3.39 | 2.35 |
| LF | North Atlantic right whale [c] | 8.68 | 2.40 | 1.72 | 1.11 | 0.06 | <0.01 | <0.01 | 0 | 11.81 | 3.90 | 3.34 | 2.31 | 11.91 | 3.91 | 3.28 | 2.25 |
| LF | Sei whale [c] (migrating) | 9.89 | 2.91 | 2.32 | 1.46 | 0.04 | <0.01 | <0.01 | 0 | 12.37 | 4.13 | 3.35 | 2.40 | 96.55 | 47.00 | 31.62 | 20.68 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10.95 | 3.91 | 3.12 | 2.29 | 4.26 | 1.50 | 1.23 | 0.83 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.91 | 4.05 | 3.60 | 2.24 | 4.15 | 1.48 | 1.14 | 0.69 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.43 | 3.93 | 3.21 | 2.34 | 4.24 | 1.51 | 1.25 | 0.87 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 8.29 | 3.17 | 2.67 | 1.91 | 3.80 | 1.38 | 1.10 | 0.76 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 11.95 | 3.96 | 3.26 | 2.38 | 4.38 | 1.51 | 1.17 | 0.81 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 11.04 | 3.90 | 3.23 | 2.24 | 4.25 | 1.47 | 1.18 | 0.82 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.30 | 3.94 | 3.25 | 2.26 | 4.19 | 1.50 | 1.20 | 0.80 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.66 | 3.94 | 3.37 | 2.36 | 4.35 | 1.56 | 1.22 | 0.76 |
| HF | Harbor porpoise (sensitive) | 0.35 | 0 | 0 | 0 | 0.33 | 0.04 | 0.05 | 0.03 | 11.52 | 3.95 | 3.17 | 2.35 | 104.65 | 100.90 | 101.68 | 82.91 |
| PW | Gray seal | 2.47 | 0.46 | 0.46 | 0.28 | <0.01 | 0 | 0 | 0 | 12.92 | 4.45 | 3.71 | 2.65 | 7.93 | 2.83 | 2.26 | 1.59 |
| PW | Harbor seal | 1.22 | 0.10 | 0.10 | 0 | 0.06 | 0 | 0 | 0 | 11.69 | 3.93 | 3.25 | 2.43 | 7.07 | 2.61 | 2.06 | 1.53 |
| PW | Harp seal | 1.07 | 0.12 | 0 | 0 | 0.07 | 0 | 0 | 0 | 12.18 | 4.05 | 3.41 | 2.39 | 7.42 | 2.66 | 2.15 | 1.40 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-34.Pre-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, 8 per day, winter): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 18.48 | 5.41 | 4.34 | 3.14 | 0.04 | <0.01 | <0.01 | 0 | 12.71 | 4.24 | 3.60 | 2.53 | 12.62 | 4.24 | 3.47 | 2.55 |
| LF | Minke whale (migrating) | 9.56 | 2.59 | 2.05 | 1.35 | 0.02 | <0.01 | <0.01 | 0 | 11.37 | 3.92 | 3.23 | 2.32 | 92.02 | 44.75 | 30.49 | 19.88 |
| LF | Humpback whale | 15.30 | 4.58 | 3.60 | 2.43 | 0 | 0 | 0 | 0 | 12.46 | 3.99 | 3.40 | 2.48 | 12.46 | 4.01 | 3.34 | 2.45 |
| LF | North Atlantic right whale [c] | 12.29 | 3.50 | 2.60 | 1.77 | 0.03 | 0 | 0 | 0 | 12.20 | 3.95 | 3.32 | 2.32 | 12.30 | 3.96 | 3.27 | 2.31 |
| LF | Sei whale [c] (migrating) | 13.29 | 4.12 | 3.15 | 2.16 | 0.04 | <0.01 | <0.01 | 0 | 12.65 | 4.12 | 3.36 | 2.38 | 98.09 | 48.45 | 32.85 | 21.36 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 11.43 | 3.83 | 3.18 | 2.32 | 4.23 | 1.52 | 1.21 | 0.84 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.33 | 4.06 | 3.45 | 2.29 | 4.21 | 1.47 | 1.04 | 0.68 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 11.06 | 3.91 | 3.31 | 2.35 | 4.25 | 1.54 | 1.19 | 0.84 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 8.55 | 3.32 | 2.78 | 1.99 | 3.85 | 1.42 | 1.09 | 0.75 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 12.42 | 4.00 | 3.24 | 2.31 | 4.30 | 1.49 | 1.15 | 0.80 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 11.40 | 3.93 | 3.21 | 2.28 | 4.17 | 1.41 | 1.19 | 0.82 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.49 | 3.91 | 3.15 | 2.27 | 4.26 | 1.43 | 1.15 | 0.78 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.30 | 3.93 | 3.27 | 2.39 | 4.27 | 1.53 | 1.14 | 0.84 |
| HF | Harbor porpoise (sensitive) | 0.62 | 0 | 0 | 0 | 0.36 | 0.08 | 0.06 | 0.01 | 11.85 | 3.93 | 3.25 | 2.33 | 104.32 | 101.27 | 101.92 | 84.67 |
| PW | Gray seal | 2.64 | 0.69 | 0.49 | 0.26 | 0 | 0 | 0 | 0 | 12.99 | 4.45 | 3.74 | 2.65 | 7.88 | 2.84 | 2.38 | 1.68 |
| PW | Harbor seal | 2.03 | 0.26 | 0.11 | 0.01 | 0.02 | <0.01 | <0.01 | <0.01 | 11.99 | 4.03 | 3.38 | 2.37 | 7.29 | 2.53 | 2.06 | 1.51 |
| PW | Harp seal | 1.73 | 0.18 | 0.06 | 0 | 0.02 | 0 | 0 | 0 | 12.56 | 4.06 | 3.46 | 2.42 | 7.36 | 2.57 | 2.20 | 1.44 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-35. Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, 4 per day, summer): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 12.59 | 4.24 | 3.56 | 2.59 | 0.04 | <0.01 | <0.01 | <0.01 | 13.27 | 4.63 | 4.06 | 2.86 | 13.29 | 4.68 | 4.07 | 2.85 |
| LF | Minke whale (migrating) | 5.94 | 1.88 | 1.37 | 0.67 | 0.02 | <0.01 | <0.01 | <0.01 | 11.36 | 4.24 | 3.50 | 2.61 | 65.42 | 28.18 | 23.25 | 18.41 |
| LF | Humpback whale | 9.12 | 3.23 | 2.55 | 1.53 | 0.03 | 0 | 0 | 0 | 12.41 | 4.46 | 3.85 | 2.70 | 12.62 | 4.47 | 3.87 | 2.72 |
| LF | North Atlantic right whale [c] | 8.09 | 2.56 | 1.78 | 1.24 | 0.05 | <0.01 | <0.01 | 0 | 12.49 | 4.28 | 3.70 | 2.67 | 12.63 | 4.29 | 3.68 | 2.62 |
| LF | Sei whale [c] (migrating) | 9.08 | 2.88 | 2.42 | 1.62 | 0.05 | <0.01 | <0.01 | 0 | 12.83 | 4.74 | 3.82 | 2.66 | 87.17 | 33.84 | 27.00 | 20.45 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.48 | 4.24 | 3.60 | 2.60 | 4.57 | 1.66 | 1.34 | 0.94 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.81 | 4.84 | 3.92 | 2.63 | 4.99 | 1.66 | 1.32 | 0.79 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.97 | 4.25 | 3.56 | 2.64 | 4.67 | 1.71 | 1.40 | 0.95 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 8.30 | 3.51 | 2.93 | 2.19 | 3.99 | 1.56 | 1.24 | 0.88 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 12.79 | 4.46 | 3.71 | 2.64 | 4.96 | 1.66 | 1.35 | 0.90 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 11.62 | 4.25 | 3.58 | 2.57 | 4.65 | 1.69 | 1.33 | 0.96 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.00 | 4.32 | 3.59 | 2.59 | 4.64 | 1.62 | 1.38 | 0.93 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.53 | 4.36 | 3.71 | 2.68 | 4.78 | 1.65 | 1.35 | 0.95 |
| HF | Harbor porpoise (sensitive) | 0.33 | 0 | 0 | 0 | 0.38 | 0.10 | 0.04 | 0.03 | 11.72 | 4.17 | 3.52 | 2.61 | 92.28 | 81.68 | 74.45 | 56.94 |
| PW | Gray seal | 2.58 | 0.46 | 0.46 | 0.28 | <0.01 | 0 | 0 | 0 | 13.63 | 5.08 | 4.24 | 3.08 | 8.91 | 3.19 | 2.53 | 1.87 |
| PW | Harbor seal | 1.47 | 0.13 | 0.10 | 0 | 0.06 | 0 | 0 | 0 | 12.26 | 4.36 | 3.77 | 2.70 | 8.04 | 2.96 | 2.28 | 1.67 |
| PW | Harp seal | 1.15 | 0.16 | 0.03 | 0 | 0.07 | 0 | 0 | 0 | 12.85 | 4.54 | 3.76 | 2.81 | 8.63 | 2.92 | 2.41 | 1.72 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-36. Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, 8 per day, summer): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 15.11 | 5.45 | 4.35 | 3.23 | 0.04 | <0.01 | <0.01 | <0.01 | 13.29 | 4.75 | 4.07 | 2.92 | 13.32 | 4.75 | 4.07 | 2.92 |
| LF | Minke whale (migrating) | 7.49 | 2.60 | 2.09 | 1.46 | 0.03 | <0.01 | <0.01 | 0 | 11.73 | 4.32 | 3.62 | 2.64 | 67.45 | 28.86 | 23.77 | 18.78 |
| LF | Humpback whale | 11.05 | 4.23 | 3.56 | 2.45 | 0.03 | 0 | 0 | 0 | 12.79 | 4.68 | 3.82 | 2.77 | 12.88 | 4.69 | 3.81 | 2.80 |
| LF | North Atlantic right whale [c] | 10.33 | 3.50 | 2.63 | 1.80 | 0.03 | 0 | 0 | 0 | 12.59 | 4.56 | 3.70 | 2.62 | 12.69 | 4.57 | 3.69 | 2.62 |
| LF | Sei whale [c] (migrating) | 10.93 | 4.10 | 3.17 | 2.19 | 0.05 | <0.01 | <0.01 | 0 | 13.16 | 4.65 | 3.82 | 2.66 | 90.50 | 34.59 | 27.95 | 20.85 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 12.02 | 4.39 | 3.57 | 2.63 | 4.71 | 1.71 | 1.31 | 0.94 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.93 | 4.95 | 3.76 | 2.63 | 5.12 | 1.61 | 1.30 | 0.79 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 11.66 | 4.34 | 3.67 | 2.69 | 4.69 | 1.70 | 1.38 | 0.92 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 8.59 | 3.63 | 2.98 | 2.31 | 4.08 | 1.64 | 1.26 | 0.81 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 12.94 | 4.51 | 3.76 | 2.65 | 4.92 | 1.71 | 1.27 | 0.87 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 12.08 | 4.25 | 3.60 | 2.59 | 4.65 | 1.67 | 1.32 | 0.97 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.25 | 4.33 | 3.60 | 2.58 | 4.62 | 1.66 | 1.33 | 0.89 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.94 | 4.57 | 3.72 | 2.81 | 4.88 | 1.71 | 1.23 | 0.93 |
| HF | Harbor porpoise (sensitive) | 0.71 | 0 | 0 | 0 | 0.38 | 0.08 | 0.06 | 0.01 | 12.15 | 4.34 | 3.73 | 2.69 | 94.32 | 83.10 | 75.47 | 57.95 |
| PW | Gray seal | 2.69 | 0.69 | 0.49 | 0.26 | 0 | 0 | 0 | 0 | 13.72 | 4.99 | 4.28 | 3.07 | 9.01 | 3.12 | 2.60 | 1.74 |
| PW | Harbor seal | 2.11 | 0.28 | 0.20 | 0.01 | 0.01 | <0.01 | <0.01 | <0.01 | 12.53 | 4.47 | 3.82 | 2.65 | 8.31 | 2.97 | 2.37 | 1.66 |
| PW | Harp seal | 1.96 | 0.22 | 0.11 | <0.01 | 0.07 | 0 | 0 | 0 | 13.08 | 4.61 | 3.85 | 2.87 | 8.80 | 3.04 | 2.39 | 1.69 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-37. Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, 4 per day, winter): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 16.13 | 4.81 | 4.08 | 2.81 | 0.05 | <0.01 | <0.01 | <0.01 | 15.41 | 4.86 | 4.08 | 2.93 | 15.41 | 4.86 | 4.08 | 2.89 |
| LF | Minke whale (migrating) | 7.95 | 2.16 | 1.64 | 0.88 | 0.02 | <0.01 | <0.01 | <0.01 | 13.23 | 4.49 | 3.80 | 2.75 | 100.38 | 54.97 | 42.19 | 24.22 |
| LF | Humpback whale | 13.08 | 3.82 | 2.89 | 1.99 | 0.04 | 0 | 0 | 0 | 14.75 | 4.75 | 3.99 | 2.80 | 14.89 | 4.71 | 3.99 | 2.80 |
| LF | North Atlantic right whale [c] | 10.37 | 2.85 | 2.06 | 1.34 | 0.06 | <0.01 | <0.01 | 0 | 14.19 | 4.63 | 3.81 | 2.76 | 14.23 | 4.63 | 3.82 | 2.73 |
| LF | Sei whale [c] (migrating) | 11.82 | 3.26 | 2.66 | 1.73 | 0.05 | <0.01 | <0.01 | 0 | 14.79 | 4.88 | 3.94 | 2.78 | 105.53 | 72.72 | 46.54 | 26.72 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13.11 | 4.56 | 3.78 | 2.74 | 5.11 | 1.74 | 1.39 | 0.95 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14.27 | 5.02 | 3.92 | 2.62 | 5.52 | 1.68 | 1.34 | 0.83 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 12.62 | 4.62 | 3.79 | 2.75 | 5.13 | 1.81 | 1.44 | 0.98 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.69 | 3.70 | 3.03 | 2.29 | 4.35 | 1.66 | 1.27 | 0.88 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 14.44 | 4.78 | 3.86 | 2.78 | 5.31 | 1.81 | 1.41 | 0.90 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 13.47 | 4.55 | 3.70 | 2.67 | 5.07 | 1.73 | 1.37 | 0.97 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13.58 | 4.55 | 3.70 | 2.77 | 5.08 | 1.73 | 1.43 | 0.96 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14.48 | 4.74 | 3.84 | 2.86 | 5.34 | 1.78 | 1.43 | 0.96 |
| HF | Harbor porpoise (sensitive) | 0.34 | 0 | 0 | 0 | 0.39 | 0.10 | 0.04 | 0.04 | 13.78 | 4.56 | 3.81 | 2.76 | 105.71 | 102.14 | 100.85 | 102.32 |
| PW | Gray seal | 2.79 | 0.46 | 0.46 | 0.28 | <0.01 | 0 | 0 | 0 | 16.00 | 5.31 | 4.34 | 3.15 | 9.74 | 3.35 | 2.60 | 1.94 |
| PW | Harbor seal | 1.63 | 0.13 | 0.10 | 0 | 0.06 | 0 | 0 | 0 | 14.37 | 4.70 | 3.90 | 2.87 | 8.91 | 3.10 | 2.47 | 1.71 |
| PW | Harp seal | 1.45 | 0.16 | 0.03 | 0 | 0.07 | 0 | 0 | 0 | 14.76 | 4.86 | 3.90 | 2.86 | 9.27 | 3.20 | 2.59 | 1.78 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-38. Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, 8 per day, winter): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 22.59 | 6.19 | 4.82 | 3.64 | 0.04 | <0.01 | <0.01 | <0.01 | 15.62 | 4.90 | 4.14 | 2.97 | 15.59 | 4.90 | 4.16 | 2.96 |
| LF | Minke whale (migrating) | 11.46 | 2.97 | 2.33 | 1.67 | 0.03 | <0.01 | <0.01 | 0 | 13.86 | 4.58 | 3.82 | 2.74 | 99.94 | 57.87 | 43.95 | 24.97 |
| LF | Humpback whale | 19.21 | 5.09 | 3.95 | 2.67 | 0 | 0 | 0 | 0 | 15.32 | 4.82 | 3.97 | 2.96 | 15.33 | 4.88 | 3.97 | 2.96 |
| LF | North Atlantic right whale [c] | 14.93 | 3.96 | 3.25 | 2.11 | 0.03 | 0 | 0 | 0 | 14.94 | 4.84 | 3.84 | 2.69 | 15.05 | 4.75 | 3.89 | 2.67 |
| LF | Sei whale [c] (migrating) | 15.98 | 4.53 | 3.57 | 2.59 | 0.05 | <0.01 | <0.01 | 0 | 15.11 | 4.83 | 3.90 | 2.81 | 104.84 | 75.68 | 48.22 | 27.74 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 13.82 | 4.64 | 3.75 | 2.78 | 5.11 | 1.77 | 1.36 | 0.97 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15.03 | 5.12 | 3.79 | 2.69 | 5.44 | 1.68 | 1.36 | 0.80 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 13.32 | 4.58 | 3.81 | 2.77 | 5.18 | 1.75 | 1.42 | 0.94 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.98 | 3.81 | 3.14 | 2.40 | 4.42 | 1.67 | 1.30 | 0.85 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 14.73 | 4.74 | 3.87 | 2.77 | 5.28 | 1.73 | 1.34 | 0.91 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 14.03 | 4.57 | 3.84 | 2.73 | 5.05 | 1.70 | 1.32 | 0.99 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14.21 | 4.59 | 3.77 | 2.70 | 5.07 | 1.74 | 1.40 | 0.91 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14.98 | 4.89 | 3.89 | 2.91 | 5.29 | 1.76 | 1.30 | 0.97 |
| HF | Harbor porpoise (sensitive) | 0.72 | 0 | 0 | 0 | 0.38 | 0.08 | 0.08 | 0.01 | 14.43 | 4.67 | 3.88 | 2.80 | 105.27 | 102.39 | 101.21 | 102.37 |
| PW | Gray seal | 2.96 | 0.69 | 0.49 | 0.26 | 0 | 0 | 0 | 0 | 16.32 | 5.21 | 4.36 | 3.10 | 9.79 | 3.38 | 2.65 | 1.96 |
| PW | Harbor seal | 2.34 | 0.28 | 0.27 | 0.01 | 0.01 | <0.01 | <0.01 | <0.01 | 14.79 | 4.78 | 3.90 | 2.88 | 9.00 | 3.21 | 2.45 | 1.69 |
| PW | Harp seal | 2.19 | 0.25 | 0.17 | <0.01 | 0.07 | 0 | 0 | 0 | 15.36 | 4.90 | 3.90 | 2.98 | 9.21 | 3.18 | 2.48 | 1.73 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-39. Post-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, 4 per day, summer): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 13.67 | 4.80 | 4.08 | 2.87 | 0.04 | <0.01 | <0.01 | <0.01 | 13.41 | 4.68 | 4.09 | 2.90 | 13.41 | 4.76 | 4.09 | 2.90 |
| LF | Minke whale (migrating) | 6.43 | 2.12 | 1.59 | 0.93 | 0.03 | <0.01 | <0.01 | <0.01 | 11.76 | 4.32 | 3.63 | 2.71 | 65.67 | 28.44 | 23.50 | 18.61 |
| LF | Humpback whale | 9.87 | 3.63 | 2.89 | 2.07 | 0.03 | 0 | 0 | 0 | 12.56 | 4.55 | 3.89 | 2.84 | 12.68 | 4.57 | 3.92 | 2.87 |
| LF | North Atlantic right whale [c] | 8.53 | 2.80 | 2.16 | 1.40 | 0.05 | <0.01 | <0.01 | 0 | 12.54 | 4.48 | 3.78 | 2.81 | 12.73 | 4.48 | 3.77 | 2.72 |
| LF | Sei whale [c] (migrating) | 9.61 | 3.26 | 2.67 | 1.66 | 0.05 | <0.01 | <0.01 | <0.01 | 12.99 | 4.82 | 3.96 | 2.76 | 87.25 | 33.84 | 27.05 | 20.69 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11.74 | 4.39 | 3.72 | 2.73 | 4.75 | 1.82 | 1.47 | 1.04 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13.11 | 5.01 | 4.04 | 3.23 | 5.09 | 1.82 | 1.49 | 0.97 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 11.28 | 4.38 | 3.74 | 2.78 | 4.77 | 1.86 | 1.49 | 1.00 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 8.34 | 3.58 | 3.02 | 2.33 | 4.23 | 1.77 | 1.38 | 0.96 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 12.84 | 4.64 | 3.83 | 2.73 | 5.02 | 1.81 | 1.48 | 1.05 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 11.92 | 4.39 | 3.66 | 2.70 | 4.76 | 1.78 | 1.44 | 1.02 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.31 | 4.42 | 3.74 | 2.79 | 4.74 | 1.78 | 1.48 | 1.01 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.82 | 4.53 | 3.78 | 2.87 | 4.90 | 1.83 | 1.46 | 1.00 |
| HF | Harbor porpoise (sensitive) | 0.41 | 0 | 0 | 0 | 0.42 | 0.12 | 0.04 | 0.03 | 12.05 | 4.37 | 3.67 | 2.74 | 92.74 | 82.11 | 74.56 | 57.20 |
| PW | Gray seal | 2.83 | 0.81 | 0.46 | 0.39 | <0.01 | 0 | 0 | 0 | 13.66 | 5.09 | 4.23 | 3.14 | 8.87 | 3.33 | 2.76 | 1.93 |
| PW | Harbor seal | 1.94 | 0.17 | 0.10 | 0 | 0.06 | <0.01 | 0 | 0 | 12.34 | 4.43 | 3.85 | 2.90 | 8.06 | 3.03 | 2.47 | 1.74 |
| PW | Harp seal | 1.57 | 0.15 | 0.03 | 0 | 0.07 | 0 | 0 | 0 | 12.99 | 4.58 | 3.90 | 2.95 | 8.79 | 3.11 | 2.51 | 1.83 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-40. Post-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, 8 per day, summer): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 16.07 | 5.93 | 4.70 | 3.65 | 0.05 | <0.01 | <0.01 | <0.01 | 13.49 | 4.92 | 4.15 | 2.97 | 13.53 | 4.87 | 4.17 | 2.97 |
| LF | Minke whale (migrating) | 8.16 | 2.83 | 2.33 | 1.60 | 0.05 | <0.01 | <0.01 | <0.01 | 11.96 | 4.42 | 3.69 | 2.75 | 67.64 | 29.01 | 23.98 | 18.94 |
| LF | Humpback whale | 11.96 | 4.87 | 3.82 | 2.66 | 0.05 | 0 | 0 | 0 | 12.97 | 4.74 | 3.88 | 2.85 | 13.01 | 4.74 | 3.89 | 2.85 |
| LF | North Atlantic right whale [c] | 11.10 | 3.82 | 3.16 | 2.10 | 0.05 | 0 | 0 | 0 | 12.74 | 4.65 | 3.81 | 2.82 | 12.92 | 4.65 | 3.81 | 2.80 |
| LF | Sei whale [c] (migrating) | 11.82 | 4.47 | 3.55 | 2.59 | 0.05 | <0.01 | <0.01 | 0 | 13.30 | 4.72 | 3.95 | 2.81 | 90.61 | 34.61 | 27.96 | 20.88 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 12.24 | 4.45 | 3.74 | 2.74 | 4.84 | 1.83 | 1.47 | 1.04 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13.25 | 5.09 | 3.99 | 3.13 | 5.22 | 1.86 | 1.48 | 0.94 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 11.89 | 4.52 | 3.77 | 2.78 | 4.82 | 1.89 | 1.51 | 1.04 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 8.67 | 3.76 | 3.13 | 2.41 | 4.26 | 1.72 | 1.42 | 0.95 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 13.04 | 4.62 | 3.83 | 2.79 | 5.00 | 1.86 | 1.45 | 0.97 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 12.23 | 4.44 | 3.78 | 2.75 | 4.74 | 1.79 | 1.41 | 1.06 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.39 | 4.51 | 3.80 | 2.72 | 4.74 | 1.82 | 1.43 | 0.99 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13.11 | 4.72 | 3.80 | 2.90 | 4.89 | 1.94 | 1.49 | 1.01 |
| HF | Harbor porpoise (sensitive) | 0.75 | 0 | 0 | 0 | 0.40 | 0.10 | 0.06 | 0.06 | 12.30 | 4.41 | 3.79 | 2.81 | 94.61 | 83.27 | 75.41 | 57.94 |
| PW | Gray seal | 2.98 | 0.85 | 0.69 | 0.26 | 0 | 0 | 0 | 0 | 13.72 | 4.99 | 4.31 | 3.16 | 9.03 | 3.36 | 2.80 | 2.10 |
| PW | Harbor seal | 2.35 | 0.43 | 0.26 | 0.11 | 0.04 | <0.01 | <0.01 | <0.01 | 12.71 | 4.57 | 3.89 | 2.86 | 8.42 | 3.01 | 2.45 | 1.83 |
| PW | Harp seal | 2.27 | 0.28 | 0.16 | <0.01 | 0.07 | 0 | 0 | 0 | 13.17 | 4.72 | 3.93 | 2.97 | 8.88 | 3.15 | 2.47 | 1.80 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-41. Post-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, 4 per day, winter): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 17.58 | 5.35 | 4.25 | 3.15 | 0.04 | <0.01 | <0.01 | <0.01 | 15.51 | 4.90 | 4.22 | 3.00 | 15.51 | 4.90 | 4.24 | 3.00 |
| LF | Minke whale (migrating) | 8.39 | 2.29 | 1.78 | 1.06 | 0.03 | <0.01 | <0.01 | <0.01 | 13.60 | 4.60 | 3.86 | 2.87 | 100.65 | 55.26 | 43.29 | 24.62 |
| LF | Humpback whale | 14.26 | 3.99 | 3.28 | 2.25 | 0.04 | 0 | 0 | 0 | 15.15 | 4.94 | 4.03 | 2.89 | 15.30 | 4.94 | 4.03 | 2.90 |
| LF | North Atlantic right whale [c] | 11.60 | 3.26 | 2.40 | 1.46 | 0.05 | <0.01 | <0.01 | 0 | 14.51 | 4.80 | 3.90 | 2.86 | 14.60 | 4.77 | 3.91 | 2.86 |
| LF | Sei whale [c] (migrating) | 12.86 | 3.78 | 2.91 | 1.91 | 0.05 | <0.01 | <0.01 | <0.01 | 14.99 | 4.96 | 4.13 | 2.91 | 105.68 | 74.37 | 47.00 | 27.12 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13.53 | 4.66 | 3.91 | 2.87 | 5.20 | 1.87 | 1.50 | 1.07 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14.73 | 5.21 | 4.05 | 3.28 | 5.56 | 1.76 | 1.48 | 1.02 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 13.08 | 4.66 | 3.93 | 2.90 | 5.23 | 1.92 | 1.51 | 1.03 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.63 | 3.80 | 3.17 | 2.51 | 4.50 | 1.77 | 1.38 | 0.97 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 14.88 | 4.91 | 3.96 | 2.85 | 5.33 | 1.83 | 1.51 | 1.06 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 13.95 | 4.70 | 3.90 | 2.78 | 5.26 | 1.82 | 1.47 | 1.04 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13.94 | 4.65 | 3.94 | 2.93 | 5.14 | 1.84 | 1.50 | 1.05 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14.73 | 4.87 | 3.94 | 2.92 | 5.38 | 1.92 | 1.56 | 1.05 |
| HF | Harbor porpoise (sensitive) | 0.44 | 0 | 0 | 0 | 0.42 | 0.13 | 0.04 | 0.05 | 14.12 | 4.83 | 3.95 | 2.88 | 106.09 | 102.66 | 100.90 | 102.34 |
| PW | Gray seal | 3.09 | 0.81 | 0.46 | 0.39 | <0.01 | 0 | 0 | 0 | 16.03 | 5.37 | 4.45 | 3.29 | 9.79 | 3.37 | 2.83 | 2.02 |
| PW | Harbor seal | 2.04 | 0.17 | 0.10 | 0.10 | 0.06 | <0.01 | 0 | 0 | 14.66 | 4.70 | 3.93 | 2.94 | 8.96 | 3.18 | 2.61 | 1.77 |
| PW | Harp seal | 1.76 | 0.15 | 0.12 | 0 | 0.07 | 0 | 0 | 0 | 14.96 | 4.90 | 4.05 | 3.06 | 9.37 | 3.33 | 2.66 | 1.86 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

Table H-42. Post-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, 8 per day, winter): Exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{PK}$ (0 dB) | Injury $L_{PK}$ (10 dB) | Injury $L_{PK}$ (12 dB) | Injury $L_{PK}$ (15 dB) | Behavior $L_p$ [a] (0 dB) | Behavior $L_p$ [a] (10 dB) | Behavior $L_p$ [a] (12 dB) | Behavior $L_p$ [a] (15 dB) | Behavior $L_p$ [b] (0 dB) | Behavior $L_p$ [b] (10 dB) | Behavior $L_p$ [b] (12 dB) | Behavior $L_p$ [b] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 24.43 | 6.88 | 5.41 | 4.04 | 0.05 | <0.01 | <0.01 | <0.01 | 15.70 | 5.07 | 4.24 | 3.12 | 15.76 | 5.10 | 4.24 | 3.12 |
| LF | Minke whale (migrating) | 12.56 | 3.34 | 2.59 | 1.71 | 0.05 | <0.01 | <0.01 | <0.01 | 14.20 | 4.70 | 3.92 | 2.84 | 100.06 | 58.23 | 44.75 | 25.51 |
| LF | Humpback whale | 21.10 | 5.61 | 4.58 | 3.12 | 0.05 | 0 | 0 | 0 | 15.43 | 4.96 | 3.99 | 2.97 | 15.45 | 4.98 | 4.01 | 2.97 |
| LF | North Atlantic right whale [c] | 16.29 | 4.49 | 3.50 | 2.27 | 0.05 | 0 | 0 | 0 | 15.18 | 4.92 | 3.95 | 2.89 | 15.27 | 4.89 | 3.96 | 2.88 |
| LF | Sei whale [c] (migrating) | 18.04 | 4.79 | 4.12 | 2.66 | 0.05 | <0.01 | <0.01 | 0 | 15.23 | 4.93 | 4.12 | 3.01 | 105.01 | 77.71 | 48.45 | 27.94 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 14.22 | 4.74 | 3.83 | 2.82 | 5.25 | 1.84 | 1.52 | 1.06 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15.44 | 5.28 | 4.06 | 3.16 | 5.53 | 1.86 | 1.47 | 0.94 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 13.78 | 4.78 | 3.91 | 2.88 | 5.26 | 1.89 | 1.54 | 1.05 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 10.98 | 4.01 | 3.32 | 2.51 | 4.57 | 1.74 | 1.42 | 0.95 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 15.15 | 4.87 | 4.00 | 2.89 | 5.36 | 1.85 | 1.49 | 0.98 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 14.37 | 4.68 | 3.93 | 2.87 | 5.16 | 1.79 | 1.41 | 1.05 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14.60 | 4.66 | 3.91 | 2.83 | 5.16 | 1.87 | 1.43 | 1.03 |
| MF | Sperm whale [c] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15.15 | 4.89 | 3.93 | 3.02 | 5.31 | 1.92 | 1.53 | 1.03 |
| HF | Harbor porpoise (sensitive) | 0.75 | 0 | 0 | 0 | 0.39 | 0.11 | 0.08 | 0.06 | 14.76 | 4.77 | 3.93 | 2.93 | 105.47 | 102.75 | 101.27 | 102.48 |
| PW | Gray seal | 3.41 | 0.93 | 0.69 | 0.40 | 0 | 0 | 0 | 0 | 16.35 | 5.22 | 4.45 | 3.27 | 9.87 | 3.44 | 2.84 | 2.12 |
| PW | Harbor seal | 2.63 | 0.44 | 0.26 | 0.11 | 0.04 | <0.01 | <0.01 | <0.01 | 14.92 | 4.80 | 4.03 | 2.93 | 9.11 | 3.25 | 2.53 | 1.90 |
| PW | Harp seal | 2.40 | 0.28 | 0.18 | 0.03 | 0.07 | 0 | 0 | 0 | 15.52 | 5.08 | 4.06 | 3.07 | 9.36 | 3.26 | 2.57 | 1.82 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA.

### H.2.2.2. Sea Turtles

This section contains sea turtle exposure ranges for each of the modeled foundation types and seasons assuming 0, 10, 12, and 15 dB broadband attenuation.

Table H-43. Monopile foundation (14 m diameter, typical, 5500 kJ hammer, one per day, summer): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.55 | 0.09 | 0 | 0 | 0 | 0 | 0 | 0 | 3.31 | 1.18 | 1.06 | 0.61 |
| Leatherback turtle [a] | 2.51 | 0.46 | 0.33 | 0 | 0 | 0 | 0 | 0 | 3.86 | 1.42 | 1.09 | 0.46 |
| Loggerhead turtle | 0.63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.02 | 1.01 | 0.83 | 0.47 |
| Green turtle | 2.00 | 0.23 | 0.19 | 0 | 0 | 0 | 0 | 0 | 3.56 | 1.31 | 1.00 | 0.57 |

[a] Listed as Endangered under the ESA.

Table H-44. Monopile foundation (14 m diameter, typical, 5500 kJ hammer, two per day, summer): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.70 | 0.07 | 0.07 | 0 | 0 | 0 | 0 | 0 | 3.55 | 1.34 | 1.02 | 0.72 |
| Leatherback turtle [a] | 2.61 | 0.45 | 0.38 | 0.20 | 0 | 0 | 0 | 0 | 3.97 | 1.57 | 1.21 | 0.68 |
| Loggerhead turtle | 0.86 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.29 | 0.94 | 0.72 | 0.39 |
| Green turtle | 2.14 | 0.25 | 0.17 | <0.01 | 0 | 0 | 0 | 0 | 3.61 | 1.29 | 1.07 | 0.66 |

[a] Listed as Endangered under the ESA.

Table H-45. Monopile foundation (14 m diameter, typical, 5500 kJ hammer, one per day, winter): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.76 | 0.09 | 0 | 0 | 0 | 0 | 0 | 0 | 3.66 | 1.46 | 1.04 | 0.62 |
| Leatherback turtle [a] | 2.54 | 0.46 | 0.44 | 0 | 0 | 0 | 0 | 0 | 4.07 | 1.57 | 1.25 | 0.46 |
| Loggerhead turtle | 0.63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.23 | 1.07 | 0.86 | 0.63 |
| Green turtle | 2.02 | 0.23 | 0.19 | 0 | 0 | 0 | 0 | 0 | 3.61 | 1.30 | 0.99 | 0.68 |

[a] Listed as Endangered under the ESA.

Table H-46. Monopile foundation (14 m diameter, typical, 5500 kJ hammer, two per day, winter): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.72 | 0.07 | 0.07 | 0 | 0 | 0 | 0 | 0 | 3.67 | 1.40 | 1.02 | 0.71 |
| Leatherback turtle [a] | 2.85 | 0.55 | 0.38 | 0.28 | 0 | 0 | 0 | 0 | 4.09 | 1.62 | 1.21 | 0.71 |
| Loggerhead turtle | 0.87 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.33 | 1.21 | 0.86 | 0.56 |
| Green turtle | 2.28 | 0.30 | 0.17 | <0.01 | 0 | 0 | 0 | 0 | 3.78 | 1.35 | 1.12 | 0.76 |

[a] Listed as Endangered under the ESA.

Table H-47. Monopile foundation (14 m diameter, difficult to drive, 6600 kJ hammer, one per day, summer): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.19 | 0.12 | 0.09 | 0 | <0.01 | 0 | 0 | 0 | 4.26 | 1.55 | 1.18 | 1.03 |
| Leatherback turtle [a] | 3.23 | 0.75 | 0.46 | 0.30 | 0 | 0 | 0 | 0 | 4.64 | 1.75 | 1.42 | 1.10 |
| Loggerhead turtle | 0.97 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 3.58 | 1.35 | 1.06 | 0.67 |
| Green turtle | 2.87 | 0.45 | 0.22 | 0 | 0 | 0 | 0 | 0 | 3.92 | 1.51 | 1.39 | 0.81 |

[a] Listed as Endangered under the ESA.

Table H-48. Monopile foundation (14 m diameter, difficult to drive, 6600 kJ hammer, two per day, summer): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.19 | 0.30 | 0.06 | 0.01 | 0 | 0 | 0 | 0 | 4.12 | 1.68 | 1.40 | 0.90 |
| Leatherback turtle [a] | 3.54 | 0.83 | 0.63 | 0.34 | 0 | 0 | 0 | 0 | 4.65 | 1.85 | 1.57 | 1.02 |
| Loggerhead turtle | 1.27 | 0.09 | 0 | 0 | 0 | 0 | 0 | 0 | 3.73 | 1.47 | 0.89 | 0.66 |
| Green turtle | 2.90 | 0.55 | 0.30 | 0.09 | <0.01 | 0 | 0 | 0 | 4.24 | 1.62 | 1.34 | 0.94 |

[a] Listed as Endangered under the ESA.

Table H-49. Monopile foundation (14 m diameter, difficult to drive, 6600 kJ hammer, one per day, winter): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.31 | 0.27 | 0.09 | 0 | <0.01 | 0 | 0 | 0 | 4.37 | 1.60 | 1.49 | 1.03 |
| Leatherback turtle [a] | 3.21 | 0.75 | 0.64 | 0.44 | 0 | 0 | 0 | 0 | 4.99 | 1.84 | 1.57 | 1.10 |
| Loggerhead turtle | 1.79 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 3.80 | 1.30 | 1.15 | 0.66 |
| Green turtle | 2.99 | 0.47 | 0.22 | 0 | 0 | 0 | 0 | 0 | 4.46 | 1.58 | 1.48 | 0.92 |

[a] Listed as Endangered under the ESA.

Table H-50. Monopile foundation (14 m diameter, difficult to drive, 6600 kJ hammer, two per day, winter): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.24 | 0.29 | 0.07 | 0.07 | 0 | 0 | 0 | 0 | 4.28 | 1.67 | 1.44 | 0.90 |
| Leatherback turtle [a] | 3.72 | 0.83 | 0.63 | 0.38 | 0 | 0 | 0 | 0 | 4.96 | 1.88 | 1.62 | 1.15 |
| Loggerhead turtle | 1.65 | 0.23 | 0 | 0 | 0 | 0 | 0 | 0 | 4.05 | 1.52 | 1.12 | 0.72 |
| Green turtle | 3.05 | 0.55 | 0.33 | 0.09 | <0.01 | 0 | 0 | 0 | 4.43 | 1.67 | 1.36 | 0.94 |

[a] Listed as Endangered under the ESA.

Table H-51. Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, 4 per day, summer): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.26 | 0.08 | 0 | 0 | 0 | 0 | 0 | 0 | 1.94 | 0.55 | 0.40 | 0.24 |
| Leatherback turtle [a] | 3.40 | 0.94 | 0.73 | 0.34 | 0 | 0 | 0 | 0 | 2.57 | 0.73 | 0.34 | 0.30 |
| Loggerhead turtle | 0.77 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.83 | 0.40 | 0.31 | 0.22 |
| Green turtle | 2.16 | 0.19 | 0.11 | 0 | 0 | 0 | 0 | 0 | 2.28 | 0.52 | 0.40 | 0.22 |

[a] Listed as Endangered under the ESA.

Table H-52. Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, 8 per day, summer): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.92 | 0.22 | 0.11 | 0 | 0 | 0 | 0 | 0 | 2.08 | 0.50 | 0.33 | 0.25 |
| Leatherback turtle [a] | 3.86 | 0.97 | 0.72 | 0.34 | 0 | 0 | 0 | 0 | 2.52 | 0.72 | 0.58 | 0.31 |
| Loggerhead turtle | 0.96 | 0.08 | 0 | 0 | 0 | 0 | 0 | 0 | 1.72 | 0.58 | 0.40 | 0.23 |
| Green turtle | 2.62 | 0.46 | 0.23 | 0.02 | 0 | 0 | 0 | 0 | 2.31 | 0.60 | 0.44 | 0.27 |

[a] Listed as Endangered under the ESA.

Table H-53. Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, 4 per day, winter): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.28 | 0.08 | 0 | 0 | 0 | 0 | 0 | 0 | 2.03 | 0.60 | 0.40 | 0.24 |
| Leatherback turtle [a] | 3.58 | 0.94 | 0.73 | 0.34 | 0 | 0 | 0 | 0 | 2.60 | 0.73 | 0.34 | 0.30 |
| Loggerhead turtle | 0.92 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.94 | 0.40 | 0.34 | 0.22 |
| Green turtle | 2.33 | 0.21 | 0.11 | 0 | 0 | 0 | 0 | 0 | 2.33 | 0.52 | 0.41 | 0.22 |

[a] Listed as Endangered under the ESA.

Table H-54. Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, 8 per day, winter): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.14 | 0.22 | 0.14 | 0 | 0 | 0 | 0 | 0 | 2.17 | 0.54 | 0.33 | 0.25 |
| Leatherback turtle [a] | 4.08 | 0.97 | 0.75 | 0.38 | 0 | 0 | 0 | 0 | 2.61 | 0.79 | 0.58 | 0.31 |
| Loggerhead turtle | 1.17 | 0.17 | 0 | 0 | 0 | 0 | 0 | 0 | 1.84 | 0.55 | 0.40 | 0.23 |
| Green turtle | 2.93 | 0.46 | 0.29 | 0.02 | 0 | 0 | 0 | 0 | 2.39 | 0.62 | 0.47 | 0.27 |

[a] Listed as Endangered under the ESA.

Table H-55. Pre-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, 4 per day, summer): Exposure ranges ($ER95_{\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.36 | 0.22 | 0 | 0 | 0 | 0 | 0 | 0 | 2.11 | 0.62 | 0.45 | 0.29 |
| Leatherback turtle [a] | 3.67 | 1.14 | 0.73 | 0.34 | 0 | 0 | 0 | 0 | 2.64 | 0.73 | 0.34 | 0.34 |
| Loggerhead turtle | 0.92 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.90 | 0.48 | 0.32 | 0.22 |
| Green turtle | 2.41 | 0.23 | 0.15 | 0 | 0 | 0 | 0 | 0 | 2.34 | 0.69 | 0.44 | 0.26 |

[a] Listed as Endangered under the ESA.

Table H-56. Pre-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, 8 per day, summer): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.16 | 0.30 | 0.20 | 0.02 | 0 | 0 | 0 | 0 | 2.20 | 0.58 | 0.42 | 0.26 |
| Leatherback turtle [a] | 4.24 | 1.19 | 0.80 | 0.47 | 0 | 0 | 0 | 0 | 2.69 | 0.75 | 0.58 | 0.33 |
| Loggerhead turtle | 1.20 | 0.23 | 0 | 0 | 0 | 0 | 0 | 0 | 1.97 | 0.59 | 0.40 | 0.26 |
| Green turtle | 3.05 | 0.54 | 0.33 | 0.15 | 0 | 0 | 0 | 0 | 2.42 | 0.67 | 0.46 | 0.30 |

[a] Listed as Endangered under the ESA.

Table H-57. Pre-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, 4 per day, winter): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.80 | 0.22 | 0 | 0 | 0 | 0 | 0 | 0 | 2.20 | 0.64 | 0.47 | 0.25 |
| Leatherback turtle [a] | 3.90 | 1.15 | 0.83 | 0.34 | 0 | 0 | 0 | 0 | 2.70 | 0.73 | 0.34 | 0.34 |
| Loggerhead turtle | 0.93 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.03 | 0.48 | 0.32 | 0.22 |
| Green turtle | 2.43 | 0.26 | 0.17 | 0 | 0 | 0 | 0 | 0 | 2.39 | 0.72 | 0.45 | 0.26 |

[a] Listed as Endangered under the ESA.

Table H-58. Pre-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, 8 per day, winter): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.41 | 0.30 | 0.20 | 0.02 | 0 | 0 | 0 | 0 | 2.24 | 0.67 | 0.42 | 0.26 |
| Leatherback turtle [a] | 4.61 | 1.19 | 0.95 | 0.47 | 0 | 0 | 0 | 0 | 2.75 | 0.79 | 0.58 | 0.33 |
| Loggerhead turtle | 1.44 | 0.23 | 0 | 0 | 0 | 0 | 0 | 0 | 2.05 | 0.59 | 0.40 | 0.25 |
| Green turtle | 3.23 | 0.60 | 0.35 | 0.15 | 0 | 0 | 0 | 0 | 2.47 | 0.69 | 0.47 | 0.28 |

[a] Listed as Endangered under the ESA.

Table H-59. Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, 4 per day, summer): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.87 | 0.18 | 0.08 | 0 | 0 | 0 | 0 | 0 | 2.51 | 0.80 | 0.55 | 0.30 |
| Leatherback turtle [a] | 4.40 | 1.23 | 0.94 | 0.34 | 0 | 0 | 0 | 0 | 3.11 | 1.02 | 0.73 | 0.34 |
| Loggerhead turtle | 0.92 | 0.06 | 0 | 0 | 0 | 0 | 0 | 0 | 2.38 | 0.63 | 0.40 | 0.28 |
| Green turtle | 2.56 | 0.31 | 0.19 | 0.04 | 0 | 0 | 0 | 0 | 2.76 | 0.83 | 0.52 | 0.31 |

[a] Listed as Endangered under the ESA.

Table H-60. Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, 8 per day, summer): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.45 | 0.49 | 0.22 | 0.02 | 0 | 0 | 0 | 0 | 2.49 | 0.77 | 0.50 | 0.30 |
| Leatherback turtle [a] | 4.62 | 1.37 | 0.97 | 0.58 | 0 | 0 | 0 | 0 | 3.21 | 0.99 | 0.72 | 0.32 |
| Loggerhead turtle | 1.34 | 0.21 | 0.08 | 0 | 0 | 0 | 0 | 0 | 2.33 | 0.69 | 0.58 | 0.26 |
| Green turtle | 3.44 | 0.69 | 0.46 | 0.15 | 0 | 0 | 0 | 0 | 2.79 | 0.85 | 0.60 | 0.32 |

[a] Listed as Endangered under the ESA.

Table H-61. Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, 4 per day, winter): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.05 | 0.17 | 0.08 | 0 | 0 | 0 | 0 | 0 | 2.65 | 0.80 | 0.60 | 0.30 |
| Leatherback turtle [a] | 4.70 | 1.27 | 0.94 | 0.63 | 0 | 0 | 0 | 0 | 3.23 | 0.84 | 0.73 | 0.34 |
| Loggerhead turtle | 0.97 | 0.06 | 0 | 0 | 0 | 0 | 0 | 0 | 2.41 | 0.63 | 0.40 | 0.28 |
| Green turtle | 2.86 | 0.31 | 0.21 | 0.04 | 0 | 0 | 0 | 0 | 2.83 | 0.87 | 0.52 | 0.34 |

[a] Listed as Endangered under the ESA.

Table H-62. Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, 8 per day, winter): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.81 | 0.52 | 0.22 | 0.08 | 0 | 0 | 0 | 0 | 2.66 | 0.79 | 0.54 | 0.31 |
| Leatherback turtle [a] | 4.98 | 1.37 | 0.97 | 0.72 | 0 | 0 | 0 | 0 | 3.22 | 0.94 | 0.79 | 0.32 |
| Loggerhead turtle | 1.67 | 0.26 | 0.17 | 0 | 0 | 0 | 0 | 0 | 2.39 | 0.72 | 0.55 | 0.26 |
| Green turtle | 3.73 | 0.68 | 0.46 | 0.15 | 0 | 0 | 0 | 0 | 2.86 | 0.85 | 0.62 | 0.32 |

[a] Listed as Endangered under the ESA.

Table H-63. Post-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, 4 per day, summer): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.22 | 0.24 | 0.22 | 0 | 0 | 0 | 0 | 0 | 2.71 | 0.84 | 0.62 | 0.41 |
| Leatherback turtle [a] | 4.77 | 1.52 | 1.14 | 0.73 | 0 | 0 | 0 | 0 | 3.24 | 1.12 | 0.73 | 0.34 |
| Loggerhead turtle | 0.99 | 0.06 | 0 | 0 | 0 | 0 | 0 | 0 | 2.56 | 0.70 | 0.48 | 0.29 |
| Green turtle | 2.86 | 0.44 | 0.23 | 0.11 | 0 | 0 | 0 | 0 | 2.86 | 0.89 | 0.69 | 0.36 |

[a] Listed as Endangered under the ESA.

Table H-64. Post-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, 8 per day, summer): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.85 | 0.54 | 0.30 | 0.11 | 0 | 0 | 0 | 0 | 2.76 | 0.89 | 0.58 | 0.31 |
| Leatherback turtle [a] | 5.01 | 1.63 | 1.19 | 0.75 | 0 | 0 | 0 | 0 | 3.26 | 1.07 | 0.75 | 0.38 |
| Loggerhead turtle | 1.66 | 0.25 | 0.23 | 0 | 0 | 0 | 0 | 0 | 2.64 | 0.83 | 0.59 | 0.34 |
| Green turtle | 3.79 | 0.88 | 0.54 | 0.23 | 0 | 0 | 0 | 0 | 2.86 | 0.95 | 0.67 | 0.44 |

[a] Listed as Endangered under the ESA.

Table H-65. Post-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, 4 per day, winter): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.42 | 0.29 | 0.22 | 0 | 0 | 0 | 0 | 0 | 2.87 | 0.86 | 0.64 | 0.41 |
| Leatherback turtle [a] | 5.17 | 1.52 | 1.15 | 0.73 | 0 | 0 | 0 | 0 | 3.28 | 1.05 | 0.73 | 0.34 |
| Loggerhead turtle | 1.32 | 0.06 | 0 | 0 | 0 | 0 | 0 | 0 | 2.61 | 0.70 | 0.48 | 0.29 |
| Green turtle | 3.07 | 0.51 | 0.26 | 0.11 | 0 | 0 | 0 | 0 | 2.96 | 0.92 | 0.72 | 0.36 |

[a] Listed as Endangered under the ESA.

Table H-66. Post-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, 8 per day, winter): Exposure ranges ($ER_{95\%}$) in km to sea turtle threshold criteria with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 3.12 | 0.65 | 0.30 | 0.11 | 0 | 0 | 0 | 0 | 2.84 | 0.88 | 0.67 | 0.31 |
| Leatherback turtle [a] | 5.42 | 1.72 | 1.19 | 0.75 | 0 | 0 | 0 | 0 | 3.35 | 1.07 | 0.79 | 0.38 |
| Loggerhead turtle | 1.84 | 0.26 | 0.23 | 0 | 0 | 0 | 0 | 0 | 2.65 | 0.80 | 0.59 | 0.34 |
| Green turtle | 4.12 | 0.89 | 0.60 | 0.22 | 0 | 0 | 0 | 0 | 2.97 | 0.98 | 0.69 | 0.44 |

[a] Listed as Endangered under the ESA.

## H.2.3. Exposure Ranges – Vibratory Pile Setting Followed by Impact Pile Driving

### H.2.3.1. Marine Mammals

#### 14 m Monopile

Table H-67. Injury: Monopile foundation (14 m diameter, typical, 5500 kJ hammer, one per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing Group | Species | $L_E$ (0 dB) | $L_E$ (10 dB) | $L_E$ (12 dB) | $L_E$ (15 dB) | $L_{pk}$ (0 dB) | $L_{pk}$ (10 dB) | $L_{pk}$ (12 dB) | $L_{pk}$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [a] | 7.09 | 3.28 | 2.44 | 1.66 | <0.01 | <0.01 | <0.01 | 0 |
| LF | Minke whale (migrating) | 4.72 | 1.59 | 1.38 | 0.67 | <0.01 | <0.01 | <0.01 | 0 |
| LF | Humpback whale | 6.20 | 2.57 | 1.86 | 1.21 | 0.02 | <0.01 | <0.01 | 0 |
| LF | North Atlantic right whale [a] | 5.68 | 1.93 | 1.51 | 0.76 | <0.01 | 0 | 0 | 0 |
| LF | Sei whale [a] (migrating) | 5.70 | 2.27 | 1.65 | 0.76 | 0.05 | <0.01 | 0 | 0 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Sperm whale [a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HF | Harbor porpoise (sensitive) | 0 | 0 | 0 | 0 | 0.46 | 0.01 | 0.01 | 0.01 |
| PW | Gray seal | 0.84 | 0.04 | 0.04 | 0 | 0 | 0 | 0 | 0 |
| PW | Harbor seal | 0.64 | 0 | 0 | 0 | 0.01 | 0 | 0 | 0 |
| PW | Harp seal | 0.67 | <0.01 | <0.01 | 0 | <0.01 | <0.01 | <0.01 | <0.01 |

[a] Listed as Endangered under the ESA.

Table H-68. Behavior: Monopile foundation (14 m diameter, typical, 5500 kJ hammer, one per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Impact $L_p$ [a] (0 dB) | Impact $L_p$ [a] (10 dB) | Impact $L_p$ [a] (12 dB) | Impact $L_p$ [a] (15 dB) | Impact $L_p$ [b] (0 dB) | Impact $L_p$ [b] (10 dB) | Impact $L_p$ [b] (12 dB) | Impact $L_p$ [b] (15 dB) | Vibratory $L_p$ [a] (0 dB) | Vibratory $L_p$ [a] (10 dB) | Vibratory $L_p$ [a] (12 dB) | Vibratory $L_p$ [a] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 11.31 | 5.50 | 4.78 | 3.87 | 11.29 | 5.42 | 4.73 | 3.87 | 53.69 | 24.63 | 21.45 | 17.50 |
| LF | Minke whale (migrating) | 10.43 | 4.84 | 4.24 | 3.29 | 40.30 | 19.98 | 17.33 | 14.17 | 46.08 | 22.48 | 19.86 | 16.44 |
| LF | Humpback whale | 10.76 | 5.45 | 4.36 | 3.42 | 10.84 | 5.46 | 4.36 | 3.50 | 49.19 | 23.47 | 20.87 | 17.10 |
| LF | North Atlantic right whale [c] | 10.85 | 5.01 | 4.46 | 3.63 | 10.92 | 5.14 | 4.43 | 3.63 | 48.40 | 23.86 | 21.61 | 17.21 |
| LF | Sei whale [c] (migrating) | 11.19 | 5.52 | 4.52 | 3.45 | 47.81 | 21.23 | 18.02 | 15.04 | 52.84 | 23.94 | 21.43 | 17.32 |
| MF | Atlantic white-sided dolphin | 10.23 | 4.70 | 4.05 | 3.36 | 4.10 | 1.84 | 1.46 | 0.95 | 45.81 | 22.49 | 19.98 | 16.34 |
| MF | Atlantic spotted dolphin | 10.94 | 5.47 | 4.51 | 3.83 | 4.70 | 2.10 | 1.50 | 1.11 | 48.51 | 24.23 | 21.14 | 17.37 |
| MF | Common dolphin | 10.36 | 4.92 | 4.25 | 3.33 | 4.35 | 1.79 | 1.50 | 1.07 | 50.76 | 23.20 | 20.55 | 17.05 |
| MF | Bottlenose dolphin, offshore | 8.60 | 4.41 | 3.66 | 3.08 | 4.03 | 1.79 | 1.43 | 0.95 | 44.35 | 21.05 | 18.81 | 14.62 |
| MF | Risso's dolphin | 10.91 | 5.33 | 4.70 | 3.75 | 4.70 | 1.97 | 1.39 | 1.11 | 53.78 | 24.43 | 21.39 | 17.18 |
| MF | Long-finned pilot whale | 10.31 | 5.05 | 4.49 | 3.59 | 4.54 | 1.77 | 1.46 | 1.07 | 48.76 | 22.44 | 19.91 | 16.51 |
| MF | Short-finned pilot whale | 10.53 | 5.16 | 4.31 | 3.55 | 4.32 | 1.78 | 1.40 | 0.99 | 53.52 | 24.31 | 21.33 | 17.11 |
| MF | Sperm whale [c] | 10.91 | 5.10 | 4.40 | 3.45 | 4.55 | 1.82 | 1.55 | 1.05 | 53.41 | 24.19 | 21.66 | 17.33 |
| HF | Harbor porpoise (sensitive) | 10.45 | 4.88 | 4.37 | 3.28 | 53.00 | 24.56 | 21.26 | 17.06 | 41.66 | 22.27 | 19.79 | 16.52 |
| PW | Gray seal | 11.42 | 5.70 | 4.84 | 3.87 | 7.66 | 3.86 | 3.32 | 2.47 | 52.79 | 24.34 | 21.62 | 17.84 |
| PW | Harbor seal | 10.81 | 5.11 | 4.52 | 3.70 | 6.73 | 3.59 | 2.87 | 2.24 | 50.57 | 23.38 | 20.56 | 16.93 |
| PW | Harp seal | 10.94 | 5.16 | 4.52 | 3.66 | 7.02 | 3.56 | 3.23 | 1.97 | 53.90 | 24.65 | 21.75 | 17.20 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table H-69. Injury: Monopile foundation (14 m diameter, typical, 5500 kJ hammer, two per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing Group | Species | $L_E$ (0 dB) | $L_E$ (10 dB) | $L_E$ (12 dB) | $L_E$ (15 dB) | $L_{pk}$ (0 dB) | $L_{pk}$ (10 dB) | $L_{pk}$ (12 dB) | $L_{pk}$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [a] | 7.19 | 3.22 | 2.64 | 1.57 | 0.02 | 0 | 0 | 0 |
| LF | Minke whale (migrating) | 4.83 | 1.79 | 1.18 | 0.67 | 0.02 | <0.01 | <0.01 | 0 |
| LF | Humpback whale | 6.37 | 2.68 | 2.32 | 1.35 | 0.03 | 0 | 0 | 0 |
| LF | North Atlantic right whale [a] | 5.62 | 2.12 | 1.76 | 1.01 | 0.03 | 0 | 0 | 0 |
| LF | Sei whale [a] (migrating) | 6.06 | 2.40 | 1.71 | 1.07 | 0.03 | <0.01 | <0.01 | 0 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Risso’s dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Sperm whale [a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HF | Harbor porpoise (sensitive) | 0 | 0 | 0 | 0 | 0.65 | 0.07 | 0.04 | 0.02 |
| PW | Gray seal | 1.02 | 0.06 | 0.06 | 0 | <0.01 | 0 | 0 | 0 |
| PW | Harbor seal | 0.99 | 0.02 | 0 | 0 | 0.05 | <0.01 | 0 | 0 |
| PW | Harp seal | 0.78 | <0.01 | 0 | 0 | 0.07 | 0 | 0 | 0 |

[a] Listed as Endangered under the ESA.

Table H-70. Behavior: Monopile foundation (14 m diameter, typical, 5500 kJ hammer, two per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Impact $L_p$ [a] (0 dB) | Impact $L_p$ [a] (10 dB) | Impact $L_p$ [a] (12 dB) | Impact $L_p$ [a] (15 dB) | Impact $L_p$ [b] (0 dB) | Impact $L_p$ [b] (10 dB) | Impact $L_p$ [b] (12 dB) | Impact $L_p$ [b] (15 dB) | Vibratory $L_p$ [a] (0 dB) | Vibratory $L_p$ [a] (10 dB) | Vibratory $L_p$ [a] (12 dB) | Vibratory $L_p$ [a] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 11.18 | 5.62 | 4.85 | 3.82 | 11.17 | 5.60 | 4.69 | 3.83 | 54.52 | 24.93 | 22.13 | 17.79 |
| LF | Minke whale (migrating) | 10.51 | 4.97 | 4.41 | 3.47 | 40.92 | 20.04 | 17.39 | 14.29 | 45.89 | 22.80 | 20.07 | 16.66 |
| LF | Humpback whale | 10.86 | 5.26 | 4.43 | 3.45 | 10.87 | 5.29 | 4.43 | 3.49 | 49.64 | 23.77 | 20.89 | 17.29 |
| LF | North Atlantic right whale [c] | 10.90 | 5.18 | 4.49 | 3.69 | 10.99 | 5.24 | 4.47 | 3.71 | 47.32 | 23.56 | 20.93 | 16.72 |
| LF | Sei whale [c] (migrating) | 11.05 | 5.28 | 4.71 | 3.64 | 48.83 | 21.55 | 18.43 | 15.10 | 53.89 | 24.49 | 21.18 | 17.24 |
| MF | Atlantic white-sided dolphin | 10.54 | 5.07 | 4.41 | 3.31 | 4.55 | 1.95 | 1.48 | 1.02 | 51.91 | 23.70 | 20.97 | 17.11 |
| MF | Atlantic spotted dolphin | 11.22 | 5.53 | 4.96 | 3.74 | 5.03 | 2.06 | 1.70 | 1.16 | 53.53 | 25.16 | 22.19 | 18.08 |
| MF | Common dolphin | 10.24 | 5.10 | 4.23 | 3.39 | 4.39 | 1.90 | 1.54 | 1.06 | 51.59 | 23.77 | 21.10 | 17.13 |
| MF | Bottlenose dolphin, offshore | 8.36 | 4.49 | 3.82 | 3.10 | 4.37 | 1.83 | 1.50 | 0.94 | 44.82 | 20.70 | 17.71 | 14.59 |
| MF | Risso's dolphin | 11.00 | 5.36 | 4.54 | 3.43 | 4.64 | 1.93 | 1.53 | 1.06 | 54.48 | 24.58 | 21.62 | 17.36 |
| MF | Long-finned pilot whale | 10.45 | 5.15 | 4.51 | 3.50 | 4.52 | 1.80 | 1.52 | 1.02 | 51.89 | 23.64 | 20.86 | 17.06 |
| MF | Short-finned pilot whale | 10.61 | 5.07 | 4.45 | 3.49 | 4.45 | 1.92 | 1.52 | 1.04 | 53.04 | 24.04 | 21.21 | 17.39 |
| MF | Sperm whale [c] | 10.86 | 5.54 | 4.58 | 3.42 | 4.53 | 2.01 | 1.59 | 1.01 | 53.61 | 24.24 | 21.61 | 17.33 |
| HF | Harbor porpoise (sensitive) | 10.48 | 5.16 | 4.43 | 3.49 | 54.53 | 24.58 | 21.49 | 17.26 | 42.78 | 22.22 | 19.86 | 16.27 |
| PW | Gray seal | 11.56 | 5.69 | 4.99 | 4.02 | 7.64 | 3.90 | 3.24 | 2.45 | 53.88 | 24.59 | 21.41 | 17.69 |
| PW | Harbor seal | 11.00 | 5.07 | 4.46 | 3.72 | 6.97 | 3.67 | 3.08 | 2.29 | 51.27 | 23.57 | 20.61 | 16.99 |
| PW | Harp seal | 10.86 | 5.55 | 4.51 | 3.58 | 7.29 | 3.55 | 3.13 | 2.21 | 54.82 | 24.93 | 21.62 | 17.53 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table H-71. Injury: Monopile foundation (14 m diameter, typical, 5500 kJ hammer, one per day, winter): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing Group | Species | $L_E$ (0 dB) | $L_E$ (10 dB) | $L_E$ (12 dB) | $L_E$ (15 dB) | $L_{pk}$ (0 dB) | $L_{pk}$ (10 dB) | $L_{pk}$ (12 dB) | $L_{pk}$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [a] | 7.69 | 3.29 | 2.79 | 1.78 | <0.01 | <0.01 | <0.01 | 0 |
| LF | Minke whale (migrating) | 5.12 | 1.89 | 1.13 | 0.75 | <0.01 | <0.01 | <0.01 | 0 |
| LF | Humpback whale | 6.58 | 2.60 | 2.42 | 1.20 | 0.02 | <0.01 | <0.01 | 0 |
| LF | North Atlantic right whale [a] | 6.28 | 2.13 | 1.74 | 1.01 | <0.01 | 0 | 0 | 0 |
| LF | Sei whale [a] (migrating) | 6.40 | 2.29 | 1.59 | 0.92 | 0.01 | <0.01 | 0 | 0 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Sperm whale [a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HF | Harbor porpoise (sensitive) | 0 | 0 | 0 | 0 | 0.46 | 0.01 | 0.01 | 0.01 |
| PW | Gray seal | 1.06 | 0.04 | 0.04 | 0 | 0 | 0 | 0 | 0 |
| PW | Harbor seal | 0.77 | 0 | 0 | 0 | 0.01 | 0 | 0 | 0 |
| PW | Harp seal | 0.72 | <0.01 | <0.01 | 0 | <0.01 | <0.01 | <0.01 | <0.01 |

[a] Listed as Endangered under the ESA.

Table H-72. Behavior: Monopile foundation (14 m diameter, typical, 5500 kJ hammer, one per day, winter): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Impact $L_p$ [a] (0 dB) | Impact $L_p$ [a] (10 dB) | Impact $L_p$ [a] (12 dB) | Impact $L_p$ [a] (15 dB) | Impact $L_p$ [b] (0 dB) | Impact $L_p$ [b] (10 dB) | Impact $L_p$ [b] (12 dB) | Impact $L_p$ [b] (15 dB) | Vibratory $L_p$ [a] (0 dB) | Vibratory $L_p$ [a] (10 dB) | Vibratory $L_p$ [a] (12 dB) | Vibratory $L_p$ [a] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 12.80 | 5.90 | 4.86 | 3.94 | 12.63 | 5.90 | 4.83 | 4.02 | 77.63 | 39.90 | 30.51 | 23.59 |
| LF | Minke whale (migrating) | 11.87 | 5.22 | 4.55 | 3.46 | 70.33 | 28.45 | 23.83 | 18.07 | 72.65 | 36.76 | 29.25 | 21.84 |
| LF | Humpback whale | 12.49 | 5.59 | 4.77 | 3.62 | 12.50 | 5.59 | 4.81 | 3.64 | 76.68 | 37.77 | 30.27 | 22.74 |
| LF | North Atlantic right whale [c] | 12.18 | 5.58 | 4.74 | 3.82 | 12.17 | 5.59 | 4.73 | 3.83 | 71.00 | 37.67 | 29.66 | 23.04 |
| LF | Sei whale [c] (migrating) | 12.51 | 5.90 | 4.85 | 3.66 | 79.26 | 30.72 | 25.25 | 18.62 | 76.82 | 39.16 | 30.29 | 22.95 |
| MF | Atlantic white-sided dolphin | 11.79 | 5.20 | 4.29 | 3.44 | 4.46 | 1.83 | 1.49 | 1.02 | 77.10 | 36.37 | 28.82 | 21.93 |
| MF | Atlantic spotted dolphin | 12.82 | 5.78 | 4.91 | 4.02 | 5.07 | 2.10 | 1.50 | 1.11 | 78.91 | 38.90 | 30.41 | 23.57 |
| MF | Common dolphin | 11.75 | 5.34 | 4.48 | 3.52 | 4.62 | 1.86 | 1.51 | 1.08 | 76.20 | 38.45 | 29.69 | 22.46 |
| MF | Bottlenose dolphin, offshore | 10.35 | 4.71 | 3.86 | 3.23 | 4.27 | 1.82 | 1.47 | 1.00 | 73.00 | 33.72 | 26.04 | 20.19 |
| MF | Risso's dolphin | 12.39 | 5.80 | 4.99 | 3.75 | 4.90 | 1.96 | 1.52 | 1.16 | 76.89 | 39.74 | 30.30 | 22.98 |
| MF | Long-finned pilot whale | 11.87 | 5.42 | 4.68 | 3.63 | 4.72 | 1.89 | 1.50 | 1.11 | 77.74 | 35.79 | 28.26 | 21.98 |
| MF | Short-finned pilot whale | 12.07 | 5.59 | 4.57 | 3.65 | 4.64 | 1.86 | 1.50 | 1.02 | 77.07 | 39.69 | 30.64 | 22.71 |
| MF | Sperm whale [c] | 12.32 | 5.68 | 4.58 | 3.52 | 4.64 | 1.85 | 1.60 | 1.14 | 76.58 | 38.79 | 30.21 | 22.90 |
| HF | Harbor porpoise (sensitive) | 12.15 | 5.42 | 4.58 | 3.51 | 84.53 | 47.41 | 34.05 | 24.45 | 77.21 | 34.83 | 27.99 | 21.80 |
| PW | Gray seal | 13.03 | 6.23 | 5.33 | 4.13 | 8.12 | 4.09 | 3.44 | 2.45 | 77.74 | 39.08 | 30.46 | 23.14 |
| PW | Harbor seal | 12.29 | 5.38 | 4.66 | 3.81 | 7.43 | 3.83 | 2.89 | 2.25 | 72.66 | 37.86 | 29.16 | 22.38 |
| PW | Harp seal | 12.49 | 5.77 | 4.84 | 3.71 | 7.84 | 3.72 | 3.24 | 2.12 | 76.96 | 39.29 | 30.66 | 22.92 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table H-73. Injury: Monopile foundation (14 m diameter, typical, 5500 kJ hammer, two per day, winter): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing Group | Species | $L_E$ (0 dB) | $L_E$ (10 dB) | $L_E$ (12 dB) | $L_E$ (15 dB) | $L_{pk}$ (0 dB) | $L_{pk}$ (10 dB) | $L_{pk}$ (12 dB) | $L_{pk}$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [a] | 8.16 | 3.39 | 2.73 | 1.87 | 0.02 | 0 | 0 | 0 |
| LF | Minke whale (migrating) | 5.19 | 1.90 | 1.27 | 0.68 | 0.02 | <0.01 | <0.01 | 0 |
| LF | Humpback whale | 7.35 | 2.97 | 2.50 | 1.38 | 0.03 | 0 | 0 | 0 |
| LF | North Atlantic right whale [a] | 6.45 | 2.30 | 1.90 | 1.02 | 0.03 | 0 | 0 | 0 |
| LF | Sei whale [a] (migrating) | 6.65 | 2.54 | 1.96 | 1.29 | 0.03 | <0.01 | <0.01 | 0 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Sperm whale [a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HF | Harbor porpoise (sensitive) | 0 | 0 | 0 | 0 | 0.61 | 0.07 | 0.07 | 0.02 |
| PW | Gray seal | 1.11 | 0.06 | 0.06 | 0 | <0.01 | 0 | 0 | 0 |
| PW | Harbor seal | 1.13 | 0.02 | 0 | 0 | 0.05 | <0.01 | 0 | 0 |
| PW | Harp seal | 0.91 | <0.01 | 0 | 0 | 0.07 | 0 | 0 | 0 |

[a] Listed as Endangered under the ESA.

Table H-74. Behavior: Monopile foundation (14 m diameter, typical, 5500 kJ hammer, two per day, winter): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Impact $L_p$ [a] (0 dB) | Impact $L_p$ [a] (10 dB) | Impact $L_p$ [a] (12 dB) | Impact $L_p$ [a] (15 dB) | Impact $L_p$ [b] (0 dB) | Impact $L_p$ [b] (10 dB) | Impact $L_p$ [b] (12 dB) | Impact $L_p$ [b] (15 dB) | Vibratory $L_p$ [a] (0 dB) | Vibratory $L_p$ [a] (10 dB) | Vibratory $L_p$ [a] (12 dB) | Vibratory $L_p$ [a] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 12.94 | 6.06 | 5.20 | 3.94 | 12.94 | 6.03 | 5.14 | 3.96 | 80.15 | 40.76 | 31.07 | 23.66 |
| LF | Minke whale (migrating) | 11.95 | 5.43 | 4.56 | 3.57 | 73.08 | 28.90 | 23.96 | 18.23 | 72.94 | 36.78 | 29.30 | 22.10 |
| LF | Humpback whale | 12.66 | 5.70 | 4.80 | 3.68 | 12.65 | 5.72 | 4.81 | 3.71 | 79.26 | 38.53 | 29.75 | 22.84 |
| LF | North Atlantic right whale [c] | 12.50 | 5.50 | 4.81 | 3.82 | 12.51 | 5.54 | 4.83 | 3.89 | 71.73 | 37.55 | 29.45 | 22.63 |
| LF | Sei whale [c] (migrating) | 12.79 | 6.04 | 4.87 | 3.78 | 82.54 | 31.47 | 25.73 | 19.28 | 79.56 | 40.10 | 30.66 | 23.10 |
| MF | Atlantic white-sided dolphin | 12.11 | 5.47 | 4.68 | 3.44 | 4.77 | 1.97 | 1.49 | 1.07 | 79.46 | 38.35 | 29.57 | 22.80 |
| MF | Atlantic spotted dolphin | 12.97 | 5.81 | 5.16 | 3.82 | 5.23 | 2.13 | 1.70 | 1.22 | 80.74 | 40.12 | 31.16 | 24.02 |
| MF | Common dolphin | 11.80 | 5.38 | 4.65 | 3.54 | 4.70 | 1.98 | 1.55 | 1.09 | 78.63 | 38.52 | 29.62 | 22.70 |
| MF | Bottlenose dolphin, offshore | 9.91 | 4.87 | 4.19 | 3.29 | 4.53 | 1.84 | 1.50 | 0.92 | 76.45 | 33.71 | 25.85 | 19.78 |
| MF | Risso’s dolphin | 12.40 | 5.67 | 4.86 | 3.62 | 4.83 | 1.97 | 1.55 | 1.13 | 79.87 | 39.98 | 31.03 | 23.47 |
| MF | Long-finned pilot whale | 11.95 | 5.48 | 4.71 | 3.65 | 4.74 | 1.84 | 1.54 | 1.06 | 79.73 | 38.00 | 29.59 | 22.45 |
| MF | Short-finned pilot whale | 12.14 | 5.49 | 4.65 | 3.73 | 4.69 | 1.97 | 1.53 | 1.08 | 79.37 | 39.26 | 29.93 | 22.78 |
| MF | Sperm whale [c] | 12.56 | 5.80 | 4.86 | 3.59 | 4.81 | 2.03 | 1.69 | 1.11 | 79.30 | 39.61 | 30.28 | 23.05 |
| HF | Harbor porpoise (sensitive) | 12.31 | 5.40 | 4.72 | 3.68 | 84.65 | 49.94 | 34.62 | 24.45 | 79.61 | 35.35 | 28.13 | 21.90 |
| PW | Gray seal | 13.01 | 6.25 | 5.25 | 4.19 | 8.18 | 4.18 | 3.37 | 2.47 | 79.49 | 39.87 | 30.74 | 23.36 |
| PW | Harbor seal | 12.12 | 5.35 | 4.74 | 4.02 | 7.52 | 3.85 | 3.11 | 2.35 | 74.26 | 38.03 | 29.69 | 22.46 |
| PW | Harp seal | 12.56 | 5.89 | 4.95 | 3.75 | 7.79 | 3.73 | 3.15 | 2.39 | 79.92 | 40.11 | 30.69 | 23.47 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table H-75. Injury: Monopile foundation (14 m diameter, difficult to drive, 6600 kJ hammer, one per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing Group | Species | $L_E$ (0 dB) | $L_E$ (10 dB) | $L_E$ (12 dB) | $L_E$ (15 dB) | $L_{pk}$ (0 dB) | $L_{pk}$ (10 dB) | $L_{pk}$ (12 dB) | $L_{pk}$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [a] | 7.91 | 3.59 | 3.29 | 2.17 | <0.01 | <0.01 | <0.01 | <0.01 |
| LF | Minke whale (migrating) | 5.43 | 2.34 | 1.82 | 1.04 | <0.01 | <0.01 | <0.01 | <0.01 |
| LF | Humpback whale | 6.97 | 3.20 | 2.58 | 1.49 | 0.05 | <0.01 | <0.01 | <0.01 |
| LF | North Atlantic right whale [a] | 6.46 | 2.53 | 2.00 | 1.46 | <0.01 | 0 | 0 | 0 |
| LF | Sei whale [a] (migrating) | 7.03 | 2.80 | 2.27 | 1.52 | 0.08 | <0.01 | <0.01 | <0.01 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Sperm whale [a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HF | Harbor porpoise (sensitive) | 0 | 0 | 0 | 0 | 0.71 | 0.13 | 0.02 | 0.01 |
| PW | Gray seal | 1.25 | 0.04 | 0.04 | 0.04 | 0 | 0 | 0 | 0 |
| PW | Harbor seal | 1.21 | 0.09 | 0 | 0 | 0.01 | 0 | 0 | 0 |
| PW | Harp seal | 0.99 | <0.01 | <0.01 | 0 | 0.06 | <0.01 | <0.01 | <0.01 |

[a] Listed as Endangered under the ESA.

Table H-76. Behavior: Monopile foundation (14 m diameter, difficult to drive, 6600 kJ hammer, one per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Impact $L_p$ [a] (0 dB) | Impact $L_p$ [a] (10 dB) | Impact $L_p$ [a] (12 dB) | Impact $L_p$ [a] (15 dB) | Impact $L_p$ [b] (0 dB) | Impact $L_p$ [b] (10 dB) | Impact $L_p$ [b] (12 dB) | Impact $L_p$ [b] (15 dB) | Vibratory $L_p$ [a] (0 dB) | Vibratory $L_p$ [a] (10 dB) | Vibratory $L_p$ [a] (12 dB) | Vibratory $L_p$ [a] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 12.67 | 6.49 | 5.51 | 4.44 | 12.74 | 6.33 | 5.36 | 4.46 | 53.69 | 24.63 | 21.45 | 17.50 |
| LF | Minke whale (migrating) | 11.81 | 5.71 | 4.91 | 3.93 | 47.49 | 22.48 | 20.16 | 16.28 | 46.08 | 22.48 | 19.86 | 16.44 |
| LF | Humpback whale | 12.38 | 6.14 | 5.43 | 4.22 | 12.48 | 6.12 | 5.44 | 4.22 | 49.19 | 23.47 | 20.87 | 17.10 |
| LF | North Atlantic right whale [c] | 12.07 | 6.24 | 5.21 | 4.19 | 12.12 | 6.26 | 5.07 | 4.19 | 48.40 | 23.86 | 21.61 | 17.21 |
| LF | Sei whale [c] (migrating) | 12.33 | 6.50 | 5.48 | 4.28 | 53.91 | 24.27 | 21.26 | 16.87 | 52.84 | 23.94 | 21.43 | 17.32 |
| MF | Atlantic white-sided dolphin | 11.69 | 5.93 | 4.83 | 3.79 | 4.96 | 2.22 | 2.00 | 1.45 | 45.81 | 22.49 | 19.98 | 16.34 |
| MF | Atlantic spotted dolphin | 12.62 | 6.37 | 5.40 | 4.27 | 5.58 | 2.50 | 2.14 | 1.47 | 48.51 | 24.23 | 21.14 | 17.37 |
| MF | Common dolphin | 11.81 | 5.79 | 4.98 | 3.97 | 5.16 | 2.22 | 1.79 | 1.38 | 50.76 | 23.20 | 20.55 | 17.05 |
| MF | Bottlenose dolphin, offshore | 10.08 | 5.30 | 4.52 | 3.64 | 5.02 | 2.10 | 1.80 | 1.20 | 44.35 | 21.05 | 18.81 | 14.62 |
| MF | Risso’s dolphin | 12.47 | 6.36 | 5.34 | 4.28 | 5.33 | 2.32 | 2.06 | 1.29 | 53.78 | 24.43 | 21.39 | 17.18 |
| MF | Long-finned pilot whale | 11.79 | 6.04 | 5.09 | 3.96 | 5.14 | 2.31 | 1.77 | 1.34 | 48.76 | 22.44 | 19.91 | 16.51 |
| MF | Short-finned pilot whale | 11.93 | 6.13 | 5.21 | 4.08 | 5.21 | 2.25 | 1.84 | 1.28 | 53.52 | 24.31 | 21.33 | 17.11 |
| MF | Sperm whale [c] | 12.28 | 6.46 | 5.11 | 4.25 | 5.05 | 2.44 | 1.89 | 1.43 | 53.41 | 24.19 | 21.66 | 17.33 |
| HF | Harbor porpoise (sensitive) | 12.06 | 5.87 | 4.93 | 4.04 | 59.08 | 27.99 | 24.61 | 19.87 | 41.66 | 22.27 | 19.79 | 16.52 |
| PW | Gray seal | 12.83 | 6.85 | 5.69 | 4.63 | 8.38 | 4.37 | 3.86 | 3.07 | 52.79 | 24.34 | 21.62 | 17.84 |
| PW | Harbor seal | 12.15 | 6.07 | 5.15 | 4.08 | 7.78 | 3.99 | 3.68 | 2.70 | 50.57 | 23.38 | 20.56 | 16.93 |
| PW | Harp seal | 12.43 | 6.34 | 5.23 | 4.25 | 8.29 | 4.28 | 3.63 | 2.99 | 53.90 | 24.65 | 21.75 | 17.20 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table H-77. Injury: Monopile foundation (14 m diameter, difficult to drive, 6600 kJ hammer, one per day, winter): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing Group | Species | $L_E$ (0 dB) | $L_E$ (10 dB) | $L_E$ (12 dB) | $L_E$ (15 dB) | $L_{pk}$ (0 dB) | $L_{pk}$ (10 dB) | $L_{pk}$ (12 dB) | $L_{pk}$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [a] | 8.75 | 4.33 | 3.29 | 2.44 | <0.01 | <0.01 | <0.01 | <0.01 |
| LF | Minke whale (migrating) | 6.54 | 2.45 | 1.91 | 1.39 | <0.01 | <0.01 | <0.01 | <0.01 |
| LF | Humpback whale | 8.34 | 3.64 | 2.63 | 1.57 | 0.02 | <0.01 | <0.01 | <0.01 |
| LF | North Atlantic right whale [a] | 7.58 | 2.73 | 2.15 | 1.50 | <0.01 | 0 | 0 | 0 |
| LF | Sei whale [a] (migrating) | 7.50 | 2.94 | 2.36 | 1.65 | 0.05 | <0.01 | <0.01 | <0.01 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Sperm whale [a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HF | Harbor porpoise (sensitive) | 0 | 0 | 0 | 0 | 0.51 | 0.13 | 0.01 | 0.01 |
| PW | Gray seal | 1.44 | 0.04 | 0.04 | 0.04 | 0.04 | 0 | 0 | 0 |
| PW | Harbor seal | 1.25 | 0.09 | 0 | 0 | 0.01 | 0 | 0 | 0 |
| PW | Harp seal | 1.15 | <0.01 | <0.01 | 0 | 0.06 | <0.01 | <0.01 | <0.01 |

[a] Listed as Endangered under the ESA.

Table H-78. Behavior: Monopile foundation (14 m diameter, difficult to drive, 6600 kJ hammer, one per day, winter): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Impact $L_p$ [a] (0 dB) | Impact $L_p$ [a] (10 dB) | Impact $L_p$ [a] (12 dB) | Impact $L_p$ [a] (15 dB) | Impact $L_p$ [b] (0 dB) | Impact $L_p$ [b] (10 dB) | Impact $L_p$ [b] (12 dB) | Impact $L_p$ [b] (15 dB) | Vibratory $L_p$ [a] (0 dB) | Vibratory $L_p$ [a] (10 dB) | Vibratory $L_p$ [a] (12 dB) | Vibratory $L_p$ [a] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 14.90 | 7.05 | 5.89 | 4.66 | 14.99 | 7.03 | 5.88 | 4.66 | 77.63 | 39.90 | 30.51 | 23.59 |
| LF | Minke whale (migrating) | 13.93 | 6.29 | 5.31 | 4.20 | 71.31 | 36.20 | 28.39 | 21.50 | 72.65 | 36.76 | 29.25 | 21.84 |
| LF | Humpback whale | 14.46 | 6.39 | 5.62 | 4.28 | 14.38 | 6.41 | 5.65 | 4.33 | 76.68 | 37.77 | 30.27 | 22.74 |
| LF | North Atlantic right whale [c] | 14.45 | 6.62 | 5.74 | 4.42 | 14.45 | 6.62 | 5.74 | 4.42 | 71.00 | 37.67 | 29.66 | 23.04 |
| LF | Sei whale [c] (migrating) | 14.57 | 6.99 | 5.80 | 4.53 | 78.65 | 38.81 | 30.49 | 22.48 | 76.82 | 39.16 | 30.29 | 22.95 |
| MF | Atlantic white-sided dolphin | 13.95 | 6.26 | 5.34 | 4.01 | 5.42 | 2.32 | 2.00 | 1.43 | 77.10 | 36.37 | 28.82 | 21.93 |
| MF | Atlantic spotted dolphin | 14.88 | 6.77 | 5.86 | 4.42 | 5.86 | 2.50 | 2.14 | 1.47 | 78.91 | 38.90 | 30.41 | 23.57 |
| MF | Common dolphin | 13.81 | 6.18 | 5.38 | 4.25 | 5.49 | 2.32 | 1.90 | 1.38 | 76.20 | 38.45 | 29.69 | 22.46 |
| MF | Bottlenose dolphin, offshore | 11.67 | 5.61 | 4.74 | 3.74 | 5.15 | 2.22 | 1.83 | 1.22 | 73.00 | 33.72 | 26.04 | 20.19 |
| MF | Risso’s dolphin | 14.18 | 6.75 | 5.77 | 4.56 | 5.64 | 2.49 | 2.06 | 1.32 | 76.89 | 39.74 | 30.30 | 22.98 |
| MF | Long-finned pilot whale | 13.76 | 6.41 | 5.56 | 4.26 | 5.52 | 2.41 | 1.90 | 1.36 | 77.74 | 35.79 | 28.26 | 21.98 |
| MF | Short-finned pilot whale | 14.14 | 6.60 | 5.58 | 4.28 | 5.58 | 2.42 | 1.87 | 1.38 | 77.07 | 39.69 | 30.64 | 22.71 |
| MF | Sperm whale [c] | 14.59 | 6.86 | 5.51 | 4.38 | 5.45 | 2.63 | 1.96 | 1.42 | 76.58 | 38.79 | 30.21 | 22.90 |
| HF | Harbor porpoise (sensitive) | 14.07 | 6.51 | 5.47 | 4.19 | 85.80 | 68.40 | 46.83 | 29.85 | 77.21 | 34.83 | 27.99 | 21.80 |
| PW | Gray seal | 14.73 | 7.25 | 6.22 | 4.80 | 9.07 | 4.50 | 4.08 | 3.18 | 77.74 | 39.08 | 30.46 | 23.14 |
| PW | Harbor seal | 14.14 | 6.48 | 5.52 | 4.34 | 8.76 | 4.23 | 3.86 | 2.85 | 72.66 | 37.86 | 29.16 | 22.38 |
| PW | Harp seal | 14.45 | 6.48 | 5.78 | 4.49 | 8.75 | 4.42 | 3.73 | 3.04 | 76.96 | 39.29 | 30.66 | 22.92 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

## 4.25 m Pre-piled Jacket Pile

Table H-79. Injury: Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, four piles per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing Group | Species | $L_{E,w,24h}$ (0 dB) | $L_E$ (10 dB) | $L_E$ (12 dB) | $L_E$ (15 dB) | $L_{pk}$ (0 dB) | $L_{pk}$ (10 dB) | $L_{pk}$ (12 dB) | $L_{pk}$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [a] | 9.72 | 3.67 | 2.92 | 1.80 | 0.02 | <0.01 | <0.01 | 0 |
| LF | Minke whale (migrating) | 4.52 | 1.37 | 0.93 | 0.51 | 0.01 | <0.01 | <0.01 | 0 |
| LF | Humpback whale | 7.23 | 2.59 | 2.07 | 1.31 | <0.01 | 0 | 0 | 0 |
| LF | North Atlantic right whale [a] | 6.39 | 1.81 | 1.46 | 0.82 | <0.01 | <0.01 | 0 | 0 |
| LF | Sei whale [a] (migrating) | 7.41 | 2.33 | 1.71 | 1.11 | 0.04 | <0.01 | 0 | 0 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Sperm whale [a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HF | Harbor porpoise (sensitive) | 0.30 | 0 | 0 | 0 | 0.31 | 0.05 | 0.05 | 0.03 |
| PW | Gray seal | 1.99 | 0.46 | 0.39 | <0.01 | <0.01 | 0 | 0 | 0 |
| PW | Harbor seal | 0.99 | 0.10 | 0.10 | 0 | 0.04 | 0 | 0 | 0 |
| PW | Harp seal | 0.93 | 0.04 | 0 | 0 | 0.04 | 0 | 0 | 0 |

[a] Listed as Endangered under the ESA.

Table H-80. Behavior: Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, four piles per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Impact $L_p$ [a] (0 dB) | Impact $L_p$ [a] (10 dB) | Impact $L_p$ [a] (12 dB) | Impact $L_p$ [a] (15 dB) | Impact $L_p$ [b] (0 dB) | Impact $L_p$ [b] (10 dB) | Impact $L_p$ [b] (12 dB) | Impact $L_p$ [b] (15 dB) | Vibratory $L_p$ [a] (0 dB) | Vibratory $L_p$ [a] (10 dB) | Vibratory $L_p$ [a] (12 dB) | Vibratory $L_p$ [a] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 10.95 | 4.03 | 3.19 | 2.35 | 10.94 | 4.01 | 3.19 | 2.38 | 59.28 | 28.91 | 24.80 | 20.23 |
| LF | Minke whale (migrating) | 9.20 | 3.59 | 2.95 | 2.17 | 55.96 | 22.95 | 19.66 | 15.00 | 50.17 | 25.14 | 21.81 | 18.32 |
| LF | Humpback whale | 10.32 | 3.85 | 3.03 | 2.29 | 10.34 | 3.86 | 3.04 | 2.30 | 55.81 | 27.63 | 23.43 | 19.60 |
| LF | North Atlantic right whale [c] | 10.33 | 3.71 | 3.01 | 2.17 | 10.45 | 3.71 | 2.97 | 2.17 | 50.87 | 26.36 | 23.05 | 19.04 |
| LF | Sei whale [c] (migrating) | 10.73 | 3.72 | 3.04 | 2.23 | 68.85 | 26.76 | 22.27 | 16.22 | 58.79 | 28.77 | 24.29 | 20.24 |
| MF | Atlantic white-sided dolphin | 9.69 | 3.60 | 2.96 | 2.17 | 3.88 | 1.31 | 1.07 | 0.71 | 54.25 | 26.19 | 22.46 | 18.82 |
| MF | Atlantic spotted dolphin | 10.82 | 3.89 | 3.30 | 2.13 | 3.99 | 1.31 | 1.01 | 0.63 | 56.82 | 28.53 | 25.36 | 20.89 |
| MF | Common dolphin | 9.20 | 3.64 | 3.01 | 2.18 | 3.89 | 1.39 | 1.10 | 0.73 | 54.23 | 26.43 | 23.00 | 18.86 |
| MF | Bottlenose dolphin, offshore | 6.99 | 2.92 | 2.43 | 1.77 | 3.42 | 1.24 | 1.02 | 0.64 | 42.95 | 19.99 | 17.64 | 14.14 |
| MF | Risso's dolphin | 10.29 | 3.68 | 3.18 | 2.21 | 3.93 | 1.27 | 0.99 | 0.72 | 58.05 | 28.22 | 24.21 | 19.78 |
| MF | Long-finned pilot whale | 9.48 | 3.61 | 2.98 | 2.11 | 3.76 | 1.30 | 1.06 | 0.76 | 56.42 | 26.58 | 22.78 | 18.76 |
| MF | Short-finned pilot whale | 9.74 | 3.65 | 2.97 | 2.09 | 3.84 | 1.38 | 1.05 | 0.68 | 57.73 | 27.59 | 24.27 | 19.14 |
| MF | Sperm whale [c] | 10.31 | 3.63 | 3.01 | 2.18 | 3.76 | 1.32 | 1.05 | 0.68 | 59.46 | 28.07 | 24.12 | 19.73 |
| HF | Harbor porpoise (sensitive) | 9.48 | 3.56 | 2.94 | 2.14 | 80.08 | 69.58 | 61.98 | 41.82 | 49.23 | 24.92 | 22.01 | 18.38 |
| PW | Gray seal | 11.33 | 4.15 | 3.32 | 2.43 | 7.30 | 2.52 | 2.07 | 1.35 | 58.82 | 29.17 | 24.64 | 20.43 |
| PW | Harbor seal | 10.38 | 3.81 | 3.12 | 2.27 | 6.56 | 2.41 | 1.88 | 1.27 | 55.77 | 27.29 | 23.69 | 19.21 |
| PW | Harp seal | 10.60 | 3.90 | 3.17 | 2.29 | 6.68 | 2.39 | 1.92 | 1.24 | 58.82 | 28.83 | 24.78 | 19.80 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table H-81. Injury: Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, eight piles per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing Group | Species | $L_E$ (0 dB) | $L_E$ (10 dB) | $L_E$ (12 dB) | $L_E$ (15 dB) | $L_{pk}$ (0 dB) | $L_{pk}$ (10 dB) | $L_{pk}$ (12 dB) | $L_{pk}$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [a] | 12.41 | 4.46 | 3.68 | 2.71 | 0.03 | <0.01 | <0.01 | 0 |
| LF | Minke whale (migrating) | 6.38 | 2.15 | 1.67 | 0.94 | 0.02 | <0.01 | 0 | 0 |
| LF | Humpback whale | 9.42 | 3.58 | 2.75 | 2.02 | 0.02 | 0 | 0 | 0 |
| LF | North Atlantic right whale [a] | 8.41 | 2.71 | 2.11 | 1.41 | 0.03 | 0 | 0 | 0 |
| LF | Sei whale [a] (migrating) | 9.23 | 3.17 | 2.59 | 1.77 | 0.05 | <0.01 | 0 | 0 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Risso’s dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Sperm whale [a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HF | Harbor porpoise (sensitive) | 0.56 | 0 | 0 | 0 | 0.36 | 0.05 | 0.03 | <0.01 |
| PW | Gray seal | 2.25 | 0.48 | 0.26 | 0.03 | 0 | 0 | 0 | 0 |
| PW | Harbor seal | 1.75 | 0.18 | 0.11 | 0.01 | 0.03 | <0.01 | <0.01 | <0.01 |
| PW | Harp seal | 1.37 | 0.09 | 0.06 | <0.01 | 0.01 | 0 | 0 | 0 |

[a] Listed as Endangered under the ESA.

Table H-82. Behavior: Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, eight piles per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Impact $L_p$ [a] (0 dB) | Impact $L_p$ [a] (10 dB) | Impact $L_p$ [a] (12 dB) | Impact $L_p$ [a] (15 dB) | Impact $L_p$ [b] (0 dB) | Impact $L_p$ [b] (10 dB) | Impact $L_p$ [b] (12 dB) | Impact $L_p$ [b] (15 dB) | Vibratory $L_p$ [a] (0 dB) | Vibratory $L_p$ [a] (10 dB) | Vibratory $L_p$ [a] (12 dB) | Vibratory $L_p$ [a] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 11.38 | 4.09 | 3.20 | 2.38 | 11.31 | 4.09 | 3.20 | 2.38 | 60.43 | 30.07 | 25.42 | 20.77 |
| LF | Minke whale (migrating) | 9.94 | 3.63 | 2.97 | 2.25 | 58.58 | 23.98 | 20.25 | 15.47 | 51.35 | 26.07 | 22.54 | 18.54 |
| LF | Humpback whale | 10.74 | 3.90 | 3.14 | 2.30 | 10.75 | 3.90 | 3.14 | 2.28 | 57.54 | 28.18 | 24.23 | 19.76 |
| LF | North Atlantic right whale [c] | 10.61 | 3.78 | 2.92 | 2.23 | 10.65 | 3.78 | 2.91 | 2.22 | 51.45 | 26.93 | 23.21 | 19.44 |
| LF | Sei whale [c] (migrating) | 10.98 | 3.95 | 3.09 | 2.25 | 71.07 | 28.01 | 23.08 | 17.03 | 60.10 | 29.56 | 25.24 | 20.28 |
| MF | Atlantic white-sided dolphin | 10.02 | 3.59 | 2.96 | 2.17 | 3.80 | 1.34 | 1.10 | 0.75 | 56.56 | 27.29 | 23.36 | 19.18 |
| MF | Atlantic spotted dolphin | 11.03 | 3.79 | 3.19 | 2.13 | 3.90 | 1.32 | 0.98 | 0.63 | 58.50 | 28.71 | 25.14 | 20.59 |
| MF | Common dolphin | 9.88 | 3.74 | 3.06 | 2.20 | 3.88 | 1.39 | 1.07 | 0.73 | 55.75 | 26.85 | 23.46 | 19.15 |
| MF | Bottlenose dolphin, offshore | 7.27 | 3.01 | 2.56 | 1.82 | 3.54 | 1.27 | 0.96 | 0.65 | 46.80 | 21.52 | 18.85 | 14.91 |
| MF | Risso’s dolphin | 10.82 | 3.77 | 3.10 | 2.18 | 3.97 | 1.26 | 1.03 | 0.72 | 59.12 | 29.05 | 25.00 | 20.25 |
| MF | Long-finned pilot whale | 10.10 | 3.68 | 2.97 | 2.15 | 3.87 | 1.33 | 1.12 | 0.74 | 58.54 | 27.72 | 23.61 | 19.20 |
| MF | Short-finned pilot whale | 10.26 | 3.67 | 2.98 | 2.14 | 3.90 | 1.33 | 1.07 | 0.71 | 58.61 | 28.03 | 24.26 | 19.88 |
| MF | Sperm whale [c] | 10.70 | 3.75 | 3.05 | 2.17 | 3.92 | 1.26 | 1.04 | 0.74 | 60.24 | 29.06 | 24.66 | 20.22 |
| HF | Harbor porpoise (sensitive) | 10.09 | 3.68 | 3.02 | 2.15 | 82.00 | 70.85 | 62.82 | 42.29 | 51.17 | 25.59 | 22.47 | 18.87 |
| PW | Gray seal | 11.70 | 4.38 | 3.49 | 2.44 | 7.56 | 2.64 | 2.23 | 1.47 | 59.67 | 29.58 | 25.43 | 20.73 |
| PW | Harbor seal | 10.87 | 3.90 | 3.22 | 2.28 | 6.68 | 2.35 | 1.90 | 1.26 | 56.87 | 27.77 | 24.34 | 19.64 |
| PW | Harp seal | 11.14 | 3.91 | 3.15 | 2.30 | 6.98 | 2.41 | 1.88 | 1.29 | 59.94 | 29.36 | 25.52 | 20.26 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table H-83. Injury: Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, four piles per day, winter): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing Group | Species | $L_E$ (0 dB) | $L_E$ (10 dB) | $L_E$ (12 dB) | $L_E$ (15 dB) | $L_{pk}$ (0 dB) | $L_{pk}$ (10 dB) | $L_{pk}$ (12 dB) | $L_{pk}$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [a] | 12.31 | 4.08 | 3.19 | 2.02 | 0.02 | <0.01 | <0.01 | 0 |
| LF | Minke whale (migrating) | 6.13 | 1.59 | 1.04 | 0.55 | 0.01 | <0.01 | <0.01 | 0 |
| LF | Humpback whale | 9.87 | 2.97 | 2.31 | 1.36 | <0.01 | 0 | 0 | 0 |
| LF | North Atlantic right whale [a] | 7.87 | 2.11 | 1.48 | 0.90 | <0.01 | <0.01 | 0 | 0 |
| LF | Sei whale [a] (migrating) | 8.95 | 2.66 | 1.93 | 1.33 | 0.04 | <0.01 | 0 | 0 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Sperm whale [a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HF | Harbor porpoise (sensitive) | 0.30 | 0 | 0 | 0 | 0.31 | 0.05 | 0.05 | 0.03 |
| PW | Gray seal | 2.03 | 0.46 | 0.39 | <0.01 | <0.01 | 0 | 0 | 0 |
| PW | Harbor seal | 1.03 | 0.10 | 0.10 | 0 | 0.01 | 0 | 0 | 0 |
| PW | Harp seal | 0.97 | 0.04 | 0 | 0 | 0.04 | 0 | 0 | 0 |

[a] Listed as Endangered under the ESA.

Table H-84. Behavior: Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, four piles per day, winter): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Impact $L_p$ [a] (0 dB) | Impact $L_p$ [a] (10 dB) | Impact $L_p$ [a] (12 dB) | Impact $L_p$ [a] (15 dB) | Impact $L_p$ [b] (0 dB) | Impact $L_p$ [b] (10 dB) | Impact $L_p$ [b] (12 dB) | Impact $L_p$ [b] (15 dB) | Vibratory $L_p$ [a] (0 dB) | Vibratory $L_p$ [a] (10 dB) | Vibratory $L_p$ [a] (12 dB) | Vibratory $L_p$ [a] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 11.96 | 4.14 | 3.24 | 2.35 | 11.92 | 4.15 | 3.25 | 2.35 | 78.65 | 51.58 | 38.14 | 26.47 |
| LF | Minke whale (migrating) | 10.37 | 3.82 | 3.15 | 2.28 | 80.90 | 40.93 | 27.86 | 18.43 | 70.48 | 45.83 | 34.01 | 23.85 |
| LF | Humpback whale | 11.35 | 4.02 | 3.35 | 2.34 | 11.34 | 4.00 | 3.35 | 2.33 | 77.41 | 49.39 | 36.16 | 25.92 |
| LF | North Atlantic right whale [c] | 11.42 | 3.82 | 3.10 | 2.22 | 11.43 | 3.82 | 3.12 | 2.17 | 73.74 | 44.11 | 34.73 | 24.61 |
| LF | Sei whale [c] (migrating) | 11.61 | 3.95 | 3.14 | 2.25 | 84.14 | 44.69 | 30.15 | 19.68 | 78.55 | 51.01 | 37.70 | 26.08 |
| MF | Atlantic white-sided dolphin | 10.45 | 3.83 | 3.05 | 2.20 | 4.20 | 1.39 | 1.09 | 0.72 | 78.05 | 48.54 | 34.31 | 24.13 |
| MF | Atlantic spotted dolphin | 11.53 | 3.92 | 3.31 | 2.16 | 4.03 | 1.31 | 1.02 | 0.63 | 79.59 | 51.12 | 37.68 | 26.80 |
| MF | Common dolphin | 10.20 | 3.83 | 3.15 | 2.24 | 4.18 | 1.46 | 1.14 | 0.77 | 77.30 | 47.30 | 34.78 | 24.32 |
| MF | Bottlenose dolphin, offshore | 8.31 | 3.12 | 2.58 | 1.86 | 3.61 | 1.25 | 1.06 | 0.65 | 74.04 | 35.55 | 25.31 | 18.69 |
| MF | Risso's dolphin | 11.39 | 3.84 | 3.26 | 2.25 | 4.31 | 1.41 | 1.04 | 0.78 | 78.97 | 50.94 | 37.25 | 25.83 |
| MF | Long-finned pilot whale | 10.57 | 3.74 | 3.15 | 2.15 | 4.08 | 1.35 | 1.08 | 0.79 | 77.98 | 47.49 | 34.66 | 24.50 |
| MF | Short-finned pilot whale | 10.53 | 3.79 | 3.06 | 2.14 | 4.08 | 1.40 | 1.09 | 0.69 | 78.36 | 50.19 | 36.85 | 25.65 |
| MF | Sperm whale [c] | 11.14 | 3.77 | 3.16 | 2.25 | 4.20 | 1.37 | 1.13 | 0.68 | 78.11 | 50.46 | 37.07 | 25.39 |
| HF | Harbor porpoise (sensitive) | 10.86 | 3.84 | 3.16 | 2.32 | 86.73 | 85.28 | 83.97 | 79.54 | 76.82 | 45.33 | 33.95 | 24.29 |
| PW | Gray seal | 12.65 | 4.30 | 3.40 | 2.41 | 7.83 | 2.65 | 2.08 | 1.41 | 77.60 | 51.47 | 37.76 | 26.19 |
| PW | Harbor seal | 11.20 | 3.79 | 3.22 | 2.32 | 7.12 | 2.53 | 2.01 | 1.42 | 73.53 | 49.30 | 35.82 | 25.30 |
| PW | Harp seal | 11.67 | 3.98 | 3.30 | 2.32 | 7.22 | 2.57 | 1.95 | 1.26 | 78.26 | 51.42 | 37.33 | 26.22 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table H-85. Injury: Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, eight piles per day, winter): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing Group | Species | $L_E$ (0 dB) | $L_E$ (10 dB) | $L_E$ (12 dB) | $L_E$ (15 dB) | $L_{pk}$ (0 dB) | $L_{pk}$ (10 dB) | $L_{pk}$ (12 dB) | $L_{pk}$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [a] | 16.96 | 4.88 | 4.15 | 2.82 | 0.03 | <0.01 | <0.01 | 0 |
| LF | Minke whale (migrating) | 8.71 | 2.39 | 1.79 | 1.16 | 0.02 | <0.01 | 0 | 0 |
| LF | Humpback whale | 14.17 | 4.02 | 3.29 | 2.24 | 0.02 | 0 | 0 | 0 |
| LF | North Atlantic right whale [a] | 11.43 | 3.21 | 2.33 | 1.57 | 0.03 | 0 | 0 | 0 |
| LF | Sei whale [a] (migrating) | 12.46 | 3.69 | 2.69 | 1.90 | 0.05 | <0.01 | 0 | 0 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Sperm whale [a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HF | Harbor porpoise (sensitive) | 0.61 | 0 | 0 | 0 | 0.28 | 0.06 | 0.03 | <0.01 |
| PW | Gray seal | 2.36 | 0.48 | 0.40 | 0.03 | 0 | 0 | 0 | 0 |
| PW | Harbor seal | 1.95 | 0.25 | 0.11 | 0.01 | 0.03 | <0.01 | <0.01 | <0.01 |
| PW | Harp seal | 1.59 | 0.09 | 0.06 | <0.01 | 0.01 | 0 | 0 | 0 |

[a] Listed as Endangered under the ESA.

Table H-86. Behavior: Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, eight piles per day, winter): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Impact $L_p$ [a] (0 dB) | Impact $L_p$ [a] (10 dB) | Impact $L_p$ [a] (12 dB) | Impact $L_p$ [a] (15 dB) | Impact $L_p$ [b] (0 dB) | Impact $L_p$ [b] (10 dB) | Impact $L_p$ [b] (12 dB) | Impact $L_p$ [b] (15 dB) | Vibratory $L_p$ [a] (0 dB) | Vibratory $L_p$ [a] (10 dB) | Vibratory $L_p$ [a] (12 dB) | Vibratory $L_p$ [a] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 12.68 | 4.20 | 3.36 | 2.38 | 12.60 | 4.19 | 3.33 | 2.38 | 81.28 | 53.08 | 39.65 | 27.04 |
| LF | Minke whale (migrating) | 11.34 | 3.86 | 3.16 | 2.29 | 82.09 | 43.90 | 29.83 | 19.61 | 74.88 | 46.97 | 35.36 | 24.76 |
| LF | Humpback whale | 12.47 | 4.00 | 3.25 | 2.37 | 12.40 | 4.01 | 3.22 | 2.37 | 79.85 | 51.32 | 37.54 | 26.37 |
| LF | North Atlantic right whale [c] | 12.12 | 3.88 | 3.09 | 2.23 | 12.11 | 3.89 | 3.06 | 2.20 | 76.62 | 44.82 | 35.29 | 25.04 |
| LF | Sei whale [c] (migrating) | 12.57 | 4.07 | 3.30 | 2.27 | 84.93 | 48.28 | 32.69 | 21.01 | 81.77 | 52.74 | 39.34 | 26.97 |
| MF | Atlantic white-sided dolphin | 11.27 | 3.78 | 3.05 | 2.24 | 4.14 | 1.42 | 1.13 | 0.80 | 80.92 | 50.37 | 35.86 | 25.17 |
| MF | Atlantic spotted dolphin | 12.07 | 3.86 | 3.20 | 2.13 | 4.00 | 1.32 | 0.97 | 0.63 | 81.95 | 52.23 | 38.21 | 26.75 |
| MF | Common dolphin | 10.85 | 3.85 | 3.20 | 2.27 | 4.18 | 1.43 | 1.09 | 0.78 | 80.61 | 49.32 | 35.69 | 24.77 |
| MF | Bottlenose dolphin, offshore | 8.85 | 3.16 | 2.68 | 1.94 | 3.75 | 1.29 | 0.96 | 0.65 | 78.47 | 39.20 | 27.97 | 19.49 |
| MF | Risso’s dolphin | 12.30 | 3.88 | 3.19 | 2.23 | 4.23 | 1.36 | 1.04 | 0.73 | 81.94 | 52.53 | 38.17 | 26.71 |
| MF | Long-finned pilot whale | 11.33 | 3.84 | 3.07 | 2.23 | 4.11 | 1.35 | 1.12 | 0.76 | 80.78 | 49.97 | 36.56 | 25.39 |
| MF | Short-finned pilot whale | 11.43 | 3.85 | 3.04 | 2.18 | 4.16 | 1.38 | 1.11 | 0.77 | 80.91 | 51.25 | 37.40 | 25.62 |
| MF | Sperm whale [c] | 12.06 | 3.85 | 3.20 | 2.25 | 4.23 | 1.33 | 1.04 | 0.77 | 80.56 | 52.31 | 37.98 | 26.35 |
| HF | Harbor porpoise (sensitive) | 11.69 | 3.88 | 3.12 | 2.24 | 86.96 | 85.90 | 84.77 | 81.21 | 79.78 | 47.71 | 35.02 | 24.90 |
| PW | Gray seal | 13.09 | 4.43 | 3.56 | 2.51 | 7.96 | 2.66 | 2.23 | 1.53 | 79.93 | 53.12 | 38.90 | 26.88 |
| PW | Harbor seal | 11.98 | 3.93 | 3.29 | 2.29 | 7.34 | 2.46 | 1.95 | 1.30 | 75.74 | 50.58 | 37.05 | 26.04 |
| PW | Harp seal | 12.56 | 4.04 | 3.28 | 2.30 | 7.38 | 2.47 | 1.99 | 1.38 | 80.75 | 53.41 | 39.08 | 26.82 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table H-87. Injury: Pre-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, four piles per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing Group | Species | $L_E$ (0 dB) | $L_E$ (10 dB) | $L_E$ (12 dB) | $L_E$ (15 dB) | $L_{pk}$ (0 dB) | $L_{pk}$ (10 dB) | $L_{pk}$ (12 dB) | $L_{pk}$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [a] | 10.38 | 4.07 | 3.21 | 2.32 | 0.04 | <0.01 | <0.01 | 0 |
| LF | Minke whale (migrating) | 5.12 | 1.59 | 1.05 | 0.53 | 0.02 | <0.01 | <0.01 | 0 |
| LF | Humpback whale | 7.85 | 2.90 | 2.33 | 1.44 | 0.02 | 0 | 0 | 0 |
| LF | North Atlantic right whale [a] | 6.77 | 2.17 | 1.57 | 1.03 | 0.06 | <0.01 | <0.01 | 0 |
| LF | Sei whale [a] (migrating) | 7.70 | 2.66 | 2.04 | 1.34 | 0.04 | <0.01 | <0.01 | 0 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Risso’s dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Sperm whale [a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HF | Harbor porpoise (sensitive) | 0.29 | 0 | 0 | 0 | 0.38 | 0.05 | 0.05 | 0.03 |
| PW | Gray seal | 2.06 | 0.46 | 0.41 | 0.28 | <0.01 | 0 | 0 | 0 |
| PW | Harbor seal | 1.10 | 0.09 | 0.10 | 0 | 0.04 | 0 | 0 | 0 |
| PW | Harp seal | 1.01 | 0.04 | 0 | 0 | 0.06 | 0 | 0 | 0 |

[a] Listed as Endangered under the ESA.

Table H-88. Behavior: Pre-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, four piles per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Impact $L_p$ [a] (0 dB) | Impact $L_p$ [a] (10 dB) | Impact $L_p$ [a] (12 dB) | Impact $L_p$ [a] (15 dB) | Impact $L_p$ [b] (0 dB) | Impact $L_p$ [b] (10 dB) | Impact $L_p$ [b] (12 dB) | Impact $L_p$ [b] (15 dB) | Vibratory $L_p$ [a] (0 dB) | Vibratory $L_p$ [a] (10 dB) | Vibratory $L_p$ [a] (12 dB) | Vibratory $L_p$ [a] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 11.05 | 4.09 | 3.22 | 2.51 | 11.05 | 4.08 | 3.24 | 2.53 | 59.28 | 28.91 | 24.80 | 20.23 |
| LF | Minke whale (migrating) | 9.50 | 3.67 | 3.08 | 2.30 | 56.20 | 23.25 | 19.97 | 15.26 | 50.17 | 25.14 | 21.81 | 18.32 |
| LF | Humpback whale | 10.58 | 3.88 | 3.14 | 2.35 | 10.56 | 3.90 | 3.15 | 2.35 | 55.81 | 27.63 | 23.43 | 19.60 |
| LF | North Atlantic right whale [c] | 10.50 | 3.82 | 3.24 | 2.28 | 10.61 | 3.81 | 3.24 | 2.24 | 50.87 | 26.36 | 23.05 | 19.04 |
| LF | Sei whale [c] (migrating) | 10.90 | 3.94 | 3.13 | 2.30 | 68.87 | 26.84 | 22.38 | 16.33 | 58.79 | 28.77 | 24.29 | 20.24 |
| MF | Atlantic white-sided dolphin | 9.95 | 3.71 | 3.01 | 2.25 | 3.95 | 1.48 | 1.20 | 0.79 | 54.25 | 26.19 | 22.46 | 18.82 |
| MF | Atlantic spotted dolphin | 11.01 | 4.08 | 3.41 | 2.31 | 4.15 | 1.52 | 1.17 | 0.70 | 56.82 | 28.53 | 25.36 | 20.89 |
| MF | Common dolphin | 9.54 | 3.74 | 3.12 | 2.26 | 4.02 | 1.50 | 1.24 | 0.84 | 54.23 | 26.43 | 23.00 | 18.86 |
| MF | Bottlenose dolphin, offshore | 7.24 | 3.03 | 2.61 | 1.91 | 3.58 | 1.37 | 1.10 | 0.75 | 42.95 | 19.99 | 17.64 | 14.14 |
| MF | Risso's dolphin | 10.45 | 3.84 | 3.22 | 2.34 | 4.08 | 1.46 | 1.11 | 0.81 | 58.05 | 28.22 | 24.21 | 19.78 |
| MF | Long-finned pilot whale | 9.81 | 3.70 | 3.10 | 2.21 | 3.92 | 1.45 | 1.17 | 0.82 | 56.42 | 26.58 | 22.78 | 18.76 |
| MF | Short-finned pilot whale | 9.94 | 3.79 | 3.17 | 2.21 | 3.95 | 1.47 | 1.18 | 0.77 | 57.73 | 27.59 | 24.27 | 19.14 |
| MF | Sperm whale [c] | 10.45 | 3.75 | 3.12 | 2.33 | 3.94 | 1.46 | 1.17 | 0.72 | 59.46 | 28.07 | 24.12 | 19.73 |
| HF | Harbor porpoise (sensitive) | 9.81 | 3.69 | 3.08 | 2.33 | 80.25 | 69.66 | 62.12 | 41.87 | 49.23 | 24.92 | 22.01 | 18.38 |
| PW | Gray seal | 11.33 | 4.17 | 3.34 | 2.58 | 7.34 | 2.76 | 2.26 | 1.46 | 58.82 | 29.17 | 24.64 | 20.43 |
| PW | Harbor seal | 10.51 | 3.89 | 3.19 | 2.32 | 6.59 | 2.50 | 2.04 | 1.49 | 55.77 | 27.29 | 23.69 | 19.21 |
| PW | Harp seal | 10.76 | 3.94 | 3.24 | 2.39 | 6.75 | 2.55 | 2.11 | 1.40 | 58.82 | 28.83 | 24.78 | 19.80 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table H-89. Injury: Pre-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, four piles per day, winter): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing Group | Species | $L_E$ (0 dB) | $L_E$ (10 dB) | $L_E$ (12 dB) | $L_E$ (15 dB) | $L_{pk}$ (0 dB) | $L_{pk}$ (10 dB) | $L_{pk}$ (12 dB) | $L_{pk}$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [a] | 13.25 | 4.22 | 3.53 | 2.58 | 0.04 | <0.01 | <0.01 | 0 |
| LF | Minke whale (migrating) | 6.73 | 1.83 | 1.25 | 0.66 | 0.02 | <0.01 | <0.01 | 0 |
| LF | Humpback whale | 10.61 | 3.30 | 2.58 | 1.54 | 0.02 | 0 | 0 | 0 |
| LF | North Atlantic right whale [a] | 8.37 | 2.36 | 1.77 | 1.11 | 0.06 | <0.01 | 0 | 0 |
| LF | Sei whale [a] (migrating) | 9.46 | 2.90 | 2.34 | 1.48 | 0.04 | <0.01 | <0.01 | 0 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Risso’s dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Sperm whale [a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HF | Harbor porpoise (sensitive) | 0.30 | 0 | 0 | 0 | 0.34 | 0.05 | 0.05 | 0.03 |
| PW | Gray seal | 2.47 | 0.46 | 0.46 | 0.28 | <0.01 | 0 | 0 | 0 |
| PW | Harbor seal | 1.22 | 0.10 | 0.10 | 0 | 0.06 | 0 | 0 | 0 |
| PW | Harp seal | 1.07 | 0.16 | 0 | 0 | 0.07 | 0 | 0 | 0 |

[a] Listed as Endangered under the ESA.

Table H-90. Behavior: Pre-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, four piles per day, winter): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Impact $L_p$ [a] (0 dB) | Impact $L_p$ [a] (10 dB) | Impact $L_p$ [a] (12 dB) | Impact $L_p$ [a] (15 dB) | Impact $L_p$ [b] (0 dB) | Impact $L_p$ [b] (10 dB) | Impact $L_p$ [b] (12 dB) | Impact $L_p$ [b] (15 dB) | Vibratory $L_p$ [a] (0 dB) | Vibratory $L_p$ [a] (10 dB) | Vibratory $L_p$ [a] (12 dB) | Vibratory $L_p$ [a] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 12.12 | 4.21 | 3.48 | 2.50 | 12.11 | 4.22 | 3.45 | 2.49 | 78.65 | 51.58 | 38.14 | 26.47 |
| LF | Minke whale (migrating) | 10.80 | 3.90 | 3.25 | 2.38 | 81.05 | 42.00 | 28.63 | 19.02 | 70.48 | 45.83 | 34.01 | 23.85 |
| LF | Humpback whale | 11.68 | 4.05 | 3.44 | 2.43 | 11.74 | 4.05 | 3.41 | 2.35 | 77.41 | 49.39 | 36.16 | 25.92 |
| LF | North Atlantic right whale [c] | 11.68 | 3.91 | 3.36 | 2.29 | 11.81 | 3.92 | 3.33 | 2.26 | 73.74 | 44.11 | 34.73 | 24.61 |
| LF | Sei whale [c] (migrating) | 11.82 | 4.13 | 3.34 | 2.33 | 84.23 | 45.14 | 30.40 | 20.07 | 78.55 | 51.01 | 37.70 | 26.08 |
| MF | Atlantic white-sided dolphin | 10.78 | 3.92 | 3.14 | 2.29 | 4.28 | 1.51 | 1.23 | 0.83 | 78.05 | 48.54 | 34.31 | 24.13 |
| MF | Atlantic spotted dolphin | 11.90 | 4.07 | 3.57 | 2.29 | 4.24 | 1.48 | 1.18 | 0.70 | 79.59 | 51.12 | 37.68 | 26.80 |
| MF | Common dolphin | 10.49 | 3.96 | 3.26 | 2.38 | 4.28 | 1.52 | 1.27 | 0.88 | 77.30 | 47.30 | 34.78 | 24.32 |
| MF | Bottlenose dolphin, offshore | 8.33 | 3.24 | 2.69 | 1.99 | 3.80 | 1.38 | 1.10 | 0.76 | 74.04 | 35.55 | 25.31 | 18.69 |
| MF | Risso’s dolphin | 11.76 | 4.00 | 3.31 | 2.40 | 4.38 | 1.51 | 1.17 | 0.81 | 78.97 | 50.94 | 37.25 | 25.83 |
| MF | Long-finned pilot whale | 10.96 | 3.90 | 3.25 | 2.25 | 4.21 | 1.48 | 1.18 | 0.85 | 77.98 | 47.49 | 34.66 | 24.50 |
| MF | Short-finned pilot whale | 11.02 | 3.93 | 3.26 | 2.25 | 4.21 | 1.50 | 1.23 | 0.83 | 78.36 | 50.19 | 36.85 | 25.65 |
| MF | Sperm whale [c] | 11.44 | 3.96 | 3.32 | 2.36 | 4.26 | 1.54 | 1.20 | 0.74 | 78.11 | 50.46 | 37.07 | 25.39 |
| HF | Harbor porpoise (sensitive) | 11.33 | 3.96 | 3.22 | 2.35 | 86.92 | 85.39 | 84.09 | 79.81 | 76.82 | 45.33 | 33.95 | 24.29 |
| PW | Gray seal | 12.65 | 4.42 | 3.61 | 2.65 | 7.83 | 2.80 | 2.28 | 1.58 | 77.60 | 51.47 | 37.76 | 26.19 |
| PW | Harbor seal | 11.37 | 3.86 | 3.27 | 2.43 | 7.14 | 2.63 | 2.07 | 1.53 | 73.53 | 49.30 | 35.82 | 25.30 |
| PW | Harp seal | 11.88 | 4.03 | 3.41 | 2.41 | 7.32 | 2.67 | 2.13 | 1.40 | 78.26 | 51.42 | 37.33 | 26.22 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

## 4.25 m Post-piled Jacket Pile

Table H-91. Injury: Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, four piles per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing Group | Species | $L_E$ (0 dB) | $L_E$ (10 dB) | $L_E$ (12 dB) | $L_E$ (15 dB) | $L_{pk}$ (0 dB) | $L_{pk}$ (10 dB) | $L_{pk}$ (12 dB) | $L_{pk}$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [a] | 11.85 | 4.49 | 3.67 | 2.60 | 0.04 | <0.01 | <0.01 | <0.01 |
| LF | Minke whale (migrating) | 5.78 | 1.88 | 1.37 | 0.74 | 0.02 | <0.01 | <0.01 | <0.01 |
| LF | Humpback whale | 8.78 | 3.30 | 2.59 | 1.55 | 0.03 | 0 | 0 | 0 |
| LF | North Atlantic right whale [a] | 7.88 | 2.49 | 1.81 | 1.25 | 0.05 | <0.01 | <0.01 | 0 |
| LF | Sei whale [a] (migrating) | 8.78 | 2.90 | 2.33 | 1.57 | 0.04 | <0.01 | <0.01 | 0 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Risso’s dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Sperm whale [a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HF | Harbor porpoise (sensitive) | 0.37 | 0 | 0 | 0 | 0.38 | 0.09 | 0.05 | 0.04 |
| PW | Gray seal | 2.75 | 0.46 | 0.46 | 0.28 | <0.01 | 0 | 0 | 0 |
| PW | Harbor seal | 1.49 | 0.10 | 0.10 | 0.01 | 0.06 | 0 | 0 | 0 |
| PW | Harp seal | 1.17 | 0.16 | 0.04 | 0 | 0.07 | 0 | 0 | 0 |

[a] Listed as Endangered under the ESA.

Table H-92. Behavior: Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, four piles per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Impact $L_p$ [a] (0 dB) | Impact $L_p$ [a] (10 dB) | Impact $L_p$ [a] (12 dB) | Impact $L_p$ [a] (15 dB) | Impact $L_p$ [b] (0 dB) | Impact $L_p$ [b] (10 dB) | Impact $L_p$ [b] (12 dB) | Impact $L_p$ [b] (15 dB) | Vibratory $L_p$ [a] (0 dB) | Vibratory $L_p$ [a] (10 dB) | Vibratory $L_p$ [a] (12 dB) | Vibratory $L_p$ [a] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 13.05 | 4.72 | 4.03 | 2.86 | 13.05 | 4.72 | 4.01 | 2.86 | 63.55 | 33.94 | 28.91 | 23.43 |
| LF | Minke whale (migrating) | 11.20 | 4.25 | 3.59 | 2.61 | 62.96 | 27.85 | 22.95 | 18.15 | 53.05 | 28.92 | 25.14 | 20.73 |
| LF | Humpback whale | 12.25 | 4.50 | 3.85 | 2.70 | 12.38 | 4.50 | 3.86 | 2.72 | 59.34 | 31.42 | 27.63 | 22.15 |
| LF | North Atlantic right whale [c] | 12.37 | 4.22 | 3.71 | 2.62 | 12.49 | 4.23 | 3.71 | 2.63 | 53.82 | 30.42 | 26.36 | 21.65 |
| LF | Sei whale [c] (migrating) | 12.81 | 4.69 | 3.72 | 2.68 | 77.65 | 33.08 | 26.76 | 20.03 | 62.05 | 33.43 | 28.77 | 22.92 |
| MF | Atlantic white-sided dolphin | 11.49 | 4.40 | 3.60 | 2.66 | 4.73 | 1.66 | 1.31 | 0.93 | 57.73 | 30.42 | 26.19 | 21.22 |
| MF | Atlantic spotted dolphin | 12.88 | 4.76 | 3.89 | 2.70 | 4.95 | 1.65 | 1.31 | 0.78 | 60.66 | 32.65 | 28.53 | 23.79 |
| MF | Common dolphin | 11.19 | 4.33 | 3.64 | 2.65 | 4.71 | 1.72 | 1.39 | 0.96 | 58.10 | 31.00 | 26.43 | 21.71 |
| MF | Bottlenose dolphin, offshore | 8.51 | 3.51 | 2.92 | 2.21 | 4.03 | 1.62 | 1.24 | 0.91 | 46.69 | 23.31 | 19.99 | 16.30 |
| MF | Risso's dolphin | 12.74 | 4.60 | 3.68 | 2.68 | 5.01 | 1.64 | 1.27 | 0.90 | 61.18 | 33.00 | 28.22 | 22.86 |
| MF | Long-finned pilot whale | 11.51 | 4.28 | 3.61 | 2.62 | 4.71 | 1.68 | 1.30 | 0.97 | 61.09 | 30.88 | 26.58 | 21.40 |
| MF | Short-finned pilot whale | 11.82 | 4.31 | 3.65 | 2.66 | 4.57 | 1.66 | 1.38 | 0.94 | 61.76 | 32.24 | 27.59 | 22.70 |
| MF | Sperm whale [c] | 12.34 | 4.35 | 3.63 | 2.78 | 4.80 | 1.67 | 1.32 | 0.95 | 65.18 | 32.50 | 28.07 | 22.65 |
| HF | Harbor porpoise (sensitive) | 11.59 | 4.18 | 3.56 | 2.63 | 81.53 | 73.68 | 69.58 | 55.53 | 53.17 | 28.50 | 24.92 | 20.96 |
| PW | Gray seal | 13.43 | 5.10 | 4.15 | 3.09 | 8.62 | 3.21 | 2.52 | 1.87 | 62.02 | 33.60 | 29.17 | 23.29 |
| PW | Harbor seal | 11.99 | 4.37 | 3.81 | 2.79 | 7.77 | 3.01 | 2.41 | 1.62 | 58.58 | 31.50 | 27.29 | 22.12 |
| PW | Harp seal | 12.58 | 4.50 | 3.90 | 2.84 | 8.39 | 2.99 | 2.39 | 1.74 | 62.86 | 32.75 | 28.83 | 23.26 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table H-93. Injury: Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, eight piles per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing Group | Species | $L_E$ (0 dB) | $L_E$ (10 dB) | $L_E$ (12 dB) | $L_E$ (15 dB) | $L_{pk}$ (0 dB) | $L_{pk}$ (10 dB) | $L_{pk}$ (12 dB) | $L_{pk}$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [a] | 15.16 | 5.46 | 4.46 | 3.26 | 0.06 | <0.01 | <0.01 | <0.01 |
| LF | Minke whale (migrating) | 7.51 | 2.62 | 2.15 | 1.57 | 0.04 | <0.01 | <0.01 | 0 |
| LF | Humpback whale | 11.16 | 4.23 | 3.58 | 2.49 | 0.02 | 0 | 0 | 0 |
| LF | North Atlantic right whale [a] | 10.34 | 3.56 | 2.71 | 1.93 | 0.03 | 0 | 0 | 0 |
| LF | Sei whale [a] (migrating) | 10.98 | 4.13 | 3.17 | 2.36 | 0.04 | <0.01 | <0.01 | 0 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Risso’s dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Sperm whale [a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HF | Harbor porpoise (sensitive) | 0.72 | 0 | 0 | 0 | 0.38 | 0.09 | 0.05 | <0.01 |
| PW | Gray seal | 2.74 | 0.69 | 0.48 | 0.26 | 0.04 | 0 | 0 | 0 |
| PW | Harbor seal | 2.14 | 0.28 | 0.18 | 0.01 | 0.05 | <0.01 | <0.01 | <0.01 |
| PW | Harp seal | 1.96 | 0.20 | 0.09 | <0.01 | 0.05 | 0 | 0 | 0 |

[a] Listed as Endangered under the ESA.

Table H-94. Behavior: Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, eight piles per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Impact $L_p$ [a] (0 dB) | Impact $L_p$ [a] (10 dB) | Impact $L_p$ [a] (12 dB) | Impact $L_p$ [a] (15 dB) | Impact $L_p$ [b] (0 dB) | Impact $L_p$ [b] (10 dB) | Impact $L_p$ [b] (12 dB) | Impact $L_p$ [b] (15 dB) | Vibratory $L_p$ [a] (0 dB) | Vibratory $L_p$ [a] (10 dB) | Vibratory $L_p$ [a] (12 dB) | Vibratory $L_p$ [a] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 13.39 | 4.92 | 4.09 | 2.94 | 13.39 | 4.80 | 4.09 | 2.95 | 65.58 | 34.71 | 30.07 | 24.02 |
| LF | Minke whale (migrating) | 11.89 | 4.36 | 3.63 | 2.65 | 65.69 | 28.88 | 23.98 | 18.76 | 54.39 | 29.66 | 26.07 | 21.19 |
| LF | Humpback whale | 12.86 | 4.76 | 3.90 | 2.81 | 12.93 | 4.71 | 3.90 | 2.83 | 61.43 | 32.57 | 28.18 | 22.79 |
| LF | North Atlantic right whale [c] | 12.79 | 4.54 | 3.78 | 2.66 | 12.96 | 4.54 | 3.78 | 2.64 | 55.28 | 31.44 | 26.93 | 21.87 |
| LF | Sei whale [c] (migrating) | 13.21 | 4.69 | 3.95 | 2.69 | 79.48 | 34.63 | 28.01 | 20.83 | 64.26 | 34.44 | 29.56 | 23.61 |
| MF | Atlantic white-sided dolphin | 12.07 | 4.38 | 3.59 | 2.62 | 4.75 | 1.71 | 1.34 | 1.00 | 60.68 | 31.50 | 27.29 | 21.97 |
| MF | Atlantic spotted dolphin | 13.05 | 4.97 | 3.79 | 2.64 | 5.13 | 1.69 | 1.32 | 0.79 | 62.53 | 33.34 | 28.71 | 23.58 |
| MF | Common dolphin | 11.71 | 4.43 | 3.74 | 2.67 | 4.76 | 1.69 | 1.39 | 0.92 | 59.71 | 31.67 | 26.85 | 22.19 |
| MF | Bottlenose dolphin, offshore | 9.04 | 3.65 | 3.01 | 2.32 | 4.18 | 1.64 | 1.27 | 0.87 | 50.45 | 24.92 | 21.52 | 16.79 |
| MF | Risso's dolphin | 13.00 | 4.60 | 3.77 | 2.61 | 4.99 | 1.72 | 1.26 | 0.92 | 63.19 | 33.89 | 29.05 | 23.47 |
| MF | Long-finned pilot whale | 12.16 | 4.28 | 3.68 | 2.69 | 4.66 | 1.65 | 1.33 | 0.93 | 63.86 | 32.01 | 27.72 | 21.93 |
| MF | Short-finned pilot whale | 12.36 | 4.39 | 3.67 | 2.63 | 4.67 | 1.68 | 1.33 | 0.93 | 62.87 | 32.90 | 28.03 | 22.90 |
| MF | Sperm whale [c] | 12.95 | 4.64 | 3.75 | 2.81 | 4.88 | 1.68 | 1.26 | 0.98 | 66.42 | 33.46 | 29.06 | 23.23 |
| HF | Harbor porpoise (sensitive) | 12.24 | 4.30 | 3.68 | 2.71 | 82.81 | 75.47 | 70.85 | 56.74 | 54.79 | 29.28 | 25.59 | 21.16 |
| PW | Gray seal | 13.78 | 5.21 | 4.38 | 3.08 | 9.12 | 3.11 | 2.64 | 1.79 | 63.66 | 34.30 | 29.58 | 23.96 |
| PW | Harbor seal | 12.69 | 4.58 | 3.90 | 2.62 | 8.47 | 2.93 | 2.35 | 1.66 | 59.82 | 32.34 | 27.77 | 22.82 |
| PW | Harp seal | 13.34 | 4.77 | 3.91 | 2.88 | 8.81 | 3.03 | 2.41 | 1.68 | 64.53 | 34.37 | 29.36 | 24.15 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table H-95. Injury: Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, four piles per day, winter): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing Group | Species | $L_E$ (0 dB) | $L_E$ (10 dB) | $L_E$ (12 dB) | $L_E$ (15 dB) | $L_{pk}$ (0 dB) | $L_{pk}$ (10 dB) | $L_{pk}$ (12 dB) | $L_{pk}$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [a] | 15.22 | 4.81 | 4.08 | 2.80 | 0.04 | <0.01 | <0.01 | <0.01 |
| LF | Minke whale (migrating) | 7.52 | 2.17 | 1.59 | 0.88 | 0.02 | <0.01 | <0.01 | <0.01 |
| LF | Humpback whale | 12.63 | 3.79 | 2.97 | 1.99 | 0.04 | 0 | 0 | 0 |
| LF | North Atlantic right whale [a] | 10.07 | 2.86 | 2.11 | 1.39 | 0.05 | <0.01 | <0.01 | 0 |
| LF | Sei whale [a] (migrating) | 11.01 | 3.26 | 2.66 | 1.70 | 0.04 | <0.01 | <0.01 | 0 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Risso’s dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Sperm whale [a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HF | Harbor porpoise (sensitive) | 0.39 | 0 | 0 | 0 | 0.39 | 0.07 | 0.05 | 0.05 |
| PW | Gray seal | 2.84 | 0.73 | 0.46 | 0.28 | <0.01 | 0 | 0 | 0 |
| PW | Harbor seal | 1.65 | 0.13 | 0.10 | 0.01 | 0.06 | 0 | 0 | 0 |
| PW | Harp seal | 1.44 | 0.16 | 0.04 | 0 | 0.07 | 0 | 0 | 0 |

[a] Listed as Endangered under the ESA.

Table H-96. Behavior: Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, four piles per day, winter): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Impact $L_p$ [a] (0 dB) | Impact $L_p$ [a] (10 dB) | Impact $L_p$ [a] (12 dB) | Impact $L_p$ [a] (15 dB) | Impact $L_p$ [b] (0 dB) | Impact $L_p$ [b] (10 dB) | Impact $L_p$ [b] (12 dB) | Impact $L_p$ [b] (15 dB) | Vibratory $L_p$ [a] (0 dB) | Vibratory $L_p$ [a] (10 dB) | Vibratory $L_p$ [a] (12 dB) | Vibratory $L_p$ [a] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 14.88 | 4.84 | 4.14 | 2.92 | 14.87 | 4.86 | 4.15 | 2.91 | 83.11 | 71.90 | 51.58 | 33.81 |
| LF | Minke whale (migrating) | 13.19 | 4.51 | 3.82 | 2.75 | 83.65 | 53.82 | 40.93 | 23.42 | 78.55 | 53.97 | 45.83 | 29.88 |
| LF | Humpback whale | 14.40 | 4.91 | 4.02 | 2.82 | 14.43 | 4.85 | 4.00 | 2.83 | 81.96 | 67.05 | 49.39 | 32.01 |
| LF | North Atlantic right whale [c] | 13.92 | 4.60 | 3.82 | 2.73 | 14.01 | 4.49 | 3.82 | 2.72 | 78.94 | 51.82 | 44.11 | 30.75 |
| LF | Sei whale [c] (migrating) | 14.22 | 4.86 | 3.95 | 2.82 | 85.56 | 70.55 | 44.69 | 25.77 | 83.19 | 72.48 | 51.01 | 33.13 |
| MF | Atlantic white-sided dolphin | 12.99 | 4.62 | 3.83 | 2.80 | 5.18 | 1.76 | 1.39 | 0.94 | 83.09 | 69.18 | 48.54 | 30.63 |
| MF | Atlantic spotted dolphin | 14.40 | 5.01 | 3.92 | 2.70 | 5.46 | 1.68 | 1.31 | 0.79 | 84.03 | 71.63 | 51.12 | 33.18 |
| MF | Common dolphin | 12.73 | 4.60 | 3.83 | 2.81 | 5.15 | 1.77 | 1.46 | 0.98 | 82.93 | 68.02 | 47.30 | 30.98 |
| MF | Bottlenose dolphin, offshore | 10.47 | 3.70 | 3.12 | 2.30 | 4.38 | 1.66 | 1.25 | 0.92 | 81.63 | 62.95 | 35.55 | 22.66 |
| MF | Risso’s dolphin | 14.16 | 4.88 | 3.84 | 2.77 | 5.30 | 1.69 | 1.41 | 0.92 | 83.76 | 72.97 | 50.94 | 32.99 |
| MF | Long-finned pilot whale | 13.39 | 4.60 | 3.74 | 2.67 | 5.13 | 1.74 | 1.35 | 0.97 | 82.00 | 66.44 | 47.49 | 30.78 |
| MF | Short-finned pilot whale | 13.37 | 4.54 | 3.79 | 2.79 | 5.05 | 1.74 | 1.40 | 0.97 | 83.40 | 71.26 | 50.19 | 32.03 |
| MF | Sperm whale [c] | 13.97 | 4.73 | 3.77 | 2.90 | 5.34 | 1.73 | 1.37 | 0.96 | 82.53 | 70.58 | 50.46 | 32.44 |
| HF | Harbor porpoise (sensitive) | 13.53 | 4.67 | 3.84 | 2.70 | 87.18 | 85.70 | 85.28 | 83.24 | 81.58 | 62.11 | 45.33 | 30.05 |
| PW | Gray seal | 15.36 | 5.25 | 4.30 | 3.21 | 9.52 | 3.35 | 2.65 | 1.91 | 82.00 | 69.34 | 51.47 | 33.51 |
| PW | Harbor seal | 13.73 | 4.66 | 3.79 | 2.90 | 8.91 | 3.19 | 2.53 | 1.64 | 78.40 | 59.59 | 49.30 | 31.59 |
| PW | Harp seal | 14.40 | 4.80 | 3.98 | 2.96 | 9.18 | 3.23 | 2.57 | 1.76 | 82.87 | 71.10 | 51.42 | 32.75 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table H-97. Injury: Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, eight piles per day, winter): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing Group | Species | $L_E$ (0 dB) | $L_E$ (10 dB) | $L_E$ (12 dB) | $L_E$ (15 dB) | $L_{pk}$ (0 dB) | $L_{pk}$ (10 dB) | $L_{pk}$ (12 dB) | $L_{pk}$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [a] | 22.78 | 6.28 | 4.88 | 3.67 | 0.06 | <0.01 | <0.01 | <0.01 |
| LF | Minke whale (migrating) | 11.54 | 3.03 | 2.39 | 1.67 | 0.05 | <0.01 | <0.01 | 0 |
| LF | Humpback whale | 19.42 | 5.27 | 4.02 | 2.81 | 0.02 | 0 | 0 | 0 |
| LF | North Atlantic right whale [a] | 14.93 | 4.04 | 3.21 | 2.06 | 0.03 | 0 | 0 | 0 |
| LF | Sei whale [a] (migrating) | 16.13 | 4.59 | 3.69 | 2.59 | 0.04 | <0.01 | <0.01 | 0 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Risso’s dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Sperm whale [a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HF | Harbor porpoise (sensitive) | 0.72 | 0 | 0 | 0 | 0.37 | 0.09 | 0.06 | <0.01 |
| PW | Gray seal | 2.97 | 0.77 | 0.48 | 0.26 | 0.04 | 0 | 0 | 0 |
| PW | Harbor seal | 2.35 | 0.28 | 0.25 | 0.01 | 0.05 | <0.01 | <0.01 | <0.01 |
| PW | Harp seal | 2.24 | 0.22 | 0.09 | <0.01 | 0.05 | 0 | 0 | 0 |

[a] Listed as Endangered under the ESA.

Table H-98. Behavior: Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, eight piles per day, winter): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Impact $L_p$ [a] (0 dB) | Impact $L_p$ [a] (10 dB) | Impact $L_p$ [a] (12 dB) | Impact $L_p$ [a] (15 dB) | Impact $L_p$ [b] (0 dB) | Impact $L_p$ [b] (10 dB) | Impact $L_p$ [b] (12 dB) | Impact $L_p$ [b] (15 dB) | Vibratory $L_p$ [a] (0 dB) | Vibratory $L_p$ [a] (10 dB) | Vibratory $L_p$ [a] (12 dB) | Vibratory $L_p$ [a] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 15.67 | 5.10 | 4.20 | 3.04 | 15.69 | 5.03 | 4.19 | 3.01 | 83.82 | 74.82 | 53.08 | 34.70 |
| LF | Minke whale (migrating) | 14.03 | 4.67 | 3.86 | 2.76 | 84.21 | 58.01 | 43.90 | 25.15 | 80.31 | 55.99 | 46.97 | 31.21 |
| LF | Humpback whale | 15.46 | 4.95 | 4.00 | 2.96 | 15.45 | 4.94 | 4.01 | 2.95 | 82.92 | 69.59 | 51.32 | 33.24 |
| LF | North Atlantic right whale [c] | 14.95 | 4.83 | 3.88 | 2.73 | 15.05 | 4.73 | 3.89 | 2.69 | 81.05 | 52.65 | 44.82 | 31.78 |
| LF | Sei whale [c] (migrating) | 15.20 | 4.81 | 4.07 | 2.78 | 85.87 | 75.72 | 48.28 | 27.88 | 84.37 | 75.00 | 52.74 | 34.48 |
| MF | Atlantic white-sided dolphin | 14.01 | 4.67 | 3.78 | 2.74 | 5.28 | 1.79 | 1.42 | 1.02 | 83.97 | 72.50 | 50.37 | 31.71 |
| MF | Atlantic spotted dolphin | 15.15 | 5.18 | 3.86 | 2.68 | 5.49 | 1.71 | 1.32 | 0.79 | 84.76 | 74.17 | 52.23 | 33.71 |
| MF | Common dolphin | 13.50 | 4.71 | 3.85 | 2.79 | 5.19 | 1.79 | 1.43 | 0.95 | 83.82 | 71.12 | 49.32 | 31.74 |
| MF | Bottlenose dolphin, offshore | 11.28 | 3.95 | 3.16 | 2.41 | 4.47 | 1.69 | 1.29 | 0.90 | 82.58 | 69.48 | 39.20 | 24.41 |
| MF | Risso's dolphin | 15.02 | 4.87 | 3.88 | 2.86 | 5.43 | 1.81 | 1.36 | 0.95 | 84.98 | 75.99 | 52.53 | 33.91 |
| MF | Long-finned pilot whale | 14.24 | 4.57 | 3.84 | 2.80 | 5.17 | 1.69 | 1.35 | 0.95 | 83.20 | 70.70 | 49.97 | 31.97 |
| MF | Short-finned pilot whale | 14.33 | 4.56 | 3.85 | 2.72 | 5.12 | 1.72 | 1.38 | 0.97 | 84.08 | 73.18 | 51.25 | 32.89 |
| MF | Sperm whale [c] | 15.05 | 4.76 | 3.85 | 2.92 | 5.28 | 1.71 | 1.33 | 1.01 | 83.24 | 73.51 | 52.31 | 33.43 |
| HF | Harbor porpoise (sensitive) | 14.51 | 4.58 | 3.88 | 2.78 | 87.35 | 86.15 | 85.90 | 84.24 | 82.92 | 65.47 | 47.71 | 30.82 |
| PW | Gray seal | 16.45 | 5.24 | 4.43 | 3.09 | 9.93 | 3.37 | 2.66 | 1.95 | 82.06 | 71.47 | 53.12 | 34.31 |
| PW | Harbor seal | 15.02 | 4.78 | 3.93 | 2.78 | 9.22 | 3.17 | 2.46 | 1.72 | 78.90 | 62.14 | 50.58 | 32.80 |
| PW | Harp seal | 15.43 | 5.02 | 4.04 | 2.98 | 9.20 | 3.22 | 2.47 | 1.71 | 83.41 | 73.86 | 53.41 | 34.42 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table H-99. Injury: Post-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, four piles per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing Group | Species | $L_E$ (0 dB) | $L_E$ (10 dB) | $L_E$ (12 dB) | $L_E$ (15 dB) | $L_{pk}$ (0 dB) | $L_{pk}$ (10 dB) | $L_{pk}$ (12 dB) | $L_{pk}$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [a] | 12.83 | 4.81 | 4.07 | 2.82 | 0.04 | <0.01 | <0.01 | <0.01 |
| LF | Minke whale (migrating) | 6.35 | 2.08 | 1.59 | 0.91 | 0.03 | <0.01 | <0.01 | <0.01 |
| LF | Humpback whale | 9.43 | 3.61 | 2.90 | 2.03 | 0.03 | 0 | 0 | 0 |
| LF | North Atlantic right whale [a] | 8.27 | 2.81 | 2.17 | 1.40 | 0.05 | <0.01 | <0.01 | 0 |
| LF | Sei whale [a] (migrating) | 9.19 | 3.19 | 2.66 | 1.71 | 0.05 | <0.01 | <0.01 | <0.01 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Risso's dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Sperm whale [a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HF | Harbor porpoise (sensitive) | 0.41 | 0 | 0 | 0 | 0.42 | 0.11 | 0.05 | 0.04 |
| PW | Gray seal | 2.83 | 0.81 | 0.46 | 0.39 | <0.01 | 0 | 0 | 0 |
| PW | Harbor seal | 1.81 | 0.17 | 0.09 | 0.01 | 0.06 | <0.01 | 0 | 0 |
| PW | Harp seal | 1.67 | 0.15 | 0.04 | 0 | 0.07 | 0 | 0 | 0 |

[a] Listed as Endangered under the ESA.

Table H-100. Behavior: Post-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, four piles per day, summer): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Impact $L_p$ [a] (0 dB) | Impact $L_p$ [a] (10 dB) | Impact $L_p$ [a] (12 dB) | Impact $L_p$ [a] (15 dB) | Impact $L_p$ [b] (0 dB) | Impact $L_p$ [b] (10 dB) | Impact $L_p$ [b] (12 dB) | Impact $L_p$ [b] (15 dB) | Vibratory $L_p$ [a] (0 dB) | Vibratory $L_p$ [a] (10 dB) | Vibratory $L_p$ [a] (12 dB) | Vibratory $L_p$ [a] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 13.18 | 4.76 | 4.09 | 2.90 | 13.18 | 4.77 | 4.08 | 2.90 | 63.55 | 33.94 | 28.91 | 23.43 |
| LF | Minke whale (migrating) | 11.56 | 4.32 | 3.67 | 2.73 | 63.14 | 28.13 | 23.25 | 18.43 | 53.05 | 28.92 | 25.14 | 20.73 |
| LF | Humpback whale | 12.42 | 4.56 | 3.88 | 2.85 | 12.62 | 4.58 | 3.90 | 2.86 | 59.34 | 31.42 | 27.63 | 22.15 |
| LF | North Atlantic right whale [c] | 12.53 | 4.44 | 3.82 | 2.83 | 12.68 | 4.46 | 3.81 | 2.80 | 53.82 | 30.42 | 26.36 | 21.65 |
| LF | Sei whale [c] (migrating) | 12.89 | 4.78 | 3.94 | 2.82 | 77.66 | 33.15 | 26.84 | 20.21 | 62.05 | 33.43 | 28.77 | 22.92 |
| MF | Atlantic white-sided dolphin | 11.69 | 4.49 | 3.71 | 2.76 | 4.82 | 1.82 | 1.48 | 1.04 | 57.73 | 30.42 | 26.19 | 21.22 |
| MF | Atlantic spotted dolphin | 13.15 | 5.00 | 4.08 | 3.23 | 5.13 | 1.88 | 1.52 | 1.01 | 60.66 | 32.65 | 28.53 | 23.79 |
| MF | Common dolphin | 11.54 | 4.41 | 3.74 | 2.78 | 4.79 | 1.87 | 1.50 | 1.01 | 58.10 | 31.00 | 26.43 | 21.71 |
| MF | Bottlenose dolphin, offshore | 8.57 | 3.61 | 3.03 | 2.37 | 4.26 | 1.79 | 1.37 | 0.97 | 46.69 | 23.31 | 19.99 | 16.30 |
| MF | Risso's dolphin | 12.93 | 4.69 | 3.84 | 2.76 | 5.05 | 1.77 | 1.46 | 0.99 | 61.18 | 33.00 | 28.22 | 22.86 |
| MF | Long-finned pilot whale | 11.76 | 4.44 | 3.70 | 2.71 | 4.79 | 1.77 | 1.45 | 1.02 | 61.09 | 30.88 | 26.58 | 21.40 |
| MF | Short-finned pilot whale | 12.20 | 4.48 | 3.79 | 2.80 | 4.77 | 1.80 | 1.47 | 1.03 | 61.76 | 32.24 | 27.59 | 22.70 |
| MF | Sperm whale [c] | 12.56 | 4.58 | 3.75 | 2.88 | 4.92 | 1.82 | 1.46 | 1.02 | 65.18 | 32.50 | 28.07 | 22.65 |
| HF | Harbor porpoise (sensitive) | 11.89 | 4.34 | 3.69 | 2.74 | 81.72 | 74.17 | 69.66 | 55.57 | 53.17 | 28.50 | 24.92 | 20.96 |
| PW | Gray seal | 13.43 | 5.09 | 4.17 | 3.12 | 8.62 | 3.31 | 2.76 | 1.91 | 62.02 | 33.60 | 29.17 | 23.29 |
| PW | Harbor seal | 12.25 | 4.41 | 3.89 | 2.88 | 7.83 | 3.08 | 2.50 | 1.73 | 58.58 | 31.50 | 27.29 | 22.12 |
| PW | Harp seal | 12.70 | 4.54 | 3.94 | 2.96 | 8.55 | 3.11 | 2.55 | 1.82 | 62.86 | 32.75 | 28.83 | 23.26 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

Table H-101. Injury: Post-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, four piles per day, winter): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing Group | Species | $L_E$ (0 dB) | $L_E$ (10 dB) | $L_E$ (12 dB) | $L_E$ (15 dB) | $L_{pk}$ (0 dB) | $L_{pk}$ (10 dB) | $L_{pk}$ (12 dB) | $L_{pk}$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [a] | 16.41 | 5.29 | 4.22 | 3.16 | 0.04 | <0.01 | <0.01 | <0.01 |
| LF | Minke whale (migrating) | 8.05 | 2.31 | 1.83 | 1.06 | 0.03 | <0.01 | <0.01 | <0.01 |
| LF | Humpback whale | 13.68 | 4.02 | 3.30 | 2.26 | 0.04 | 0 | 0 | 0 |
| LF | North Atlantic right whale [a] | 11.34 | 3.22 | 2.36 | 1.47 | 0.05 | <0.01 | <0.01 | 0 |
| LF | Sei whale [a] (migrating) | 12.26 | 3.84 | 2.90 | 1.91 | 0.05 | <0.01 | <0.01 | <0.01 |
| MF | Atlantic white-sided dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Atlantic spotted dolphin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Common dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Bottlenose dolphin, offshore | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Risso’s dolphin | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Long-finned pilot whale | 0 | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 |
| MF | Short-finned pilot whale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MF | Sperm whale [a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HF | Harbor porpoise (sensitive) | 0.42 | 0 | 0 | 0 | 0.42 | 0.13 | 0.05 | 0.05 |
| PW | Gray seal | 3.09 | 0.81 | 0.46 | 0.39 | <0.01 | 0 | 0 | 0 |
| PW | Harbor seal | 2.12 | 0.17 | 0.10 | 0.10 | 0.06 | <0.01 | 0 | 0 |
| PW | Harp seal | 1.77 | 0.14 | 0.16 | 0 | 0.07 | 0 | 0 | 0 |

[a] Listed as Endangered under the ESA.

Table H-102. Behavior: Post-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, four piles per day, winter): Vibratory and impact exposure ranges ($ER_{95\%}$) in km to marine mammal threshold criteria with sound attenuation.

| Hearing group | Species | Impact $L_p$ [a] (0 dB) | Impact $L_p$ [a] (10 dB) | Impact $L_p$ [a] (12 dB) | Impact $L_p$ [a] (15 dB) | Impact $L_p$ [b] (0 dB) | Impact $L_p$ [b] (10 dB) | Impact $L_p$ [b] (12 dB) | Impact $L_p$ [b] (15 dB) | Vibratory $L_p$ [a] (0 dB) | Vibratory $L_p$ [a] (10 dB) | Vibratory $L_p$ [a] (12 dB) | Vibratory $L_p$ [a] (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF | Fin whale [c] | 14.99 | 4.91 | 4.21 | 2.97 | 14.98 | 4.91 | 4.22 | 2.97 | 83.11 | 71.90 | 51.58 | 33.81 |
| LF | Minke whale (migrating) | 13.54 | 4.60 | 3.90 | 2.87 | 83.87 | 54.16 | 42.00 | 24.25 | 78.55 | 53.97 | 45.83 | 29.88 |
| LF | Humpback whale | 14.64 | 4.93 | 4.05 | 2.90 | 14.68 | 4.92 | 4.05 | 2.92 | 81.96 | 67.05 | 49.39 | 32.01 |
| LF | North Atlantic right whale [c] | 14.21 | 4.75 | 3.91 | 2.94 | 14.39 | 4.72 | 3.92 | 2.94 | 78.94 | 51.82 | 44.11 | 30.75 |
| LF | Sei whale [c] (migrating) | 14.50 | 4.97 | 4.13 | 2.94 | 85.72 | 73.03 | 45.14 | 26.26 | 83.19 | 72.48 | 51.01 | 33.13 |
| MF | Atlantic white-sided dolphin | 13.44 | 4.73 | 3.92 | 2.88 | 5.26 | 1.88 | 1.51 | 1.07 | 83.09 | 69.18 | 48.54 | 30.63 |
| MF | Atlantic spotted dolphin | 14.81 | 5.24 | 4.07 | 3.24 | 5.57 | 1.85 | 1.48 | 1.02 | 84.03 | 71.63 | 51.12 | 33.18 |
| MF | Common dolphin | 13.16 | 4.70 | 3.96 | 2.92 | 5.25 | 1.91 | 1.52 | 1.05 | 82.93 | 68.02 | 47.30 | 30.98 |
| MF | Bottlenose dolphin, offshore | 10.47 | 3.88 | 3.24 | 2.50 | 4.56 | 1.80 | 1.38 | 0.98 | 81.63 | 62.95 | 35.55 | 22.66 |
| MF | Risso’s dolphin | 14.56 | 4.93 | 4.00 | 2.91 | 5.37 | 1.81 | 1.51 | 1.02 | 83.76 | 72.97 | 50.94 | 32.99 |
| MF | Long-finned pilot whale | 13.74 | 4.73 | 3.90 | 2.82 | 5.26 | 1.82 | 1.48 | 1.05 | 82.00 | 66.44 | 47.49 | 30.78 |
| MF | Short-finned pilot whale | 13.93 | 4.71 | 3.93 | 2.94 | 5.20 | 1.85 | 1.50 | 1.06 | 83.40 | 71.26 | 50.19 | 32.03 |
| MF | Sperm whale [c] | 14.29 | 4.89 | 3.96 | 2.97 | 5.37 | 1.88 | 1.54 | 1.05 | 82.53 | 70.58 | 50.46 | 32.44 |
| HF | Harbor porpoise (sensitive) | 13.89 | 4.85 | 3.96 | 2.86 | 87.34 | 85.92 | 85.39 | 83.30 | 81.58 | 62.11 | 45.33 | 30.05 |
| PW | Gray seal | 15.37 | 5.27 | 4.42 | 3.28 | 9.62 | 3.35 | 2.80 | 2.02 | 82.00 | 69.34 | 51.47 | 33.51 |
| PW | Harbor seal | 14.03 | 4.71 | 3.86 | 2.94 | 8.95 | 3.22 | 2.63 | 1.76 | 78.40 | 59.59 | 49.30 | 31.59 |
| PW | Harp seal | 14.64 | 4.86 | 4.03 | 3.08 | 9.27 | 3.32 | 2.67 | 1.86 | 82.87 | 71.10 | 51.42 | 32.75 |

[a] NOAA (2005), [b] Wood et al. (2012), [c] Listed as Endangered under the ESA

### H.2.3.2. Sea Turtles

### 14 m Monopile

Table H-103. Monopile foundation (14 m diameter, typical, 5500 kJ hammer, one per day, summer) sea turtle exposure ranges ($ER_{95\%}$) in km for injury thresholds (impact piling only) and behavioral thresholds (30 minute vibratory plus impact piling), with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.55 | 0.09 | 0 | 0 | 0 | 0 | 0 | 0 | 3.36 | 1.32 | 1.03 | 0.55 |
| Leatherback turtle [a] | 2.51 | 0.46 | 0.44 | 0 | 0 | 0 | 0 | 0 | 3.86 | 1.42 | 1.09 | 0.46 |
| Loggerhead turtle | 0.63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.07 | 0.99 | 0.72 | 0.64 |
| Green turtle | 1.95 | 0.22 | 0.19 | 0 | 0 | 0 | 0 | 0 | 3.51 | 1.42 | 0.94 | 0.53 |

a Listed as Endangered under the ESA.

Table H-104. Monopile foundation (14 m diameter, typical, 5500 kJ hammer, two per day, summer) sea turtle exposure ranges ($ER_{95\%}$) in km for injury thresholds (impact piling only) and behavioral thresholds (30 minute vibratory plus impact piling), with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.64 | 0.07 | 0.07 | 0 | 0 | 0 | 0 | 0 | 3.56 | 1.34 | 0.93 | 0.71 |
| Leatherback turtle [a] | 2.57 | 0.45 | 0.38 | 0.20 | 0 | 0 | 0 | 0 | 3.97 | 1.57 | 1.21 | 0.68 |
| Loggerhead turtle | 0.84 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.32 | 0.89 | 0.72 | 0.46 |
| Green turtle | 2.15 | 0.31 | 0.17 | <0.01 | 0 | 0 | 0 | 0 | 3.66 | 1.29 | 0.99 | 0.77 |

a Listed as Endangered under the ESA.

Table H-105. Monopile foundation (14 m diameter, typical, 5500 kJ hammer, one per day, winter) sea turtle exposure ranges ($ER_{95\%}$) in km for injury thresholds (impact piling only) and behavioral thresholds (30 minute vibratory plus impact piling), with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.76 | 0.09 | 0 | 0 | 0 | 0 | 0 | 0 | 3.57 | 1.51 | 1.03 | 0.66 |
| Leatherback turtle [a] | 2.49 | 0.46 | 0.44 | 0 | 0 | 0 | 0 | 0 | 4.07 | 1.57 | 1.25 | 0.46 |
| Loggerhead turtle | 0.67 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.23 | 1.07 | 0.83 | 0.67 |
| Green turtle | 2.01 | 0.22 | 0.19 | 0 | 0 | 0 | 0 | 0 | 3.61 | 1.40 | 0.97 | 0.53 |

a Listed as Endangered under the ESA.

Table H-106. Monopile foundation (14 m diameter, typical, 5500 kJ hammer, two per day, winter) sea turtle exposure ranges ($ER_{95\%}$) in km for injury thresholds (impact piling only) and behavioral thresholds (30 minute vibratory plus impact piling), with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.74 | 0.07 | 0.07 | 0 | 0 | 0 | 0 | 0 | 3.59 | 1.40 | 0.98 | 0.71 |
| Leatherback turtle [a] | 2.80 | 0.55 | 0.38 | 0.20 | 0 | 0 | 0 | 0 | 4.09 | 1.62 | 1.21 | 0.71 |
| Loggerhead turtle | 0.87 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.35 | 1.08 | 0.82 | 0.49 |
| Green turtle | 2.29 | 0.31 | 0.17 | <0.01 | 0 | 0 | 0 | 0 | 3.73 | 1.32 | 0.99 | 0.80 |

a Listed as Endangered under the ESA.

Table H-107. Monopile foundation (14 m diameter, difficult to drive, 6600 kJ hammer, one per day, summer) sea turtle exposure ranges ($ER_{95\%}$) in km for injury thresholds (impact piling only) and behavioral thresholds (30 minute vibratory plus impact piling), with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.20 | 0.12 | 0.09 | 0 | <0.01 | 0 | 0 | 0 | 4.26 | 1.57 | 1.30 | 0.94 |
| Leatherback turtle [a] | 3.14 | 0.75 | 0.46 | 0.30 | 0 | 0 | 0 | 0 | 4.64 | 1.84 | 1.42 | 1.10 |
| Loggerhead turtle | 0.97 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 3.58 | 1.42 | 0.97 | 0.67 |
| Green turtle | 2.94 | 0.46 | 0.22 | 0 | 0 | 0 | 0 | 0 | 3.89 | 1.57 | 1.40 | 0.82 |

a Listed as Endangered under the ESA.

Table H-108. Monopile foundation (14 m diameter, difficult to drive, 6600 kJ hammer, one per day, winter) sea turtle exposure ranges ($ER_{95\%}$) in km for injury thresholds (impact piling only) and behavioral thresholds (30 minute vibratory plus impact piling), with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.26 | 0.27 | 0.09 | 0 | <0.01 | 0 | 0 | 0 | 4.38 | 1.72 | 1.50 | 1.03 |
| Leatherback turtle [a] | 3.22 | 0.75 | 0.46 | 0.30 | 0 | 0 | 0 | 0 | 5.00 | 1.84 | 1.57 | 1.10 |
| Loggerhead turtle | 1.87 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 3.90 | 1.51 | 1.07 | 0.67 |
| Green turtle | 3.00 | 0.47 | 0.22 | 0 | 0 | 0 | 0 | 0 | 4.39 | 1.59 | 1.40 | 0.95 |

a Listed as Endangered under the ESA.

## 4.25 m Pre-piled Jacket Pile

Table H-109. Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, four piles per day, summer) sea turtle exposure ranges ($ER_{95\%}$) in km for injury thresholds (impact piling only) and behavioral thresholds (30 minute vibratory plus impact piling), with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.18 | 0.08 | 0 | 0 | 0 | 0 | 0 | 0 | 1.93 | 0.51 | 0.37 | 0.24 |
| Leatherback turtle [a] | 3.40 | 0.93 | 0.73 | 0.34 | 0 | 0 | 0 | 0 | 2.53 | 0.81 | 0.34 | 0.30 |
| Loggerhead turtle | 0.81 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.87 | 0.48 | 0.30 | 0.23 |
| Green turtle | 2.19 | 0.19 | 0.11 | 0 | 0 | 0 | 0 | 0 | 2.20 | 0.59 | 0.33 | 0.26 |

a Listed as Endangered under the ESA.

Table H-110. Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, eight piles per day, summer) sea turtle exposure ranges ($ER_{95\%}$) in km for injury thresholds (impact piling only) and behavioral thresholds (30 minute vibratory plus impact piling), with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.95 | 0.25 | 0.10 | 0 | 0 | 0 | 0 | 0 | 2.03 | 0.53 | 0.31 | 0.25 |
| Leatherback turtle [a] | 3.87 | 0.97 | 0.75 | 0.38 | 0 | 0 | 0 | 0 | 2.51 | 0.72 | 0.58 | 0.33 |
| Loggerhead turtle | 0.95 | 0.17 | 0 | 0 | 0 | 0 | 0 | 0 | 1.72 | 0.48 | 0.32 | 0.23 |
| Green turtle | 2.76 | 0.45 | 0.29 | 0.05 | 0 | 0 | 0 | 0 | 2.28 | 0.66 | 0.42 | 0.29 |

a Listed as Endangered under the ESA.

Table H-111. Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, four piles per day, winter) sea turtle exposure ranges ($ER_{95\%}$) in km for injury thresholds (impact piling only) and behavioral thresholds (30 minute vibratory plus impact piling), with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.28 | 0.08 | 0 | 0 | 0 | 0 | 0 | 0 | 2.05 | 0.53 | 0.39 | 0.24 |
| Leatherback turtle [a] | 3.65 | 0.93 | 0.73 | 0.34 | 0 | 0 | 0 | 0 | 2.56 | 0.81 | 0.34 | 0.30 |
| Loggerhead turtle | 0.91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.93 | 0.48 | 0.30 | 0.23 |
| Green turtle | 2.36 | 0.19 | 0.13 | 0 | 0 | 0 | 0 | 0 | 2.29 | 0.64 | 0.45 | 0.26 |

a Listed as Endangered under the ESA.

Table H-112. Pre-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, eight piles per day, winter) sea turtle exposure ranges ($ER_{95\%}$) in km for injury thresholds (impact piling only) and behavioral thresholds (30 minute vibratory plus impact piling), with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.18 | 0.27 | 0.11 | 0 | 0 | 0 | 0 | 0 | 2.14 | 0.53 | 0.31 | 0.26 |
| Leatherback turtle [a] | 4.21 | 1.04 | 0.75 | 0.38 | 0 | 0 | 0 | 0 | 2.59 | 0.79 | 0.58 | 0.31 |
| Loggerhead turtle | 1.17 | 0.17 | 0 | 0 | 0 | 0 | 0 | 0 | 1.84 | 0.50 | 0.39 | 0.25 |
| Green turtle | 3.05 | 0.46 | 0.29 | 0.11 | 0 | 0 | 0 | 0 | 2.38 | 0.67 | 0.50 | 0.27 |

a Listed as Endangered under the ESA.

Table H-113. Pre-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, four piles per day, summer) sea turtle exposure ranges ($ER_{95\%}$) in km for injury thresholds (impact piling only) and behavioral thresholds (30 minute vibratory plus impact piling), with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.36 | 0.22 | 0 | 0 | 0 | 0 | 0 | 0 | 2.06 | 0.62 | 0.45 | 0.28 |
| Leatherback turtle [a] | 3.70 | 1.14 | 0.73 | 0.34 | 0 | 0 | 0 | 0 | 2.58 | 0.81 | 0.34 | 0.34 |
| Loggerhead turtle | 0.93 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.93 | 0.61 | 0.32 | 0.23 |
| Green turtle | 2.42 | 0.22 | 0.15 | 0 | 0 | 0 | 0 | 0 | 2.31 | 0.68 | 0.46 | 0.26 |

a Listed as Endangered under the ESA.

Table H-114. Pre-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, four piles per day, winter) sea turtle exposure ranges ($ER_{95\%}$) in km for injury thresholds (impact piling only) and behavioral thresholds (30 minute vibratory plus impact piling), with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.86 | 0.21 | 0.08 | 0 | 0 | 0 | 0 | 0 | 2.17 | 0.63 | 0.45 | 0.25 |
| Leatherback turtle [a] | 3.99 | 1.15 | 0.83 | 0.34 | 0 | 0 | 0 | 0 | 2.67 | 0.81 | 0.34 | 0.34 |
| Loggerhead turtle | 0.93 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.02 | 0.61 | 0.32 | 0.23 |
| Green turtle | 2.45 | 0.26 | 0.17 | 0 | 0 | 0 | 0 | 0 | 2.39 | 0.72 | 0.47 | 0.26 |

a Listed as Endangered under the ESA.

## 4.25 m Post-piled Jacket Pile

Table H-115. Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, four piles per day, summer) sea turtle exposure ranges ($ER_{95\%}$) in km for injury thresholds (impact piling only) and behavioral thresholds (30 minute vibratory plus impact piling), with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 1.90 | 0.24 | 0.08 | 0 | 0 | 0 | 0 | 0 | 2.51 | 0.79 | 0.51 | 0.29 |
| Leatherback turtle [a] | 4.50 | 1.27 | 0.93 | 0.63 | 0 | 0 | 0 | 0 | 3.12 | 0.98 | 0.81 | 0.34 |
| Loggerhead turtle | 0.92 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.36 | 0.65 | 0.48 | 0.30 |
| Green turtle | 2.60 | 0.31 | 0.19 | 0.11 | 0 | 0 | 0 | 0 | 2.74 | 0.83 | 0.59 | 0.30 |

a Listed as Endangered under the ESA.

Table H-116. Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, eight piles per day, summer) sea turtle exposure ranges ($ER_{95\%}$) in km for injury thresholds (impact piling only) and behavioral thresholds (30 minute vibratory plus impact piling), with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.54 | 0.44 | 0.25 | 0.09 | 0 | 0 | 0 | 0 | 2.51 | 0.75 | 0.53 | 0.31 |
| Leatherback turtle [a] | 4.68 | 1.37 | 0.97 | 0.66 | 0 | 0 | 0 | 0 | 3.20 | 0.99 | 0.72 | 0.33 |
| Loggerhead turtle | 1.45 | 0.20 | 0.17 | 0 | 0 | 0 | 0 | 0 | 2.35 | 0.72 | 0.48 | 0.27 |
| Green turtle | 3.53 | 0.69 | 0.45 | 0.15 | 0 | 0 | 0 | 0 | 2.76 | 0.84 | 0.66 | 0.30 |

a Listed as Endangered under the ESA.

Table H-117. Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, four piles per day, winter) sea turtle exposure ranges ($ER_{95\%}$) in km for injury thresholds (impact piling only) and behavioral thresholds (30 minute vibratory plus impact piling), with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.08 | 0.25 | 0.08 | 0 | 0 | 0 | 0 | 0 | 2.67 | 0.80 | 0.53 | 0.29 |
| Leatherback turtle [a] | 4.74 | 1.27 | 0.93 | 0.63 | 0 | 0 | 0 | 0 | 3.16 | 0.81 | 0.81 | 0.34 |
| Loggerhead turtle | 0.99 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.41 | 0.75 | 0.48 | 0.29 |
| Green turtle | 2.83 | 0.31 | 0.19 | 0.11 | 0 | 0 | 0 | 0 | 2.84 | 0.83 | 0.64 | 0.31 |

a Listed as Endangered under the ESA.

Table H-118. Post-piled jacket foundation (4.25 m diameter, typical, 3500 kJ hammer, eight piles per day, winter) sea turtle exposure ranges ($ER_{95\%}$) in km for injury thresholds (impact piling only) and behavioral thresholds (30 minute vibratory plus impact piling), with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.84 | 0.57 | 0.27 | 0.09 | 0 | 0 | 0 | 0 | 2.63 | 0.76 | 0.53 | 0.31 |
| Leatherback turtle [a] | 5.02 | 1.39 | 1.04 | 0.66 | 0 | 0 | 0 | 0 | 3.22 | 0.94 | 0.79 | 0.33 |
| Loggerhead turtle | 1.68 | 0.25 | 0.17 | 0 | 0 | 0 | 0 | 0 | 2.41 | 0.75 | 0.50 | 0.26 |
| Green turtle | 3.84 | 0.74 | 0.46 | 0.15 | 0 | 0 | 0 | 0 | 2.85 | 0.78 | 0.67 | 0.31 |

a Listed as Endangered under the ESA.

Table H-119. Post-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, four piles per day, summer) sea turtle exposure ranges ($ER_{95\%}$) in km for injury thresholds (impact piling only) and behavioral thresholds (30 minute vibratory plus impact piling), with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.22 | 0.26 | 0.22 | 0 | 0 | 0 | 0 | 0 | 2.66 | 0.86 | 0.62 | 0.40 |
| Leatherback turtle [a] | 4.77 | 1.52 | 1.14 | 0.73 | 0 | 0 | 0 | 0 | 3.24 | 1.12 | 0.81 | 0.34 |
| Loggerhead turtle | 0.99 | 0.06 | 0 | 0 | 0 | 0 | 0 | 0 | 2.61 | 0.72 | 0.61 | 0.29 |
| Green turtle | 2.86 | 0.46 | 0.22 | 0.11 | 0 | 0 | 0 | 0 | 2.86 | 0.90 | 0.68 | 0.33 |

a Listed as Endangered under the ESA.

Table H-120. Post-piled jacket foundation (4.25 m diameter, difficult to drive, 3500 kJ hammer, four piles per day, winter) sea turtle exposure ranges ($ER_{95\%}$) in km for injury thresholds (impact piling only) and behavioral thresholds (30 minute vibratory plus impact piling), with sound attenuation.

| Species | Injury $L_E$ (0 dB) | Injury $L_E$ (10 dB) | Injury $L_E$ (12 dB) | Injury $L_E$ (15 dB) | Injury $L_{pk}$ (0 dB) | Injury $L_{pk}$ (10 dB) | Injury $L_{pk}$ (12 dB) | Injury $L_{pk}$ (15 dB) | Behavior $L_p$ (0 dB) | Behavior $L_p$ (10 dB) | Behavior $L_p$ (12 dB) | Behavior $L_p$ (15 dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley turtle [a] | 2.45 | 0.25 | 0.21 | 0 | 0 | 0 | 0 | 0 | 2.83 | 0.89 | 0.63 | 0.40 |
| Leatherback turtle [a] | 5.20 | 1.66 | 1.15 | 0.73 | 0 | 0 | 0 | 0 | 3.25 | 1.03 | 0.81 | 0.34 |
| Loggerhead turtle | 1.32 | 0.09 | 0 | 0 | 0 | 0 | 0 | 0 | 2.61 | 0.77 | 0.61 | 0.29 |
| Green turtle | 3.08 | 0.52 | 0.26 | 0.11 | 0 | 0 | 0 | 0 | 2.94 | 0.91 | 0.72 | 0.33 |

a Listed as Endangered under the ESA.

## H.2.4. Animal Densities

As described in Section 3.2, for vibratory setting of piles followed by impact pile driving, densities were calculated within buffered polygons around the Lease Area perimeter for the following buffer ranges: 1, 5, 10, 15, 20, 30, 40, and 50 km. The following section contains density values for those ranges.

### H.2.4.1. Marine Mammals

Table H-121. Mean monthly marine mammal density (animals/100 $km^2$)[a] estimates for all species in a 10 km perimeter around the Lease Area.

| Species of interest | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual mean | May to Dec mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fin whale [b] | 0.231 | 0.165 | 0.153 | 0.153 | 0.330 | 0.375 | 0.494 | 0.406 | 0.254 | 0.079 | 0.063 | 0.157 | 0.238 | 0.270 |
| Minke whale | 0.116 | 0.140 | 0.148 | 0.768 | 1.563 | 2.072 | 1.101 | 0.576 | 0.604 | 0.511 | 0.054 | 0.078 | 0.644 | 0.820 |
| Humpback whale | 0.026 | 0.030 | 0.058 | 0.202 | 0.371 | 0.387 | 0.288 | 0.175 | 0.210 | 0.299 | 0.234 | 0.029 | 0.192 | 0.249 |
| North Atlantic right whale [b] | 0.950 | 1.059 | 0.910 | 0.828 | 0.671 | 0.147 | 0.091 | 0.043 | 0.076 | 0.103 | 0.197 | 0.598 | 0.473 | 0.241 |
| Sei whale [b] | 0.035 | 0.026 | 0.054 | 0.111 | 0.192 | 0.065 | 0.017 | 0.013 | 0.021 | 0.041 | 0.096 | 0.065 | 0.061 | 0.064 |
| Atlantic white-sided dolphin | 2.361 | 1.281 | 0.984 | 1.699 | 3.989 | 4.039 | 2.817 | 1.283 | 2.426 | 3.452 | 2.559 | 3.564 | 2.538 | 3.016 |
| Atlantic spotted dolphin | 0.001 | 0.000 | 0.002 | 0.008 | 0.027 | 0.044 | 0.052 | 0.087 | 0.403 | 0.427 | 0.108 | 0.008 | 0.097 | 0.145 |
| Common dolphin | 8.955 | 3.279 | 3.333 | 5.019 | 7.716 | 16.819 | 20.483 | 25.800 | 39.437 | 30.592 | 16.932 | 14.302 | 16.056 | 21.510 |
| Bottlenose dolphin, offshore | 0.404 | 0.095 | 0.073 | 0.216 | 0.914 | 1.533 | 1.955 | 2.144 | 2.094 | 1.834 | 1.520 | 1.242 | 1.169 | 1.655 |
| Risso's dolphin | 0.034 | 0.004 | 0.004 | 0.022 | 0.134 | 0.091 | 0.106 | 0.264 | 0.301 | 0.145 | 0.134 | 0.181 | 0.118 | 0.170 |
| Long-finned pilot whale [c] | 0.274 | 0.274 | 0.274 | 0.274 | 0.274 | 0.274 | 0.274 | 0.274 | 0.274 | 0.274 | 0.274 | 0.274 | 0.274 | 0.274 |
| Short-finned pilot whale [c] | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 |
| Sperm whale [b] | 0.047 | 0.018 | 0.017 | 0.005 | 0.020 | 0.035 | 0.066 | 0.194 | 0.147 | 0.105 | 0.058 | 0.034 | 0.062 | 0.082 |
| Harbor porpoise | 11.842 | 12.547 | 11.888 | 11.118 | 8.912 | 1.914 | 1.935 | 1.698 | 2.152 | 2.735 | 2.760 | 9.012 | 6.543 | 3.890 |
| Gray seal | 5.461 | 5.178 | 3.498 | 3.406 | 4.459 | 0.382 | 0.100 | 0.087 | 0.171 | 0.477 | 2.852 | 4.917 | 2.582 | 1.681 |
| Harbor seal | 8.192 | 7.767 | 5.247 | 5.109 | 6.688 | 0.573 | 0.150 | 0.131 | 0.256 | 0.715 | 4.278 | 7.375 | 3.873 | 2.521 |
| Harp seal | 5.851 | 5.548 | 3.748 | 3.650 | 4.777 | 0.409 | 0.107 | 0.093 | 0.183 | 0.511 | 3.056 | 5.268 | 2.767 | 1.801 |

[a] Density estimates are from habitat-based density modeling of the entire Atlantic Exclusive Economic Zone (EEZ) (Roberts et al. 2016, 2022).
[b] Listed as Endangered under the ESA.
[c] Density adjusted by relative abundance.

Table H-122. Mean monthly marine mammal density (animals/100 $km^2$)[a] estimates for all species in a 10 km perimeter around the Lease Area.

| Species of interest | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual mean | May to Dec mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fin whale [b] | 0.231 | 0.173 | 0.158 | 0.155 | 0.330 | 0.368 | 0.502 | 0.402 | 0.268 | 0.088 | 0.062 | 0.155 | 0.241 | 0.272 |
| Minke whale | 0.114 | 0.139 | 0.149 | 0.756 | 1.532 | 1.998 | 1.045 | 0.554 | 0.593 | 0.524 | 0.054 | 0.077 | 0.628 | 0.797 |
| Humpback whale | 0.026 | 0.029 | 0.056 | 0.200 | 0.355 | 0.381 | 0.274 | 0.162 | 0.196 | 0.286 | 0.223 | 0.029 | 0.185 | 0.238 |
| North Atlantic right whale [b] | 0.996 | 1.106 | 0.953 | 0.843 | 0.673 | 0.158 | 0.104 | 0.048 | 0.081 | 0.103 | 0.212 | 0.647 | 0.494 | 0.253 |
| Sei whale [b] | 0.034 | 0.026 | 0.054 | 0.115 | 0.194 | 0.066 | 0.017 | 0.013 | 0.020 | 0.042 | 0.095 | 0.064 | 0.062 | 0.064 |
| Atlantic white-sided dolphin | 2.533 | 1.402 | 1.048 | 1.727 | 3.936 | 4.082 | 2.735 | 1.173 | 2.298 | 3.382 | 2.493 | 3.592 | 2.533 | 2.961 |
| Atlantic spotted dolphin | 0.001 | 0.000 | 0.002 | 0.008 | 0.030 | 0.053 | 0.054 | 0.088 | 0.427 | 0.516 | 0.122 | 0.010 | 0.109 | 0.163 |
| Common dolphin | 9.428 | 3.577 | 3.483 | 5.113 | 7.895 | 17.110 | 19.595 | 24.845 | 39.483 | 33.632 | 17.879 | 14.908 | 16.412 | 21.918 |
| Bottlenose dolphin, offshore | 0.443 | 0.106 | 0.080 | 0.232 | 0.979 | 1.641 | 2.046 | 2.249 | 2.203 | 1.941 | 1.628 | 1.303 | 1.238 | 1.749 |
| Risso's dolphin | 0.041 | 0.005 | 0.004 | 0.023 | 0.140 | 0.099 | 0.120 | 0.286 | 0.337 | 0.162 | 0.139 | 0.187 | 0.129 | 0.184 |
| Long-finned pilot whale [c] | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 |
| Short-finned pilot whale [c] | 0.067 | 0.067 | 0.067 | 0.067 | 0.067 | 0.067 | 0.067 | 0.067 | 0.067 | 0.067 | 0.067 | 0.067 | 0.067 | 0.067 |
| Sperm whale [b] | 0.049 | 0.018 | 0.017 | 0.004 | 0.018 | 0.031 | 0.061 | 0.193 | 0.123 | 0.099 | 0.054 | 0.033 | 0.058 | 0.077 |
| Harbor porpoise | 11.384 | 12.084 | 11.478 | 10.579 | 8.423 | 1.835 | 1.872 | 1.644 | 1.983 | 2.504 | 2.576 | 8.347 | 6.226 | 3.648 |
| Gray seal | 5.351 | 5.120 | 3.522 | 3.401 | 4.416 | 0.405 | 0.113 | 0.097 | 0.181 | 0.491 | 2.692 | 4.797 | 2.549 | 1.649 |
| Harbor seal | 8.027 | 7.680 | 5.282 | 5.102 | 6.623 | 0.607 | 0.170 | 0.145 | 0.271 | 0.736 | 4.037 | 7.195 | 3.823 | 2.473 |
| Harp seal | 5.734 | 5.486 | 3.773 | 3.644 | 4.731 | 0.434 | 0.121 | 0.103 | 0.194 | 0.526 | 2.884 | 5.139 | 2.731 | 1.767 |

[a] Density estimates are from habitat-based density modeling of the entire Atlantic Exclusive Economic Zone (EEZ) (Roberts et al. 2016, 2022).
[b] Listed as Endangered under the ESA.
[c] Density adjusted by relative abundance.

Table H-123. Mean monthly marine mammal density (animals/100 km$^2$)[a] estimates for all species in a 10 km perimeter around the Lease Area.

| Species of interest | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual mean | May to Dec mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fin whale [b] | 0.231 | 0.176 | 0.163 | 0.158 | 0.325 | 0.364 | 0.503 | 0.399 | 0.274 | 0.096 | 0.063 | 0.154 | 0.242 | 0.272 |
| Minke whale | 0.111 | 0.135 | 0.148 | 0.749 | 1.507 | 1.933 | 1.011 | 0.537 | 0.575 | 0.532 | 0.054 | 0.076 | 0.614 | 0.778 |
| Humpback whale | 0.028 | 0.029 | 0.056 | 0.200 | 0.343 | 0.372 | 0.264 | 0.152 | 0.185 | 0.272 | 0.214 | 0.031 | 0.179 | 0.229 |
| North Atlantic right whale [b] | 1.079 | 1.200 | 1.032 | 0.891 | 0.712 | 0.177 | 0.123 | 0.056 | 0.091 | 0.109 | 0.234 | 0.717 | 0.535 | 0.277 |
| Sei whale [b] | 0.034 | 0.026 | 0.055 | 0.119 | 0.197 | 0.068 | 0.018 | 0.013 | 0.020 | 0.043 | 0.094 | 0.063 | 0.063 | 0.065 |
| Atlantic white-sided dolphin | 2.704 | 1.525 | 1.118 | 1.789 | 3.979 | 4.178 | 2.769 | 1.127 | 2.221 | 3.346 | 2.489 | 3.679 | 2.577 | 2.974 |
| Atlantic spotted dolphin | 0.001 | 0.000 | 0.002 | 0.008 | 0.034 | 0.066 | 0.056 | 0.088 | 0.444 | 0.598 | 0.131 | 0.011 | 0.120 | 0.179 |
| Common dolphin | 10.018 | 3.984 | 3.742 | 5.346 | 8.265 | 17.853 | 19.693 | 24.671 | 39.957 | 36.945 | 19.266 | 15.758 | 17.125 | 22.801 |
| Bottlenose dolphin, offshore | 0.460 | 0.114 | 0.084 | 0.241 | 1.008 | 1.696 | 2.070 | 2.262 | 2.230 | 1.984 | 1.685 | 1.323 | 1.263 | 1.782 |
| Risso's dolphin | 0.048 | 0.007 | 0.005 | 0.025 | 0.150 | 0.112 | 0.138 | 0.320 | 0.384 | 0.184 | 0.147 | 0.195 | 0.143 | 0.204 |
| Long-finned pilot whale [c] | 0.276 | 0.276 | 0.276 | 0.276 | 0.276 | 0.276 | 0.276 | 0.276 | 0.276 | 0.276 | 0.276 | 0.276 | 0.276 | 0.276 |
| Short-finned pilot whale [c] | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 | 0.069 |
| Sperm whale [b] | 0.051 | 0.018 | 0.017 | 0.004 | 0.017 | 0.030 | 0.058 | 0.191 | 0.115 | 0.092 | 0.052 | 0.034 | 0.057 | 0.074 |
| Harbor porpoise | 10.861 | 11.551 | 11.019 | 10.218 | 8.119 | 1.913 | 1.986 | 1.715 | 1.924 | 2.403 | 2.530 | 7.848 | 6.007 | 3.555 |
| Gray seal | 5.262 | 5.034 | 3.565 | 3.554 | 4.566 | 0.477 | 0.151 | 0.124 | 0.212 | 0.535 | 2.609 | 4.660 | 2.562 | 1.667 |
| Harbor seal | 7.892 | 7.550 | 5.347 | 5.330 | 6.849 | 0.716 | 0.227 | 0.186 | 0.317 | 0.802 | 3.913 | 6.990 | 3.843 | 2.500 |
| Harp seal | 5.637 | 5.393 | 3.820 | 3.807 | 4.892 | 0.511 | 0.162 | 0.133 | 0.227 | 0.573 | 2.795 | 4.993 | 2.745 | 1.786 |

[a] Density estimates are from habitat-based density modeling of the entire Atlantic Exclusive Economic Zone (EEZ) (Roberts et al. 2016, 2022).
[b] Listed as Endangered under the ESA.
[c] Density adjusted by relative abundance.

Table H-124. Mean monthly marine mammal density (animals/100 km$^2$)[a] estimates for all species in a 10 km perimeter around the Lease Area.

| Species of interest | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual mean | May to Dec mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fin whale [b] | 0.230 | 0.180 | 0.170 | 0.163 | 0.325 | 0.367 | 0.511 | 0.404 | 0.285 | 0.105 | 0.065 | 0.153 | 0.247 | 0.277 |
| Minke whale | 0.108 | 0.133 | 0.147 | 0.741 | 1.484 | 1.878 | 0.985 | 0.524 | 0.561 | 0.543 | 0.053 | 0.075 | 0.603 | 0.763 |
| Humpback whale | 0.029 | 0.029 | 0.055 | 0.206 | 0.339 | 0.372 | 0.260 | 0.146 | 0.176 | 0.264 | 0.208 | 0.033 | 0.176 | 0.225 |
| North Atlantic right whale [b] | 1.127 | 1.260 | 1.079 | 0.920 | 0.738 | 0.196 | 0.138 | 0.065 | 0.098 | 0.113 | 0.248 | 0.762 | 0.562 | 0.295 |
| Sei whale [b] | 0.034 | 0.026 | 0.056 | 0.125 | 0.203 | 0.072 | 0.020 | 0.013 | 0.020 | 0.044 | 0.094 | 0.062 | 0.064 | 0.066 |
| Atlantic white-sided dolphin | 2.926 | 1.682 | 1.209 | 1.895 | 4.082 | 4.334 | 2.864 | 1.093 | 2.162 | 3.360 | 2.515 | 3.822 | 2.662 | 3.029 |
| Atlantic spotted dolphin | 0.001 | 0.000 | 0.002 | 0.008 | 0.041 | 0.088 | 0.061 | 0.092 | 0.482 | 0.712 | 0.147 | 0.013 | 0.137 | 0.205 |
| Common dolphin | 10.894 | 4.597 | 4.163 | 5.730 | 8.832 | 19.041 | 20.211 | 24.933 | 40.972 | 40.913 | 21.144 | 16.856 | 18.191 | 24.113 |
| Bottlenose dolphin, offshore | 0.489 | 0.125 | 0.092 | 0.259 | 1.069 | 1.804 | 2.185 | 2.368 | 2.331 | 2.086 | 1.801 | 1.381 | 1.333 | 1.878 |
| Risso's dolphin | 0.058 | 0.009 | 0.006 | 0.027 | 0.167 | 0.134 | 0.167 | 0.379 | 0.457 | 0.218 | 0.159 | 0.208 | 0.166 | 0.236 |
| Long-finned pilot whale [c] | 0.286 | 0.286 | 0.286 | 0.286 | 0.286 | 0.286 | 0.286 | 0.286 | 0.286 | 0.286 | 0.286 | 0.286 | 0.286 | 0.286 |
| Short-finned pilot whale [c] | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 |
| Sperm whale [b] | 0.055 | 0.019 | 0.017 | 0.005 | 0.017 | 0.031 | 0.056 | 0.189 | 0.110 | 0.087 | 0.051 | 0.035 | 0.056 | 0.072 |
| Harbor porpoise | 10.396 | 11.066 | 10.611 | 9.904 | 7.892 | 1.972 | 2.081 | 1.758 | 1.856 | 2.301 | 2.478 | 7.387 | 5.809 | 3.466 |
| Gray seal | 5.130 | 4.912 | 3.582 | 3.614 | 4.601 | 0.545 | 0.193 | 0.155 | 0.242 | 0.572 | 2.516 | 4.523 | 2.549 | 1.668 |
| Harbor seal | 7.695 | 7.368 | 5.374 | 5.421 | 6.901 | 0.817 | 0.290 | 0.233 | 0.363 | 0.857 | 3.774 | 6.784 | 3.823 | 2.502 |
| Harp seal | 5.497 | 5.263 | 3.838 | 3.872 | 4.930 | 0.584 | 0.207 | 0.166 | 0.259 | 0.612 | 2.696 | 4.846 | 2.731 | 1.788 |

[a] Density estimates are from habitat-based density modeling of the entire Atlantic Exclusive Economic Zone (EEZ) (Roberts et al. 2016, 2022).
[b] Listed as Endangered under the ESA.
[c] Density adjusted by relative abundance.

Table H-125. Mean monthly marine mammal density (animals/100 km$^2$)[a] estimates for all species in a 10 km perimeter around the Lease Area.

| Species of interest | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual mean | May to Dec mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fin whale [b] | 0.229 | 0.182 | 0.176 | 0.169 | 0.322 | 0.364 | 0.514 | 0.407 | 0.292 | 0.112 | 0.066 | 0.152 | 0.249 | 0.279 |
| Minke whale | 0.107 | 0.132 | 0.148 | 0.737 | 1.464 | 1.820 | 0.954 | 0.511 | 0.541 | 0.542 | 0.053 | 0.076 | 0.590 | 0.745 |
| Humpback whale | 0.030 | 0.029 | 0.055 | 0.211 | 0.339 | 0.375 | 0.256 | 0.142 | 0.171 | 0.258 | 0.207 | 0.035 | 0.176 | 0.223 |
| North Atlantic right whale [b] | 1.147 | 1.288 | 1.097 | 0.929 | 0.747 | 0.208 | 0.146 | 0.070 | 0.101 | 0.115 | 0.254 | 0.778 | 0.573 | 0.302 |
| Sei whale [b] | 0.034 | 0.027 | 0.056 | 0.131 | 0.208 | 0.074 | 0.021 | 0.013 | 0.019 | 0.045 | 0.094 | 0.062 | 0.065 | 0.067 |
| Atlantic white-sided dolphin | 3.120 | 1.842 | 1.305 | 1.981 | 4.173 | 4.441 | 2.895 | 1.060 | 2.099 | 3.342 | 2.536 | 3.903 | 2.725 | 3.056 |
| Atlantic spotted dolphin | 0.001 | 0.000 | 0.002 | 0.008 | 0.051 | 0.124 | 0.066 | 0.100 | 0.533 | 0.849 | 0.167 | 0.015 | 0.160 | 0.238 |
| Common dolphin | 11.748 | 5.283 | 4.641 | 6.159 | 9.543 | 20.513 | 20.669 | 25.040 | 40.776 | 43.545 | 22.893 | 17.817 | 19.052 | 25.100 |
| Bottlenose dolphin, offshore | 0.521 | 0.136 | 0.099 | 0.272 | 1.098 | 1.861 | 2.206 | 2.368 | 2.351 | 2.134 | 1.881 | 1.428 | 1.363 | 1.916 |
| Risso's dolphin | 0.072 | 0.011 | 0.007 | 0.031 | 0.189 | 0.165 | 0.210 | 0.459 | 0.551 | 0.260 | 0.175 | 0.223 | 0.196 | 0.279 |
| Long-finned pilot whale [c] | 0.298 | 0.298 | 0.298 | 0.298 | 0.298 | 0.298 | 0.298 | 0.298 | 0.298 | 0.298 | 0.298 | 0.298 | 0.298 | 0.298 |
| Short-finned pilot whale [c] | 0.074 | 0.074 | 0.074 | 0.074 | 0.074 | 0.074 | 0.074 | 0.074 | 0.074 | 0.074 | 0.074 | 0.074 | 0.074 | 0.074 |
| Sperm whale [b] | 0.055 | 0.022 | 0.018 | 0.005 | 0.018 | 0.033 | 0.055 | 0.186 | 0.107 | 0.082 | 0.050 | 0.038 | 0.056 | 0.071 |
| Harbor porpoise | 9.900 | 10.571 | 10.191 | 9.583 | 7.658 | 2.065 | 2.203 | 1.817 | 1.813 | 2.234 | 2.453 | 6.953 | 5.620 | 3.400 |
| Gray seal | 5.023 | 4.815 | 3.616 | 3.719 | 4.691 | 0.672 | 0.268 | 0.215 | 0.297 | 0.634 | 2.480 | 4.386 | 2.568 | 1.705 |
| Harbor seal | 7.534 | 7.222 | 5.423 | 5.579 | 7.037 | 1.008 | 0.401 | 0.322 | 0.445 | 0.950 | 3.720 | 6.579 | 3.852 | 2.558 |
| Harp seal | 5.381 | 5.159 | 3.874 | 3.985 | 5.027 | 0.720 | 0.287 | 0.230 | 0.318 | 0.679 | 2.657 | 4.699 | 2.751 | 1.827 |

[a] Density estimates are from habitat-based density modeling of the entire Atlantic Exclusive Economic Zone (EEZ) (Roberts et al. 2016, 2022).
[b] Listed as Endangered under the ESA.
[c] Density adjusted by relative abundance.

Table H-126. Mean monthly marine mammal density (animals/100 km$^2$)[a] estimates for all species in a 10 km perimeter around the Lease Area.

| Species of interest | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual mean | May to Dec mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fin whale [b] | 0.228 | 0.184 | 0.183 | 0.190 | 0.320 | 0.364 | 0.524 | 0.417 | 0.309 | 0.124 | 0.071 | 0.147 | 0.255 | 0.285 |
| Minke whale | 0.109 | 0.133 | 0.153 | 0.726 | 1.426 | 1.706 | 0.893 | 0.486 | 0.504 | 0.533 | 0.055 | 0.081 | 0.567 | 0.711 |
| Humpback whale | 0.033 | 0.030 | 0.054 | 0.227 | 0.357 | 0.402 | 0.260 | 0.140 | 0.167 | 0.254 | 0.213 | 0.039 | 0.181 | 0.229 |
| North Atlantic right whale [b] | 1.075 | 1.220 | 1.040 | 0.878 | 0.708 | 0.213 | 0.143 | 0.070 | 0.096 | 0.109 | 0.244 | 0.727 | 0.544 | 0.289 |
| Sei whale [b] | 0.033 | 0.028 | 0.057 | 0.143 | 0.222 | 0.081 | 0.024 | 0.013 | 0.019 | 0.047 | 0.094 | 0.061 | 0.069 | 0.070 |
| Atlantic white-sided dolphin | 3.580 | 2.246 | 1.558 | 2.180 | 4.433 | 4.773 | 2.936 | 1.007 | 1.989 | 3.303 | 2.624 | 4.069 | 2.892 | 3.142 |
| Atlantic spotted dolphin | 0.002 | 0.000 | 0.002 | 0.009 | 0.083 | 0.245 | 0.083 | 0.142 | 0.700 | 1.222 | 0.230 | 0.022 | 0.228 | 0.341 |
| Common dolphin | 13.752 | 7.096 | 6.003 | 7.402 | 11.626 | 24.974 | 22.329 | 25.730 | 39.392 | 46.905 | 26.565 | 19.715 | 20.957 | 27.155 |
| Bottlenose dolphin, offshore | 0.688 | 0.195 | 0.133 | 0.326 | 1.231 | 2.101 | 2.348 | 2.452 | 2.518 | 2.371 | 2.204 | 1.689 | 1.521 | 2.114 |
| Risso's dolphin | 0.115 | 0.022 | 0.012 | 0.044 | 0.276 | 0.281 | 0.384 | 0.753 | 0.865 | 0.400 | 0.229 | 0.272 | 0.304 | 0.433 |
| Long-finned pilot whale [c] | 0.338 | 0.338 | 0.338 | 0.338 | 0.338 | 0.338 | 0.338 | 0.338 | 0.338 | 0.338 | 0.338 | 0.338 | 0.338 | 0.338 |
| Short-finned pilot whale [c] | 0.084 | 0.084 | 0.084 | 0.084 | 0.084 | 0.084 | 0.084 | 0.084 | 0.084 | 0.084 | 0.084 | 0.084 | 0.084 | 0.084 |
| Sperm whale [b] | 0.055 | 0.030 | 0.025 | 0.007 | 0.022 | 0.039 | 0.059 | 0.186 | 0.104 | 0.080 | 0.051 | 0.046 | 0.059 | 0.073 |
| Harbor porpoise | 9.013 | 9.686 | 9.467 | 9.053 | 7.294 | 2.188 | 2.384 | 1.918 | 1.748 | 2.119 | 2.388 | 6.192 | 5.288 | 3.279 |
| Gray seal | 4.726 | 4.587 | 3.661 | 3.826 | 4.768 | 1.046 | 0.479 | 0.392 | 0.443 | 0.789 | 2.390 | 4.086 | 2.599 | 1.799 |
| Harbor seal | 7.089 | 6.880 | 5.492 | 5.738 | 7.151 | 1.568 | 0.718 | 0.588 | 0.665 | 1.184 | 3.584 | 6.129 | 3.899 | 2.698 |
| Harp seal | 5.064 | 4.914 | 3.923 | 4.099 | 5.108 | 1.120 | 0.513 | 0.420 | 0.475 | 0.846 | 2.560 | 4.378 | 2.785 | 1.928 |

[a] Density estimates are from habitat-based density modeling of the entire Atlantic Exclusive Economic Zone (EEZ) (Roberts et al. 2016, 2022).
[b] Listed as Endangered under the ESA.
[c] Density adjusted by relative abundance.

Table H-127. Mean monthly marine mammal density (animals/100 $km^2$)[a] estimates for all species in a 10 km perimeter around the Lease Area.

| Species of interest | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual mean | May to Dec mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fin whale [b] | 0.224 | 0.188 | 0.185 | 0.208 | 0.331 | 0.363 | 0.530 | 0.425 | 0.314 | 0.130 | 0.076 | 0.146 | 0.260 | 0.289 |
| Minke whale | 0.113 | 0.136 | 0.156 | 0.714 | 1.387 | 1.596 | 0.839 | 0.464 | 0.471 | 0.510 | 0.056 | 0.086 | 0.544 | 0.676 |
| Humpback whale | 0.037 | 0.033 | 0.057 | 0.237 | 0.372 | 0.424 | 0.267 | 0.139 | 0.162 | 0.247 | 0.218 | 0.044 | 0.186 | 0.234 |
| North Atlantic right whale [b] | 0.936 | 1.077 | 0.926 | 0.787 | 0.628 | 0.199 | 0.125 | 0.063 | 0.084 | 0.098 | 0.216 | 0.627 | 0.481 | 0.255 |
| Sei whale [b] | 0.033 | 0.029 | 0.058 | 0.151 | 0.232 | 0.087 | 0.025 | 0.012 | 0.018 | 0.046 | 0.094 | 0.060 | 0.070 | 0.072 |
| Atlantic white-sided dolphin | 3.921 | 2.561 | 1.764 | 2.316 | 4.621 | 5.075 | 2.918 | 0.980 | 1.889 | 3.180 | 2.693 | 4.117 | 3.003 | 3.184 |
| Atlantic spotted dolphin | 0.002 | 0.001 | 0.002 | 0.009 | 0.106 | 0.332 | 0.101 | 0.197 | 0.817 | 1.451 | 0.270 | 0.025 | 0.276 | 0.412 |
| Common dolphin | 15.222 | 8.692 | 7.332 | 8.552 | 13.639 | 29.229 | 23.457 | 25.515 | 36.617 | 46.244 | 28.710 | 20.762 | 21.998 | 28.022 |
| Bottlenose dolphin, offshore | 0.931 | 0.302 | 0.196 | 0.421 | 1.459 | 2.500 | 2.646 | 2.657 | 2.835 | 2.776 | 2.647 | 2.037 | 1.784 | 2.445 |
| Risso's dolphin | 0.171 | 0.040 | 0.020 | 0.067 | 0.413 | 0.468 | 0.717 | 1.223 | 1.295 | 0.594 | 0.308 | 0.337 | 0.471 | 0.669 |
| Long-finned pilot whale [c] | 0.377 | 0.377 | 0.377 | 0.377 | 0.377 | 0.377 | 0.377 | 0.377 | 0.377 | 0.377 | 0.377 | 0.377 | 0.377 | 0.377 |
| Short-finned pilot whale [c] | 0.094 | 0.094 | 0.094 | 0.094 | 0.094 | 0.094 | 0.094 | 0.094 | 0.094 | 0.094 | 0.094 | 0.094 | 0.094 | 0.094 |
| Sperm whale [b] | 0.058 | 0.035 | 0.031 | 0.008 | 0.025 | 0.044 | 0.064 | 0.179 | 0.109 | 0.089 | 0.052 | 0.050 | 0.062 | 0.077 |
| Harbor porpoise | 8.328 | 8.956 | 8.865 | 8.649 | 7.038 | 2.259 | 2.399 | 1.920 | 1.679 | 2.037 | 2.312 | 5.665 | 5.009 | 3.164 |
| Gray seal | 4.520 | 4.404 | 3.704 | 3.923 | 4.940 | 1.918 | 0.913 | 0.751 | 0.747 | 1.145 | 2.410 | 3.897 | 2.773 | 2.090 |
| Harbor seal | 6.780 | 6.606 | 5.556 | 5.885 | 7.411 | 2.877 | 1.369 | 1.126 | 1.121 | 1.718 | 3.615 | 5.846 | 4.159 | 3.135 |
| Harp seal | 4.843 | 4.718 | 3.969 | 4.203 | 5.293 | 2.055 | 0.978 | 0.804 | 0.801 | 1.227 | 2.582 | 4.175 | 2.971 | 2.239 |

[a] Density estimates are from habitat-based density modeling of the entire Atlantic Exclusive Economic Zone (EEZ) (Roberts et al. 2016, 2022).
[b] Listed as Endangered under the ESA.
[c] Density adjusted by relative abundance.

Table H-128. Mean monthly marine mammal density (animals/100 $km^2$)[a] estimates for all species in a 10 km perimeter around the Lease Area.

| Species of interest | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual mean | May to Dec mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fin whale [b] | 0.218 | 0.194 | 0.193 | 0.222 | 0.348 | 0.364 | 0.529 | 0.422 | 0.315 | 0.134 | 0.082 | 0.147 | 0.264 | 0.293 |
| Minke whale | 0.118 | 0.139 | 0.159 | 0.686 | 1.324 | 1.481 | 0.786 | 0.441 | 0.439 | 0.482 | 0.057 | 0.091 | 0.517 | 0.638 |
| Humpback whale | 0.042 | 0.039 | 0.064 | 0.241 | 0.383 | 0.441 | 0.270 | 0.137 | 0.156 | 0.236 | 0.215 | 0.049 | 0.189 | 0.236 |
| North Atlantic right whale [b] | 0.790 | 0.924 | 0.805 | 0.692 | 0.538 | 0.178 | 0.106 | 0.055 | 0.072 | 0.085 | 0.184 | 0.523 | 0.413 | 0.218 |
| Sei whale [b] | 0.032 | 0.029 | 0.059 | 0.158 | 0.240 | 0.092 | 0.027 | 0.012 | 0.017 | 0.046 | 0.094 | 0.057 | 0.072 | 0.073 |
| Atlantic white-sided dolphin | 4.190 | 2.853 | 1.944 | 2.456 | 4.787 | 5.378 | 2.880 | 0.971 | 1.812 | 3.057 | 2.721 | 4.120 | 3.097 | 3.216 |
| Atlantic spotted dolphin | 0.002 | 0.001 | 0.002 | 0.009 | 0.112 | 0.351 | 0.115 | 0.229 | 0.845 | 1.485 | 0.284 | 0.026 | 0.288 | 0.431 |
| Common dolphin | 16.713 | 10.401 | 8.818 | 9.867 | 15.923 | 32.979 | 24.051 | 24.798 | 33.727 | 44.335 | 30.399 | 21.892 | 22.825 | 28.513 |
| Bottlenose dolphin, offshore | 1.209 | 0.458 | 0.304 | 0.588 | 1.819 | 3.083 | 3.082 | 2.986 | 3.282 | 3.343 | 3.166 | 2.413 | 2.144 | 2.897 |
| Risso's dolphin | 0.252 | 0.072 | 0.036 | 0.106 | 0.604 | 0.728 | 1.255 | 1.850 | 1.804 | 0.845 | 0.422 | 0.430 | 0.700 | 0.992 |
| Long-finned pilot whale [c] | 0.413 | 0.413 | 0.413 | 0.413 | 0.413 | 0.413 | 0.413 | 0.413 | 0.413 | 0.413 | 0.413 | 0.413 | 0.413 | 0.413 |
| Short-finned pilot whale [c] | 0.103 | 0.103 | 0.103 | 0.103 | 0.103 | 0.103 | 0.103 | 0.103 | 0.103 | 0.103 | 0.103 | 0.103 | 0.103 | 0.103 |
| Sperm whale [b] | 0.061 | 0.039 | 0.034 | 0.010 | 0.029 | 0.050 | 0.072 | 0.177 | 0.119 | 0.099 | 0.052 | 0.049 | 0.066 | 0.081 |
| Harbor porpoise | 7.666 | 8.261 | 8.256 | 8.205 | 6.779 | 2.277 | 2.359 | 1.915 | 1.616 | 1.947 | 2.177 | 5.194 | 4.721 | 3.033 |
| Gray seal | 4.386 | 4.260 | 3.748 | 4.081 | 5.287 | 2.982 | 1.245 | 1.050 | 1.095 | 1.684 | 2.506 | 3.772 | 3.008 | 2.453 |
| Harbor seal | 6.579 | 6.390 | 5.622 | 6.121 | 7.931 | 4.473 | 1.867 | 1.575 | 1.642 | 2.526 | 3.758 | 5.658 | 4.512 | 3.679 |
| Harp seal | 4.699 | 4.564 | 4.016 | 4.372 | 5.665 | 3.195 | 1.334 | 1.125 | 1.173 | 1.804 | 2.685 | 4.042 | 3.223 | 2.628 |

[a] Density estimates are from habitat-based density modeling of the entire Atlantic Exclusive Economic Zone (EEZ) (Roberts et al. 2016, 2022).
[b] Listed as Endangered under the ESA.
[c] Density adjusted by relative abundance.

### H.2.4.2. Sea Turtles

Table H-129. Sea turtle density (animals/100 km²)[a] estimates for all modeled species in a 1 km perimeter around the Lease Area.

| Species of interest | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual mean | May to Dec mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley sea turtle | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.004 | 0.003 | 0.003 | 0.002 | 0.000 | 0.000 | 0.001 | 0.002 |
| Leatherback sea turtle | 0.001 | 0.000 | 0.000 | 0.000 | 0.004 | 0.082 | 0.232 | 0.391 | 0.557 | 0.323 | 0.054 | 0.004 | 0.137 | 0.206 |
| Loggerhead sea turtle | 0.003 | 0.001 | 0.001 | 0.002 | 0.003 | 0.012 | 0.030 | 0.032 | 0.037 | 0.035 | 0.014 | 0.004 | 0.015 | 0.021 |
| Green sea turtle | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.018 | 0.102 | 0.143 | 0.118 | 0.017 | 0.003 | 0.000 | 0.033 | 0.050 |

[a] Density estimates are from DiMatteo et al. (2023).

Table H-130. Sea turtle density (animals/100 km²)[a] estimates for all modeled species in a 5 km perimeter around the Lease Area.

| Species of interest | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual mean | May to Dec mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley sea turtle | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.004 | 0.003 | 0.003 | 0.002 | 0.000 | 0.000 | 0.001 | 0.002 |
| Leatherback sea turtle | 0.001 | 0.000 | 0.000 | 0.000 | 0.004 | 0.086 | 0.242 | 0.402 | 0.571 | 0.333 | 0.055 | 0.004 | 0.142 | 0.212 |
| Loggerhead sea turtle | 0.002 | 0.001 | 0.001 | 0.002 | 0.003 | 0.012 | 0.029 | 0.031 | 0.036 | 0.034 | 0.014 | 0.004 | 0.014 | 0.020 |
| Green sea turtle | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.018 | 0.103 | 0.142 | 0.116 | 0.017 | 0.003 | 0.000 | 0.033 | 0.050 |

[a] Density estimates are from DiMatteo et al. (2023).

Table H-131. Sea turtle density (animals/100 $km^2$)[a] estimates for all modeled species in a 10 km perimeter around the Lease Area.

| Species of interest | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual mean | May to Dec mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley sea turtle | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.004 | 0.003 | 0.003 | 0.002 | 0.000 | 0.000 | 0.001 | 0.002 |
| Leatherback sea turtle | 0.001 | 0.000 | 0.000 | 0.000 | 0.004 | 0.083 | 0.239 | 0.398 | 0.563 | 0.331 | 0.056 | 0.005 | 0.140 | 0.210 |
| Loggerhead sea turtle | 0.003 | 0.001 | 0.001 | 0.002 | 0.004 | 0.013 | 0.029 | 0.031 | 0.037 | 0.036 | 0.015 | 0.004 | 0.015 | 0.021 |
| Green sea turtle | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.020 | 0.106 | 0.138 | 0.112 | 0.018 | 0.003 | 0.000 | 0.033 | 0.050 |

[a] Density estimates are from DiMatteo et al. (2023).

Table H-132. Sea turtle density (animals/100 $km^2$)[a] estimates for all modeled species in a 15 km perimeter around the Lease Area.

| Species of interest | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual mean | May to Dec mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley sea turtle | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.004 | 0.003 | 0.003 | 0.002 | 0.000 | 0.000 | 0.001 | 0.002 |
| Leatherback sea turtle | 0.001 | 0.000 | 0.000 | 0.000 | 0.004 | 0.084 | 0.247 | 0.407 | 0.571 | 0.337 | 0.056 | 0.005 | 0.143 | 0.214 |
| Loggerhead sea turtle | 0.003 | 0.001 | 0.001 | 0.002 | 0.004 | 0.013 | 0.028 | 0.029 | 0.035 | 0.035 | 0.015 | 0.004 | 0.014 | 0.020 |
| Green sea turtle | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.019 | 0.106 | 0.132 | 0.108 | 0.018 | 0.003 | 0.000 | 0.032 | 0.048 |

[a] Density estimates are from DiMatteo et al. (2023).

Table H-133. Sea turtle density (animals/100 $km^2$)[a] estimates for all modeled species in a 20 km perimeter around the Lease Area.

| Species of interest | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual mean | May to Dec mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley sea turtle | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.003 | 0.003 | 0.003 | 0.002 | 0.000 | 0.000 | 0.001 | 0.002 |
| Leatherback sea turtle | 0.001 | 0.000 | 0.000 | 0.000 | 0.005 | 0.084 | 0.241 | 0.397 | 0.557 | 0.334 | 0.057 | 0.005 | 0.140 | 0.210 |
| Loggerhead sea turtle | 0.003 | 0.002 | 0.001 | 0.002 | 0.004 | 0.014 | 0.029 | 0.029 | 0.036 | 0.036 | 0.016 | 0.005 | 0.015 | 0.021 |
| Green sea turtle | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.021 | 0.109 | 0.131 | 0.106 | 0.019 | 0.003 | 0.000 | 0.032 | 0.049 |

[a] Density estimates are from DiMatteo et al. (2023).

Table H-134. Sea turtle density (animals/100 km$^2$)[a] estimates for all modeled species in a 30 km perimeter around the Lease Area.

| Species of interest | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual mean | May to Dec mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley sea turtle | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.003 | 0.003 | 0.002 | 0.002 | 0.000 | 0.000 | 0.001 | 0.001 |
| Leatherback sea turtle | 0.001 | 0.000 | 0.000 | 0.000 | 0.006 | 0.085 | 0.239 | 0.390 | 0.540 | 0.328 | 0.059 | 0.006 | 0.138 | 0.207 |
| Loggerhead sea turtle | 0.003 | 0.002 | 0.002 | 0.002 | 0.004 | 0.016 | 0.028 | 0.028 | 0.035 | 0.037 | 0.017 | 0.005 | 0.015 | 0.021 |
| Green sea turtle | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.022 | 0.107 | 0.120 | 0.098 | 0.021 | 0.003 | 0.000 | 0.031 | 0.046 |

[a] Density estimates are from DiMatteo et al. (2023).

Table H-135. Sea turtle density (animals/100 km$^2$)[a] estimates for all modeled species in a 40 km perimeter around the Lease Area.

| Species of interest | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual mean | May to Dec mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley sea turtle | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.003 | 0.003 | 0.002 | 0.002 | 0.000 | 0.000 | 0.001 | 0.001 |
| Leatherback sea turtle | 0.001 | 0.000 | 0.000 | 0.000 | 0.006 | 0.085 | 0.233 | 0.380 | 0.520 | 0.317 | 0.058 | 0.006 | 0.134 | 0.201 |
| Loggerhead sea turtle | 0.003 | 0.002 | 0.002 | 0.002 | 0.005 | 0.017 | 0.028 | 0.027 | 0.034 | 0.037 | 0.017 | 0.006 | 0.015 | 0.021 |
| Green sea turtle | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.022 | 0.103 | 0.111 | 0.091 | 0.021 | 0.003 | 0.000 | 0.029 | 0.044 |

[a] Density estimates are from DiMatteo et al. (2023).

Table H-136. Sea turtle density (animals/100 km$^2$)[a] estimates for all modeled species in a 50 km perimeter around the Lease Area.

| Species of interest | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual mean | May to Dec mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kemp's ridley sea turtle | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.003 | 0.003 | 0.002 | 0.002 | 0.000 | 0.000 | 0.001 | 0.001 |
| Leatherback sea turtle | 0.001 | 0.000 | 0.000 | 0.000 | 0.007 | 0.081 | 0.216 | 0.353 | 0.479 | 0.297 | 0.057 | 0.007 | 0.125 | 0.187 |
| Loggerhead sea turtle | 0.003 | 0.002 | 0.002 | 0.003 | 0.006 | 0.019 | 0.029 | 0.027 | 0.034 | 0.038 | 0.019 | 0.007 | 0.016 | 0.022 |
| Green sea turtle | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.023 | 0.100 | 0.106 | 0.085 | 0.021 | 0.003 | 0.000 | 0.028 | 0.042 |

[a] Density estimates are from DiMatteo et al. (2023).

## H.3. Animat Seeding Areas

Exposure modeling seeding areas are set using each species' preferred depth range. The following maps show seeding areas for each species, overlaid on a density map, if available, displaying the highest density month for that species. If density surfaces are unavailable for a particular species, a surrogate may be used, and for some species, the density data source shown in the image may not coincide with the data source used in predicting exposures. Please refer to Section 3.2 for a detailed description of density sources and calculations.

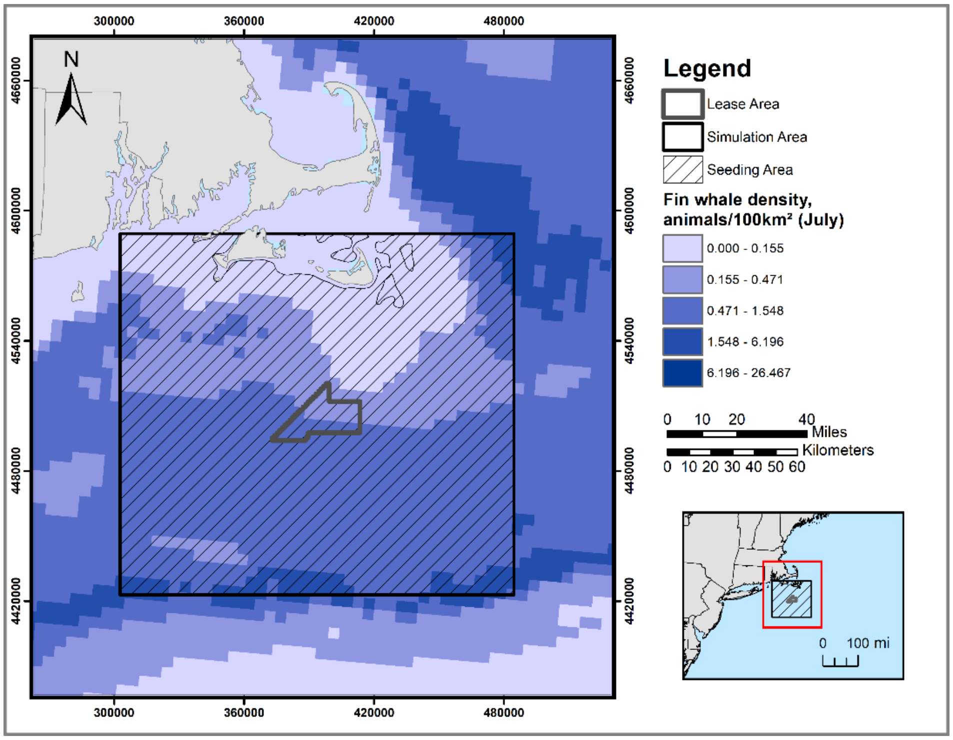



Figure H-1. Map of fin whale animat seeding area range.

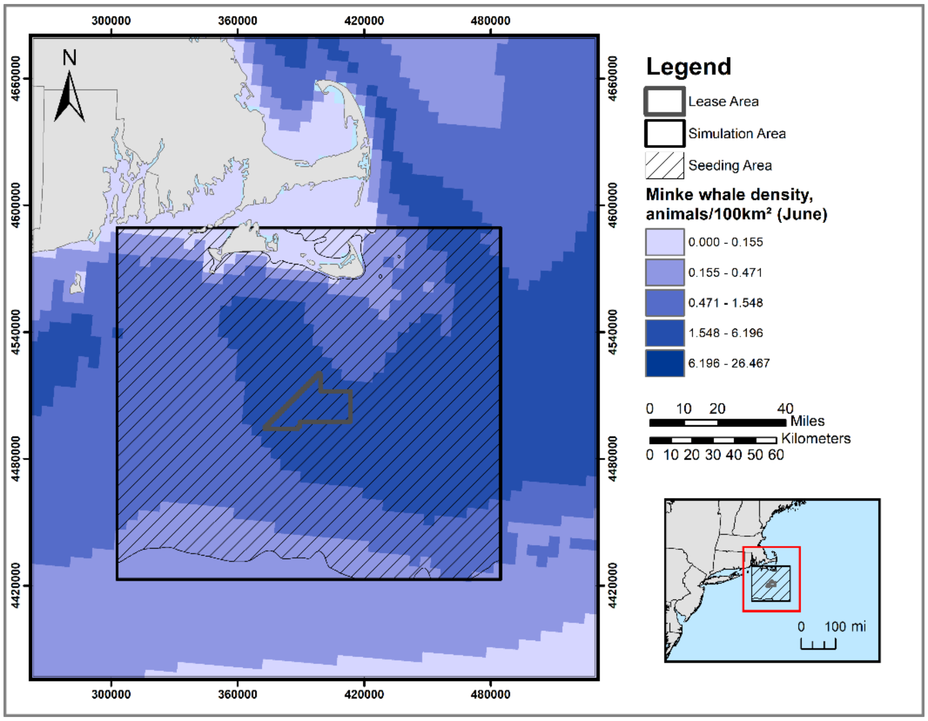



Figure H-2. Map of minke whale animat seeding area range.

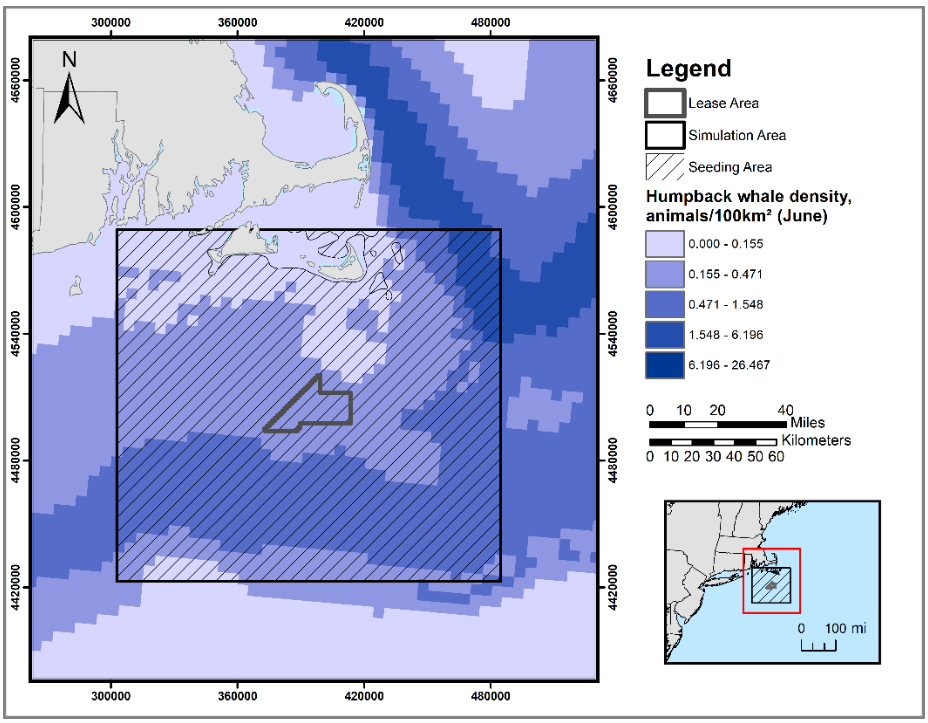



Figure H-3. Map of humpback whale animat seeding area range.

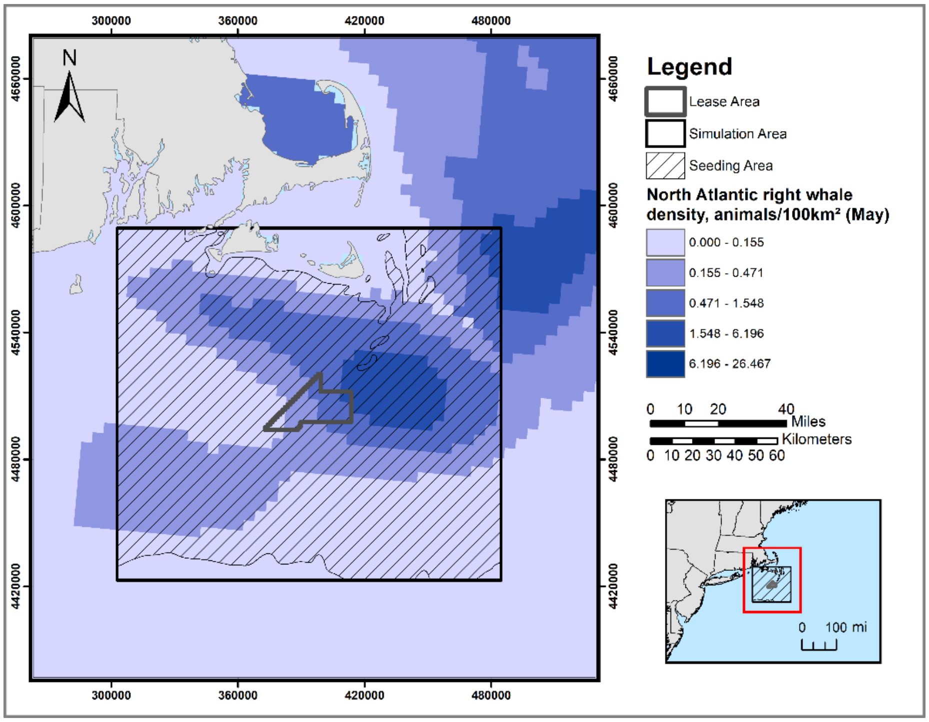



Figure H-4. Map of North Atlantic right whale animat seeding area range.

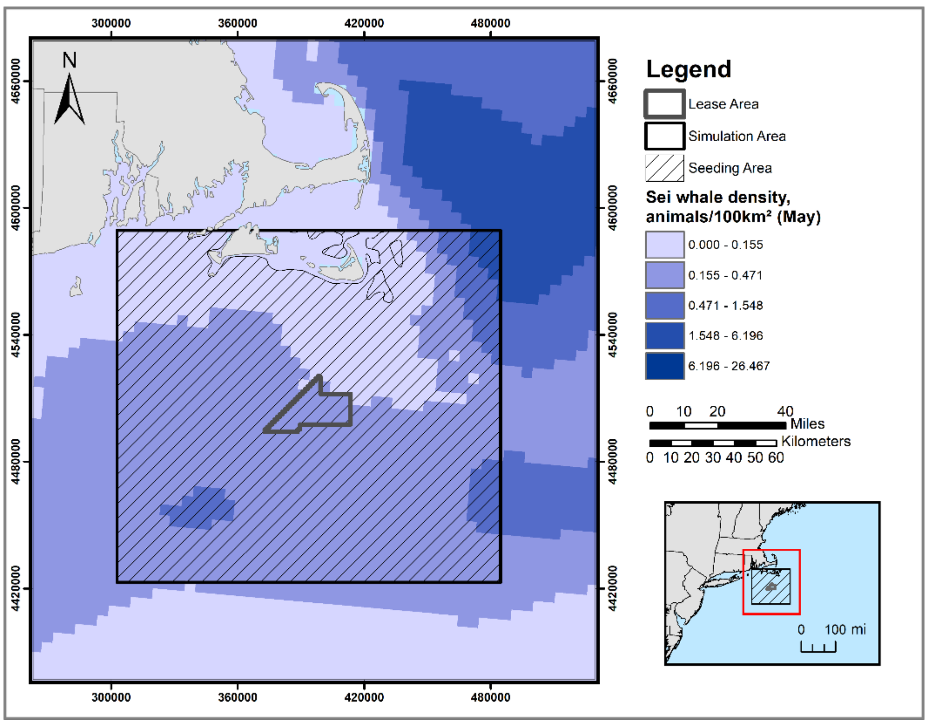



Figure H-5. Map of sei whale animat seeding area range.

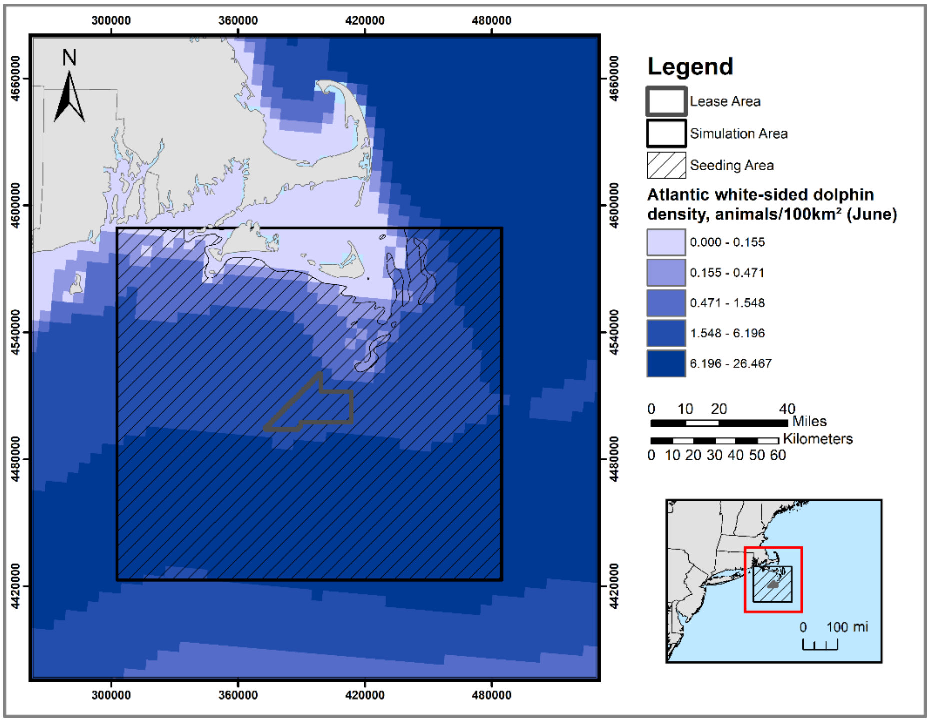



Figure H-6. Map of Atlantic white-sided dolphin animat seeding area range.

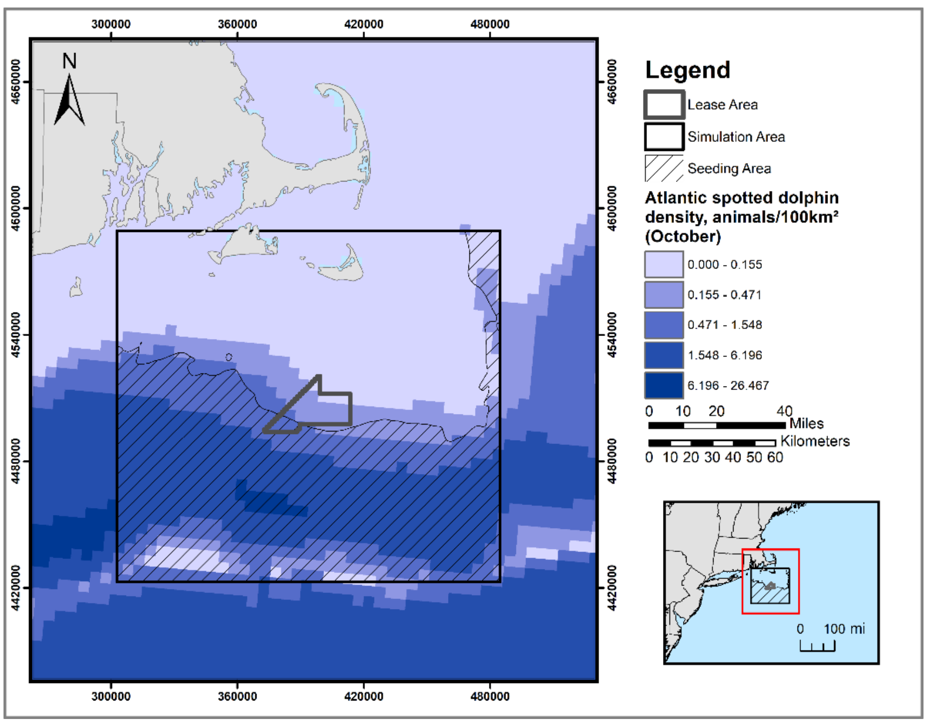



Figure H-7. Map of Atlantic spotted dolphin animat seeding area range.

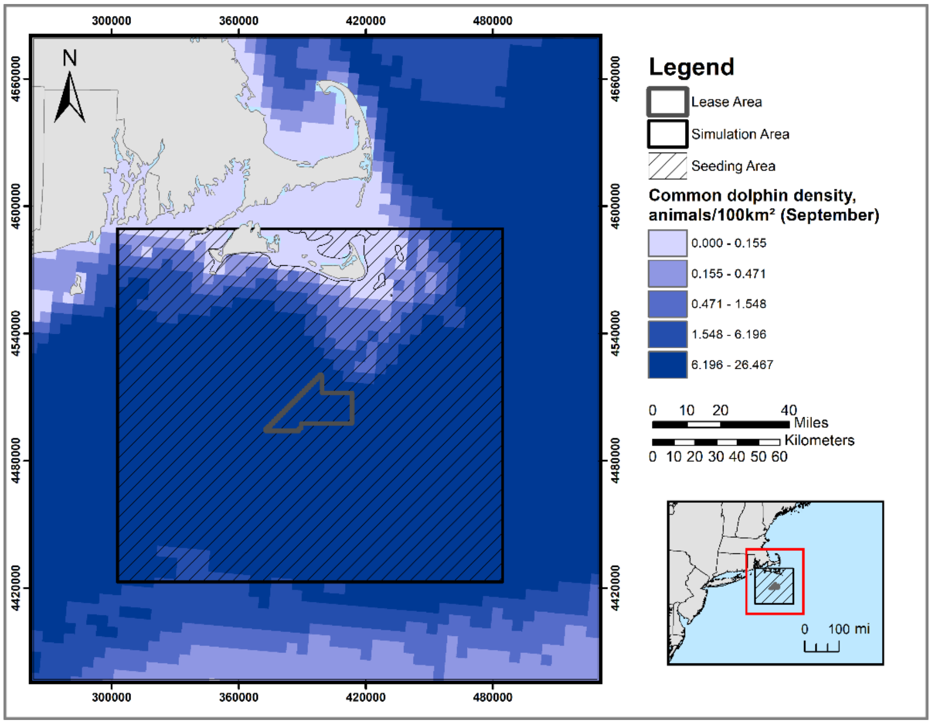



Figure H-8. Map of common dolphin animat seeding area range.

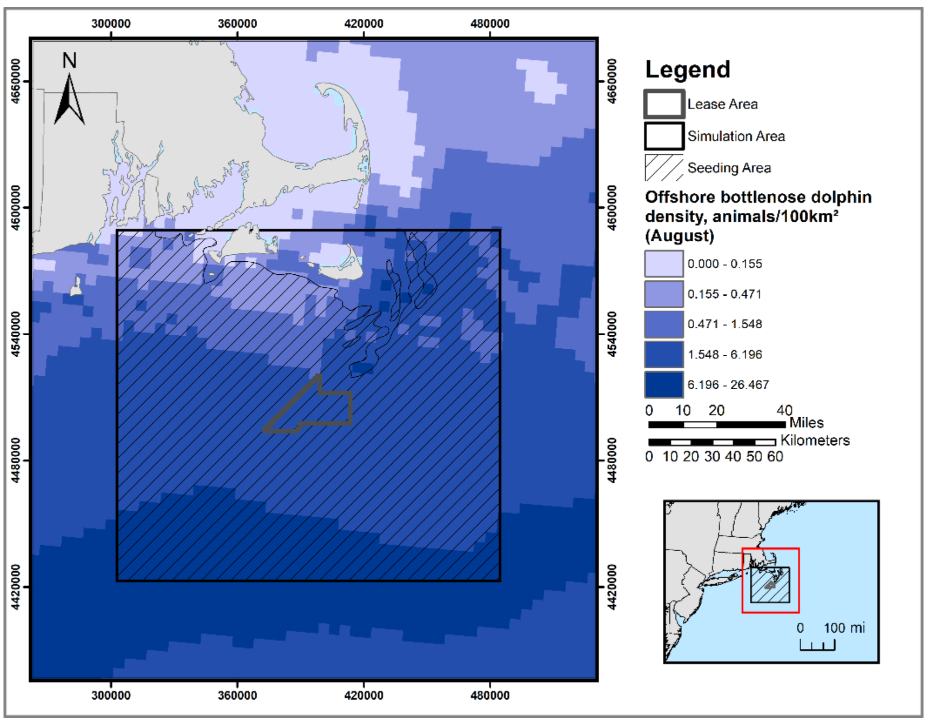



Figure H-9. Map of bottlenose dolphin (offshore) animat seeding area range.

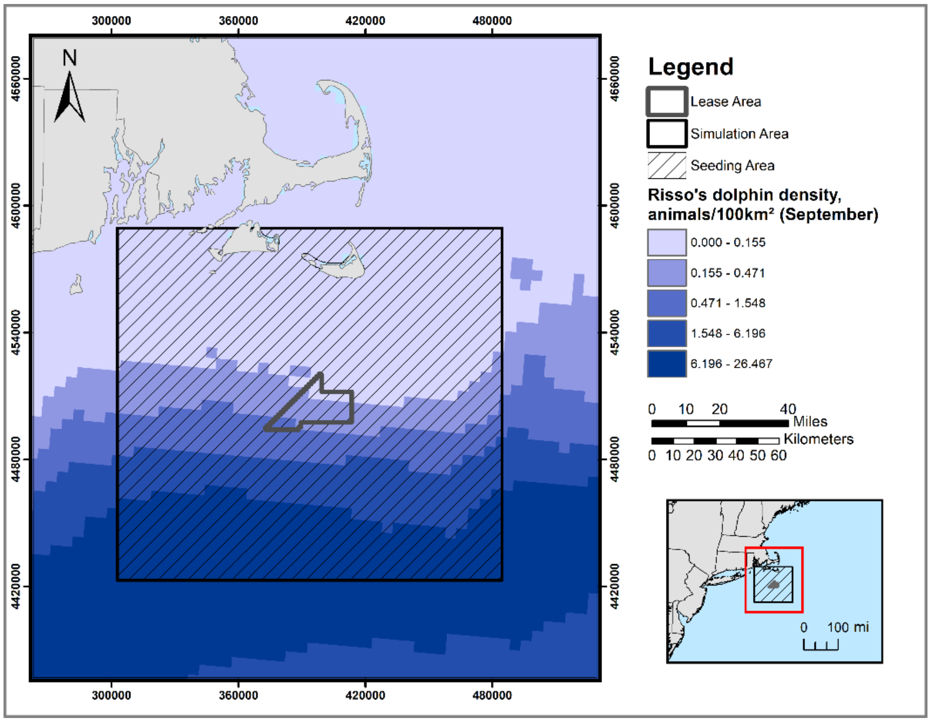



Figure H-10. Map of Risso's dolphin animat seeding area range.

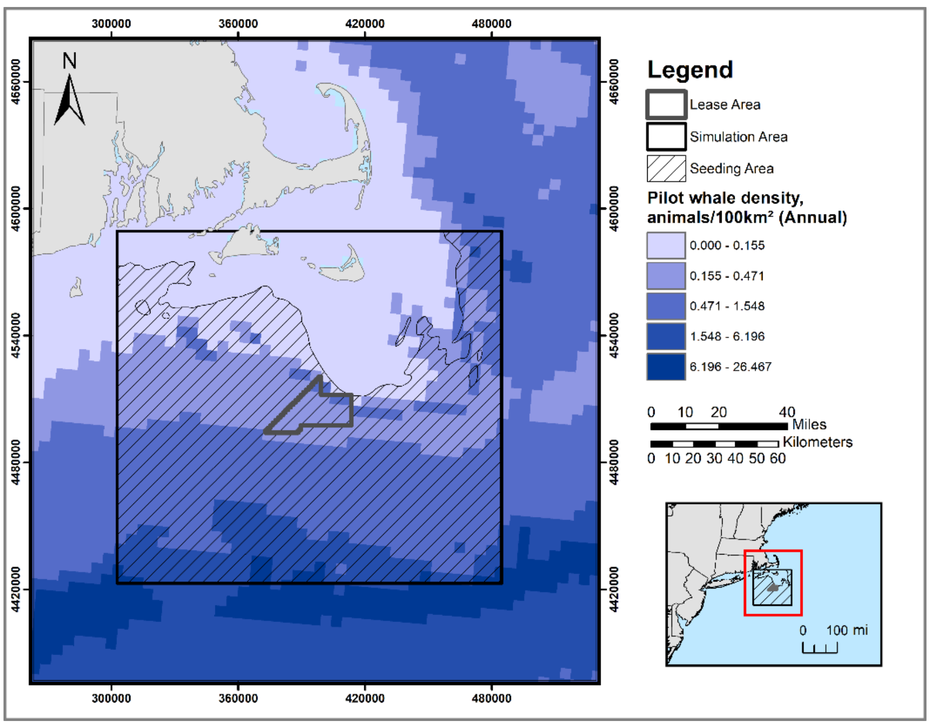



Figure H-11. Map of long-finned pilot whale animat seeding area range.

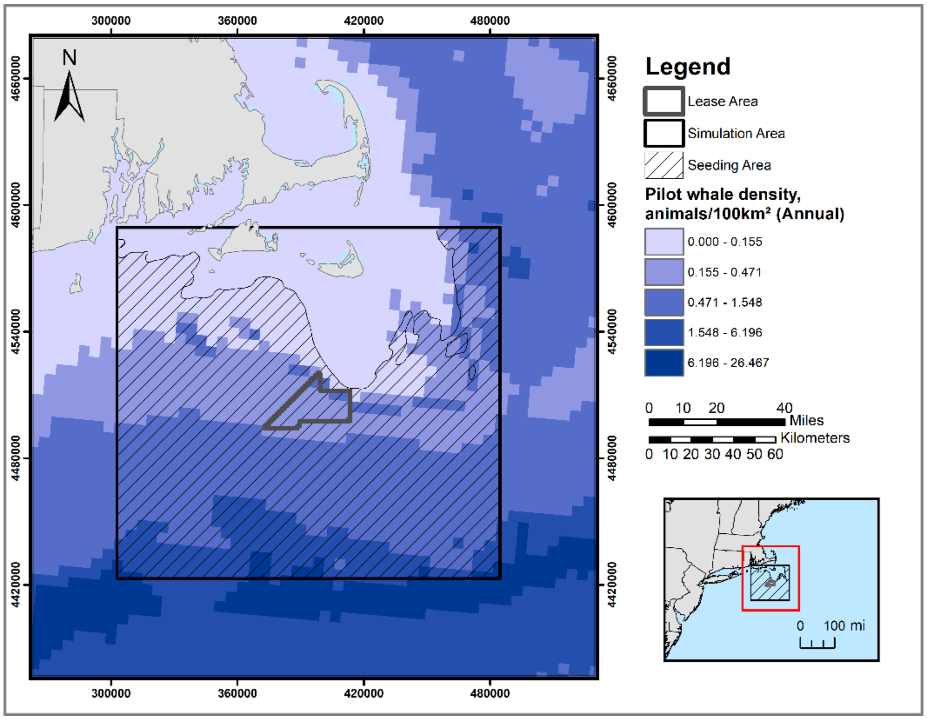



Figure H-12. Map of short-finned pilot whale animat seeding area range.

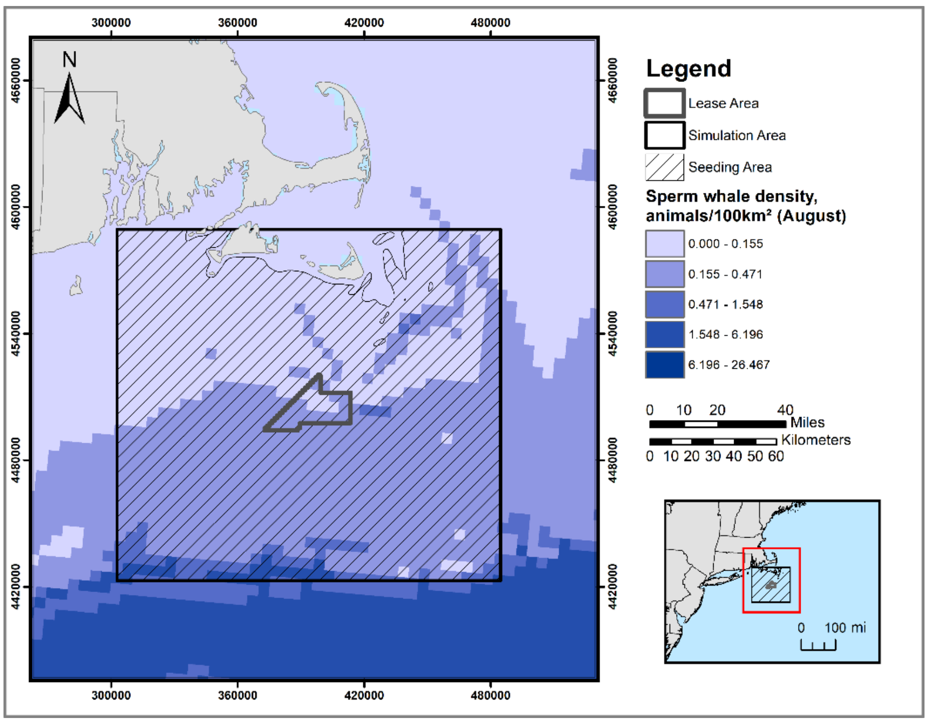



Figure H-13. Map of sperm whale animat seeding area range.

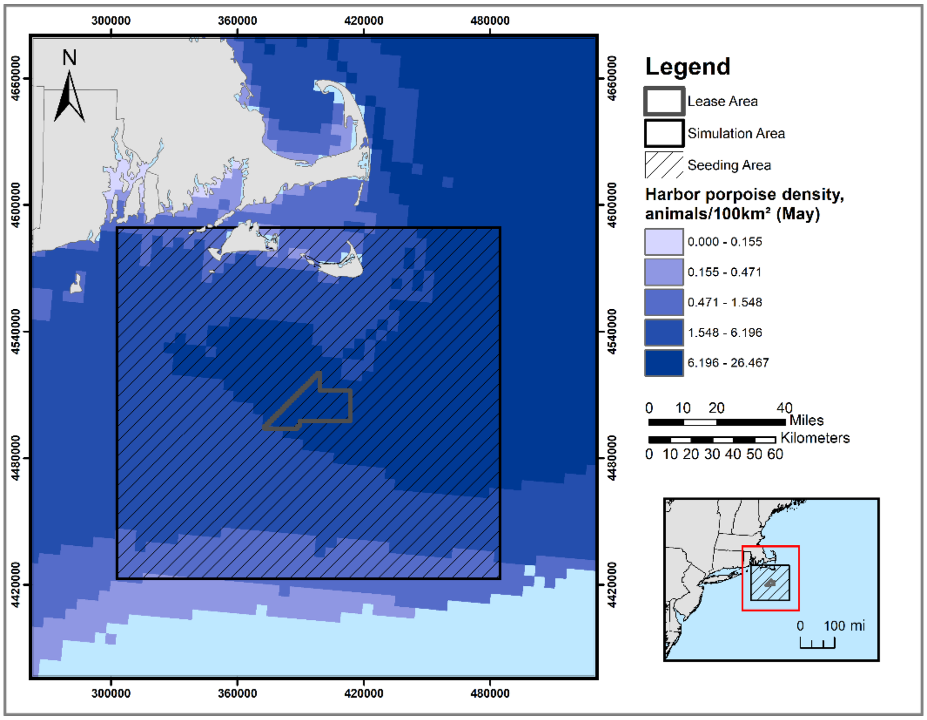



Figure H-14. Map of harbor porpoise animat seeding area range.

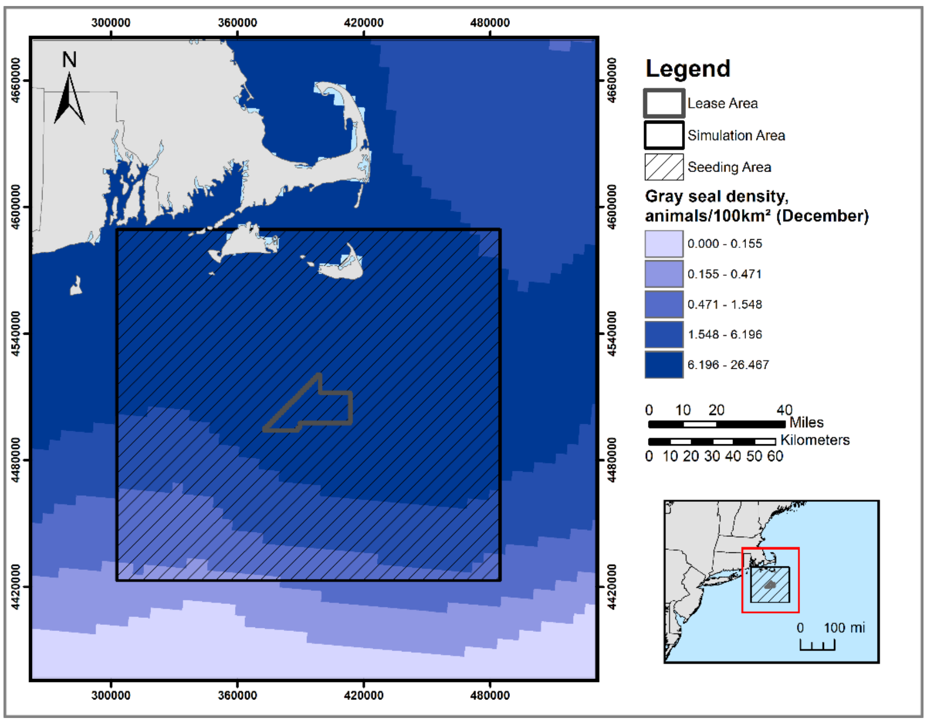



Figure H-15. Map of gray seal animat seeding area range.

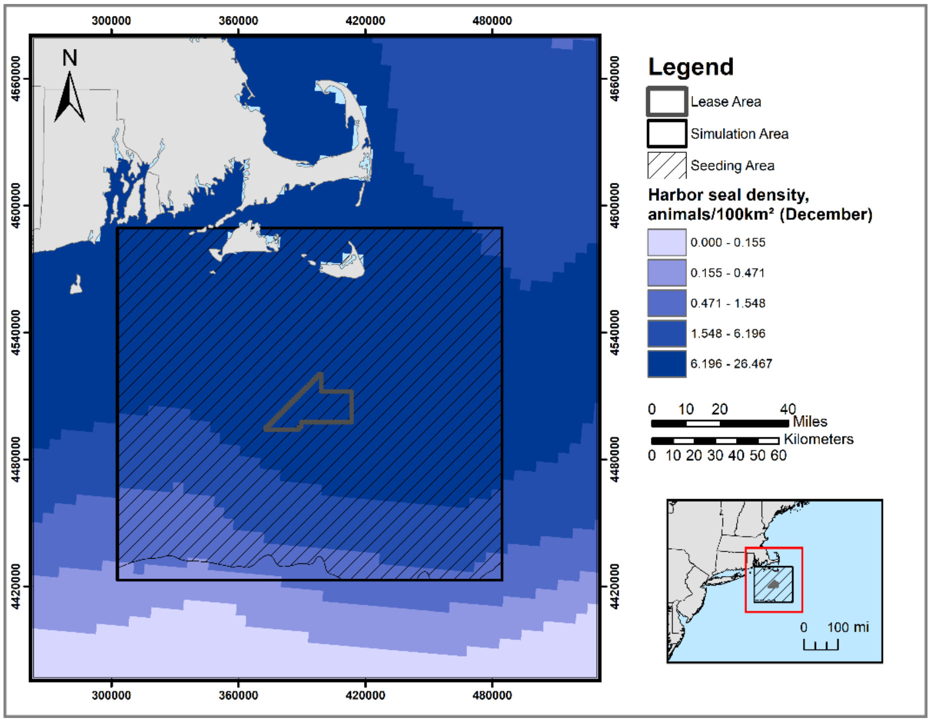



Figure H-16. Map of harbor seal animat seeding area range.

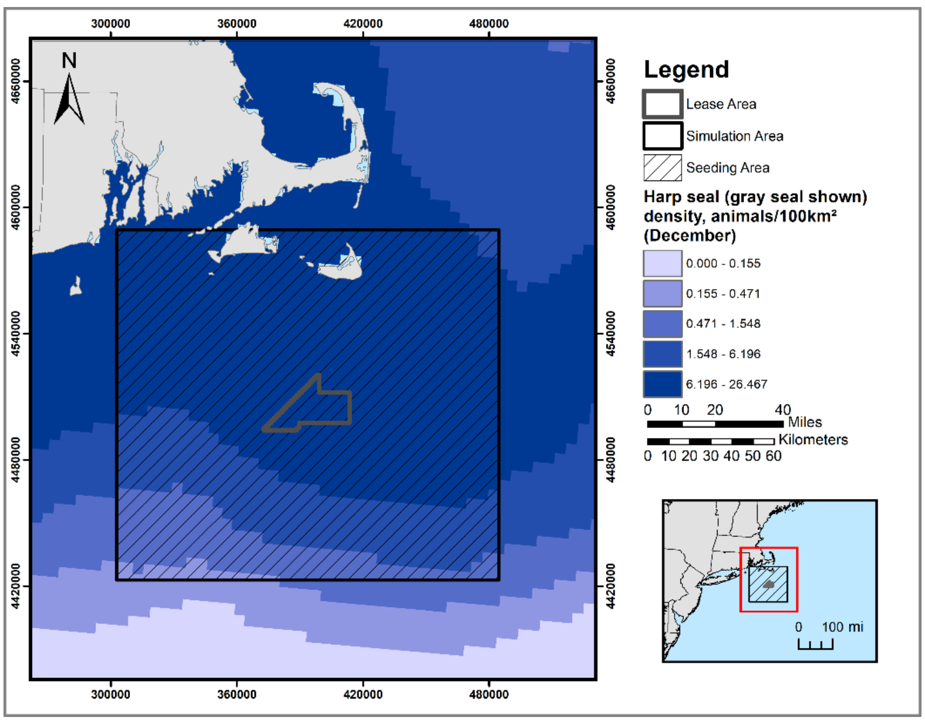



Figure H-17. Map of harp seal animat seeding area range.

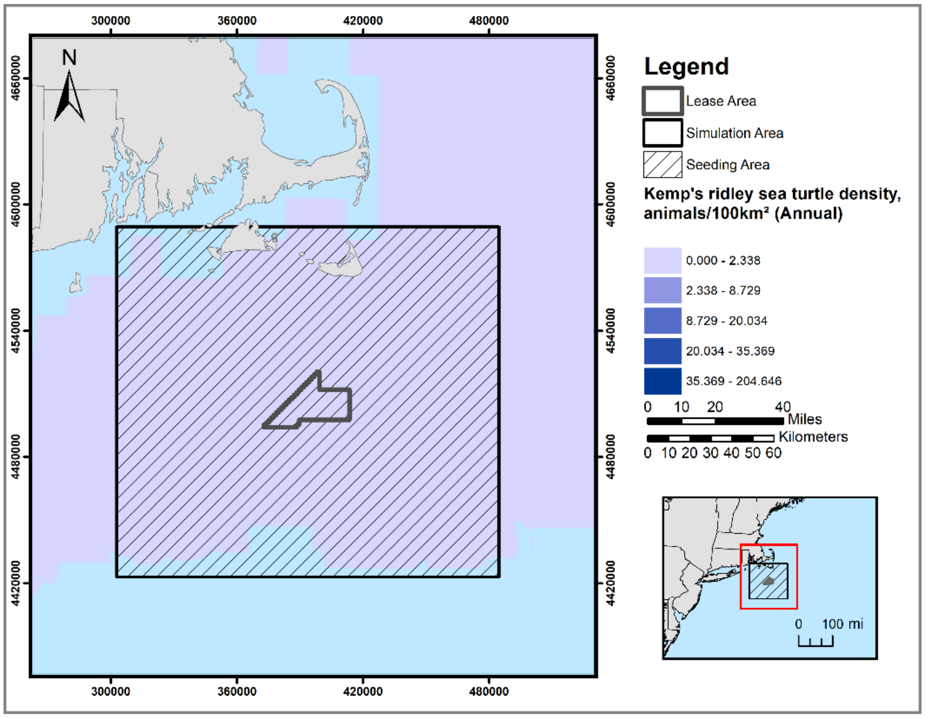



Figure H-18. Map of Kemp's ridley sea turtle animat seeding area range.

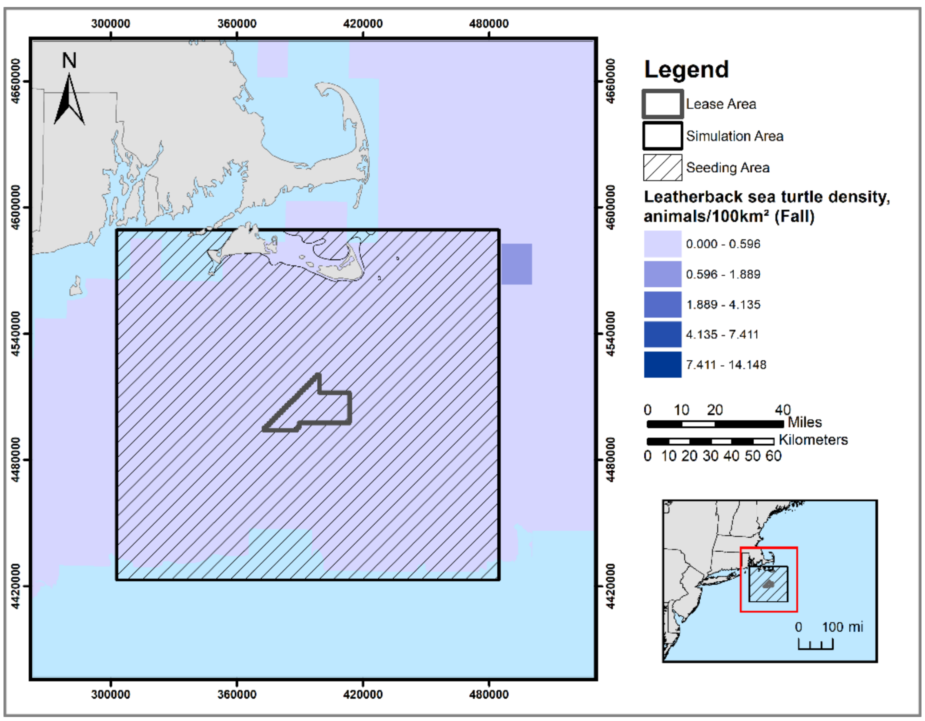



Figure H-19. Map of leatherback sea turtle animat seeding area range.

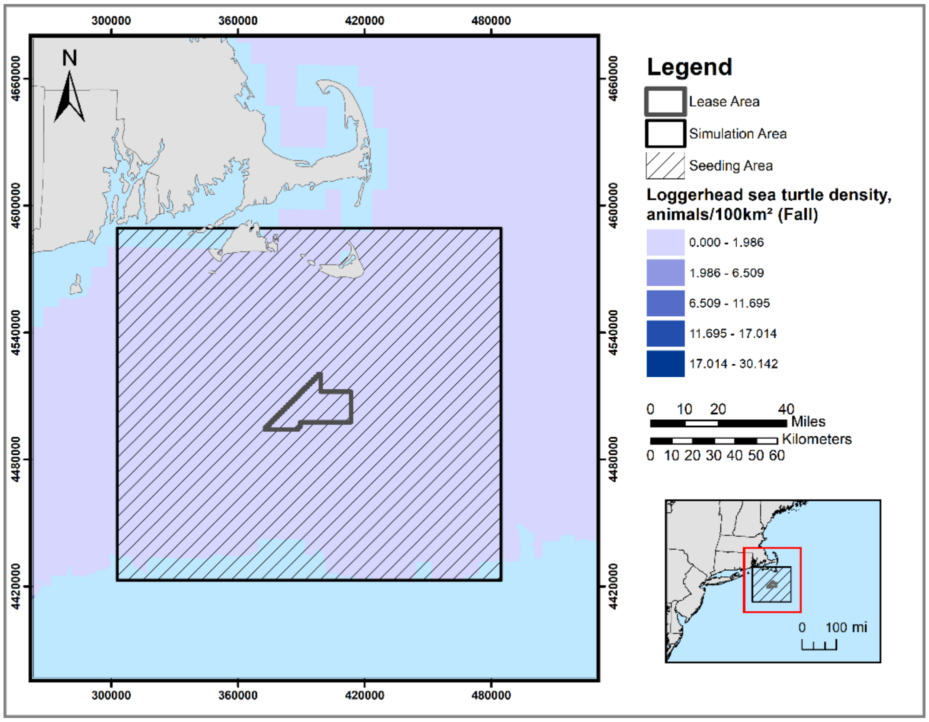



Figure H-20. Map of loggerhead sea turtle animat seeding area range.

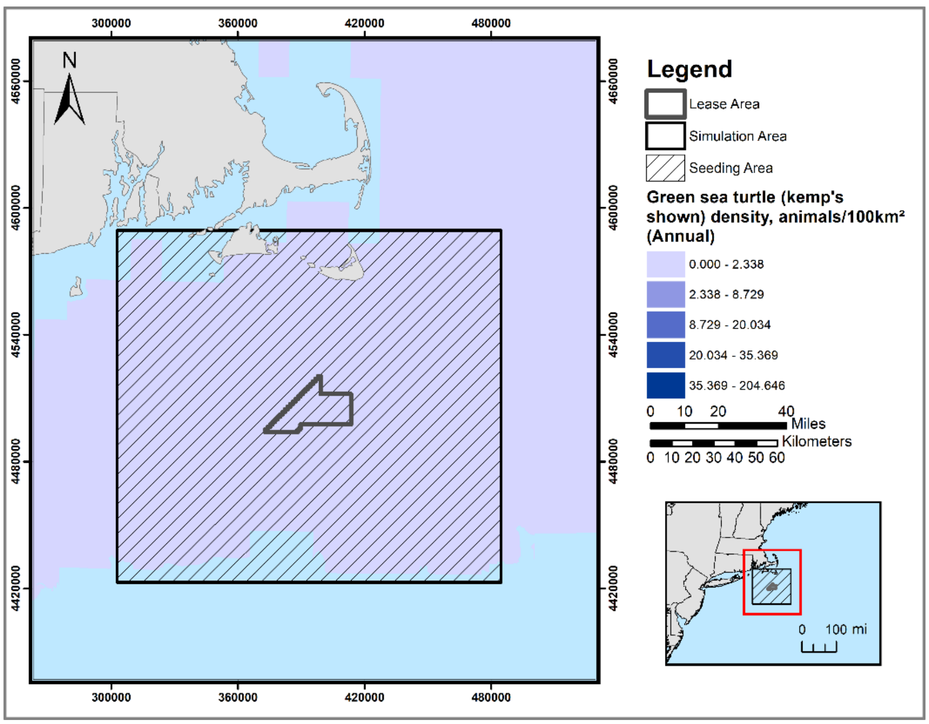



Figure H-21. Map of green sea turtle animat seeding area range.

# Appendix I. Drilling Memo

DATE: 1 March 2024

Version: 4.20

FROM: Emma Ozanich, Kaylyn Terry, Bailey Jenkins, Elizabeth Küsel, David Zeddies, and Katy Limpert

TO: Maria Hartnett (Epsilon)

**Subject: Marine Mammal Exposure Estimates for Drilling Activities During Pile Installation for Vineyard Northeast**

## I.1. Introduction

During the construction phase of Vineyard Northeast, there may be instances when large sub-surface boulders or hard sediment layers are encountered during pile driving, requiring drilling operations to pass through these barriers. Vineyard Northeast estimates that foundations could potentially require up to 6 hours of drilling per day in addition to pile driving operations for the installation of wind turbines.

Drilling activities produce non-impulsive sounds that may cause hearing damage or behavioral responses in marine mammals, sea turtles and fish. Distances to potential injury and behavioral disruption of marine animals are computed here by propagating measured drilling source levels in the construction area and then comparing the resulting sound fields to regulatory thresholds. The modeled ensonified areas are combined with the planned drilling schedules and predicted species densities to estimate the number of marine mammals and sea turtles that will be exposed above thresholds for injury and behavioral response.

## I.2. Methods

### I.2.1. Modeled Locations

Sound fields from drilling activities were modeled at two representative locations in the Lease Area (L01 and L02) as depicted in Figure I-1 and Table I-2. The modeling locations were selected as they represent the range of water depths in the Lease Area.

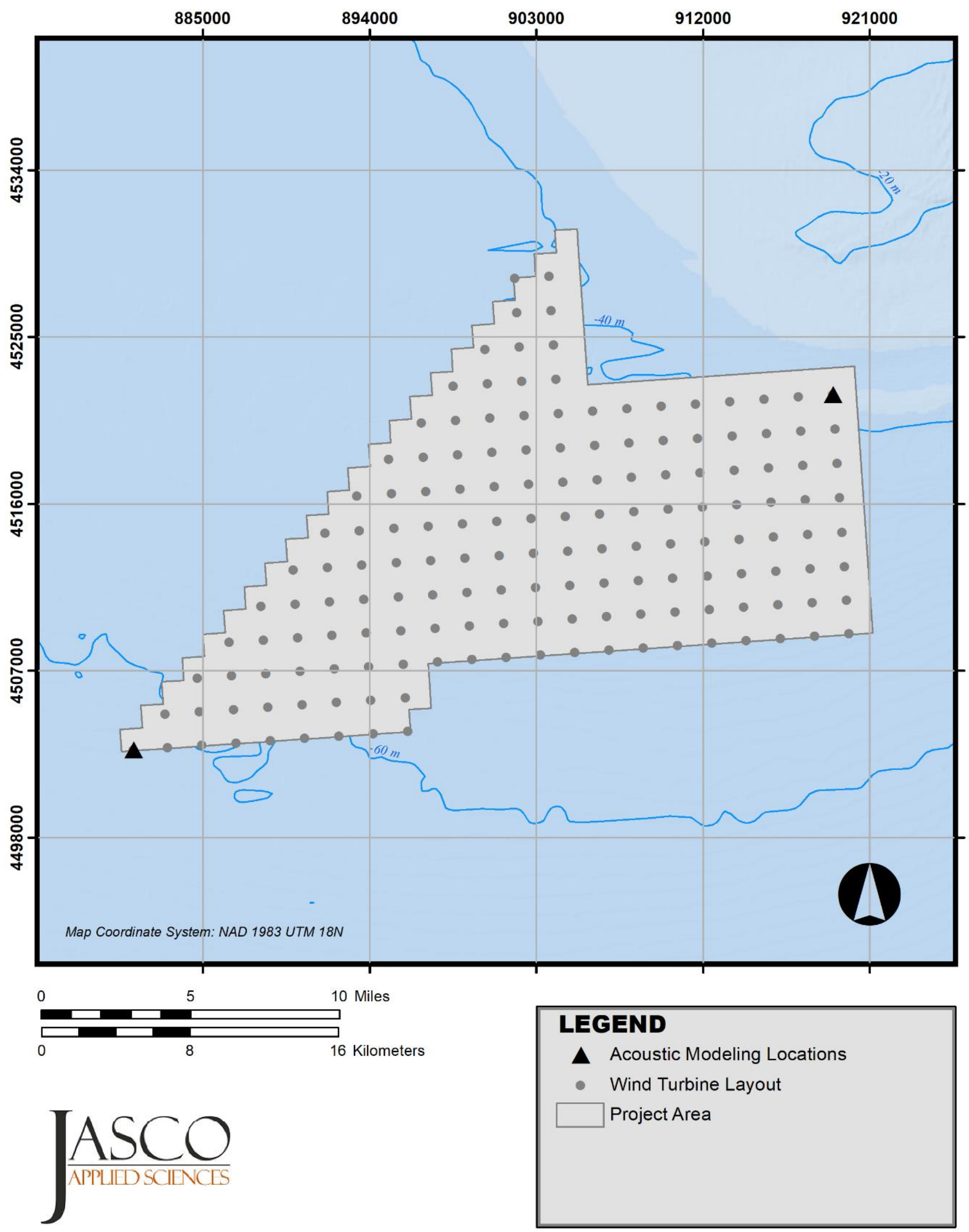



Figure I-1. Vineyard Northeast Lease Area OCS-A 0522 wind turbine layout and acoustic modeling locations with acoustic propagation for drilling activities.

Table I-1. Acoustic modeling locations and water depth for the monopile and jacket foundations.

| Modeling location | Latitude | Longitude | Depth (m) |
|---|---|---|---|
| L01 | 40.74124 | −70.06064 | 35.1 |
| L02 | 40.58755 | −70.81783 | 63.2 |

## I.2.2. Evaluation Criteria

Injury to the hearing apparatus of marine mammals may result from a fatiguing stimulus measured in terms of the sound exposure level (SEL), which considers the sound level and duration of the exposure signal. A permanent threshold shift (PTS) in hearing may be considered injurious, but there are no published data on the sound levels that cause PTS in marine mammals. There are, however, data that indicate the received sound levels at which temporary threshold shift (TTS) occurs, and PTS onset can be extrapolated from TTS onset level and an assumed growth function (Southall et al. 2007). In 2018, the National Oceanographic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) issued a Technical Guidance document (NMFS 2018) that incorporated the best available science to estimate PTS onset thresholds in marine mammals from sound energy, SEL, accumulated over 24 h.

NMFS (2018) also provided guidance on using weighting functions to adjust the received sound levels according to the hearing sensitivity of the animals. Acoustic criteria and weighting function application are divided into functional hearing groups (low-, mid-, and high-frequency cetaceans and phocid pinnipeds) that species are assigned to based on their respective hearing frequency ranges. Table I-2 shows hearing group frequency ranges that are used to define the auditory weighting function, and Table I-3 shows the hearing group thresholds.

After numerous studies on marine mammal behavioral responses to sound exposure there is still no consensus in the scientific community regarding the appropriate metric for assessing behavioral reactions. NMFS currently uses behavioral response thresholds of 120 dB re 1 µPa for continuous sounds for all marine mammal species (NMFS 2018) based on observations of mysticetes (Malme et al. 1983, 1984, Richardson et al. 1986, 1990).

Marine mammals, sea turtles, and fish were considered static receivers. Acoustic distances where sound levels could exceed marine mammal (NMFS 2018), sea turtle (Finneran et al. 2017), and fish (FHWG 2008) injury regulatory thresholds were determined using a maximum-over-depth approach. Distances to SEL thresholds for fish published in the scientific literature are also provided (Popper et al. 2014).

Table I-2. Marine mammal hearing groups and frequency ranges (Sills et al. 2014, NMFS 2018).

| Faunal group | Generalized hearing range [a] |
|---|---|
| Low-frequency (LF) cetaceans (mysticetes or baleen whales) | 7 Hz to 35 kHz |
| Mid-frequency (MF) cetaceans (odontocetes: delphinids, beaked whales) | 150 Hz to 160 kHz |
| High-frequency (HF) cetaceans (other odontocetes) | 275 Hz to 160 kHz |
| Phocid pinnipeds in water (PPW) | 50 Hz to 86 kHz |

[a] The generalized hearing range is for all species within a group. Individual hearing will vary.

Table I-3. Summary of permanent threshold shift onset acoustic thresholds for marine mammals exposed to continuous sound sources (NMFS 2018).

| Faunal group | Frequency-weighted $L_{E,24h}$ (dB re 1 µPa²·s) |
|---|---|
| Low-frequency (LF) cetaceans | 199 |
| Mid-frequency (MF) cetaceans | 198 |
| High-frequency (HF) cetaceans | 173 |
| Phocid pinnipeds in water (PPW) | 201 |

## I.2.3. Source and Propagation Modeling

The Proponent is not aware of acoustic measurements of very large rotational drills specifically for this purpose, but comprehensive measurements of large seabed drills are available from projects in the Alaskan Chukchi and Beaufort Seas. In particular, measurements were made during use of mudline cellar drilling with a 6 m diameter bit (Austin et al. 2018). The mudline cellar is a circular area centered on an oil or gas well on the seabed for the purpose of placing well heads and blow-out preventers below the seafloor elevation. Mudline cellars are important in shallow arctic waters, where deep ice keels can destroy equipment that sits above the seafloor grade. Austin et al. (2018) measured sound pressure level (SPL) for three mobile drilling units at 1000 m and estimated their broadband source levels. Here, the average source level of these mobile drilling units is used as representative source spectrum of broadband drilling activity.

The mudline cellar drilling in the Chukchi Sea was measured at a site with a 46 m water depth, which is similar to the average depth of the Vineyard Northeast project area. Seabed sediment geoacoustic properties differ: the Chukchi Sea drilling site had softer surface sediments with a 14.5 m thick top layer of a constant sound speed of 1630 m/s and a density of 1.45 g/cm$^3$, overlying more consolidated sediments with a sound speed of 2384 m/s and a density of 2.32 g/cm$^3$. By comparison, Vineyard Northeast surficial sediments are expected to be predominantly sand, based on samples from nearby study sites. Figure I-2 shows the sediment layer geoacoustic property profile based on the sediment type and generic porosity-depth profile using a sediment grain-shearing model (Buckingham 2005). Overall, the Chukchi Sea surface sediments have a slightly lower sound speed and lower density than the Vineyard Northeast site, with similar sound speeds at depth. Overall, the acoustic reflectivity at lower frequencies is expected to be similar between these sites. The ocean sound speed profiles at both the Chukchi and Vineyard Northeast sites are slightly downward refracting in summer (which is when the measurements were taken for Austin et al. (2018)). A profile was also included for winter at Vineyard Northeast, which is slightly upward refracting and expected to result in longer ranges.

A separate modeling study that included mudline cellar drilling was performed to predict noise footprints of that operation in the Chukchi Sea (Quijano et al. 2019). This modeling study found the 120 dB re µPa SPL threshold occurred at a distance of 16 km, which included noise from several vessels near the drill site on dynamic positioning.

We assumed that pile installation drilling produces similar sound levels as mudline cellar drilling, and, as a conservative measure, we averaged the three representative source levels estimated by Austin et al. (2018) for the 10–32,000 Hz band.’

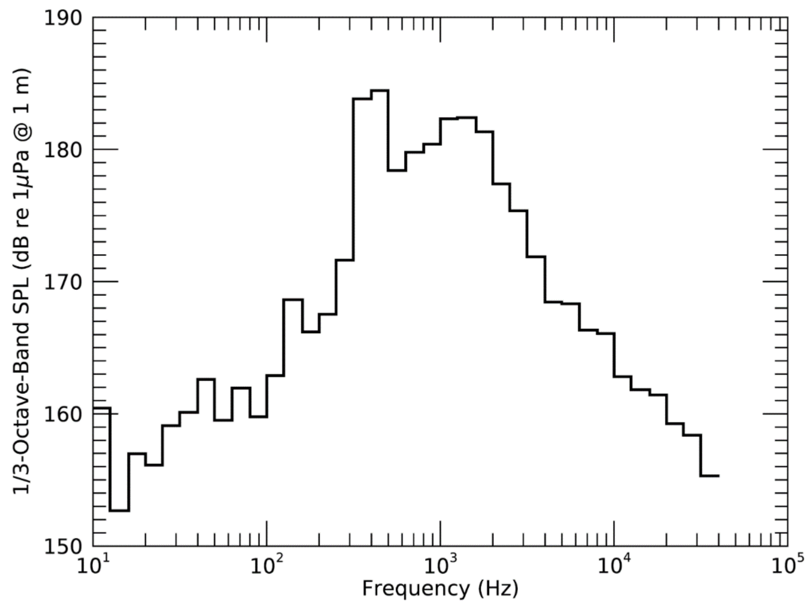



Figure I-2. Decidecade band source levels averaged across three sources for drilling and excavation of mudline cellars (Austin et al. 2018).

JASCO's Marine Operations Noise Model (MONM) was used to predict SEL and SPL sound fields up to 1 kHz at a representative location near the proposed drilling sites considering the influence of bathymetry, seabed, water sound speed, and water attenuation. MONM uses a wide-angle parabolic equation solution to the acoustic wave equation (Collins 1993) based on a version of the US Naval Research Laboratory's Range-dependent Acoustic Model (RAM), which has been modified to account for a solid seabed (Zhang and Tindle 1995). From 1 to 32 kHz, the Bellhop ray tracing model (Porter and Liu 1994) was used to predict sound fields at the same representative location using from 2512 to 5012 geometric beams, increasing the beam coverage with frequency. The drill was represented as a point source in mid-water column at each site. The total sound energy transmission loss was computed at the center frequencies of decidecade bands as a function of range and depth from the source. The acoustic field in three dimensions was generated by modeling two-dimensional (2-D) vertical planes radially spaced at 2.5° in a 360° swath around the source (*N* x 2-D). Composite broadband received SEL were computed by summing the received decidecade band levels across frequency and taking the maximum-over-depth. Major modeling assumptions are listed in Table I-4 and the estimated geoacoustic properties used for modeling are listed in Table I-5.

Table I-4. Major assumptions used in underwater acoustic modeling of relief drilling during piling by both JASCO Applied Sciences and Vineyard Northeast.

| Parameter | Value | Reference (if applicable) |
|---|---|---|
| Drill | 6 m drill bit, mudline cellar excavation | Austin et al. (2018) |
| Bathymetry | | US Coastal Relief Model, National Centers for Environmental Information NOAA (September 2010). (NGDC 2003) |
| Sound speed | Regionally and seasonally [a] averaged profiles | GDEM v-3.0 (NAVO 2003) |
| Geoacoustics | Elastic seabed properties based on client-supplied description of seabed layering | Buckingham (2005). See Table I-5. |

[a] Sound speed was converted to mean summer (June to August) and mean winter (January to March) profiles.

Table I-5. Estimated geoacoustic properties used for modeling, as a function of depth. Within an indicated depth range, the parameter varies linearly within the stated range.

| Depth below seafloor (m) | Material | Density (g/cm$^3$) | Compressional wave Speed (m/s) | Compressional wave Attenuation (dB/λ) | Compressional wave Speed (m/s) | Shear wave Attenuation (dB/λ) |
|---|---|---|---|---|---|---|
| 0–3.3 | Sand | 2.090–2.090 | 1,770–1,774 | 0.88–0.879 | 300 | 3.65 |
| 3.3–6.7 | Sand | 2.090–2.095 | 1,774–1,779 | 0.879–0.878 | 300 | 3.65 |
| 6.7–10 | Sand | 2.095–2.099 | 1,779–1,783 | 0.878–0.877 | 300 | 3.65 |
| 10–50 | Sand | 2.099–2.152 | 1,783–1,833 | 0.877–0.865 | 300 | 3.65 |
| 50–100 | Sand | 2.152–2.216 | 1,833–1,893 | 0.865–0.848 | 300 | 3.65 |
| 100–200 | Sand | 2.216–2.337 | 1,893–2,003 | 0.848–0.807 | 300 | 3.65 |
| 200–500 | Sand | 2.337–2.634 | 2,003–2,269 | 0.807–0.664 | 300 | 3.65 |
| >500 | Sand | 2.634 | 2,269 | 0.664 | 300 | 3.65 |

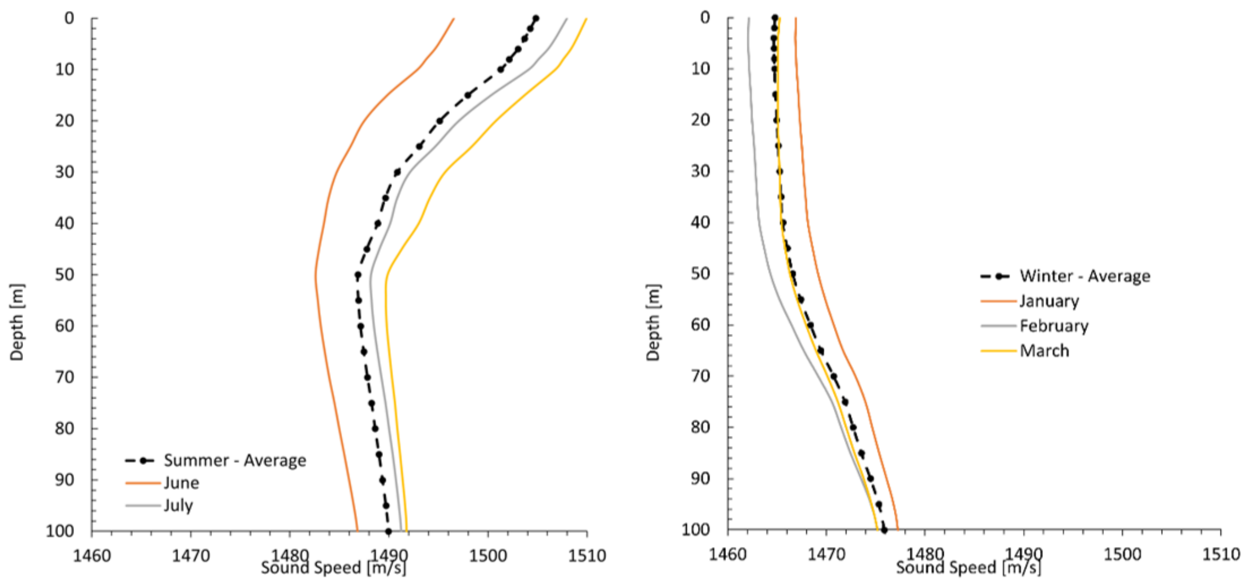



Figure I-3. Sound speed profiles up to 100 m for (left) the summer months of June through August and (right) the winter months of January through March for Vineyard Northeast. The mean profile used in the modeling was obtained by taking the average of all profiles for each season.

## I.2.4. Exposure Estimates for Marine Mammals

Exposures were calculated for one day of drilling. Drilling was modeled at each of the two site locations (L01 and L02). Exposures were estimated using the average animal densities for the summer months, from May to November, and winter month of December, which are expected to represent a spectrum of annual conditions.

### I.2.4.1. Density Calculations

Marine mammal densities in the potential impact area were estimated using the Marine Geospatial Ecology Laboratory (MGEL)/Duke University Habitat-based Marine Mammal Density Models for the US Atlantic (Roberts et al. 2016a, 2016b, 2017, 2018, 2021). Densities in the MGEL/Duke models are provided as the number of animals per 100 square kilometers (animals/100 km$^2$) and given for each 5 × 5 km cell in the US Atlantic for all species. Sea turtle densities were estimated using the East Coast sea turtle density models developed by the U.S. Naval Undersea Warfare Center (NUWC, DiMatteo et al. 2023). The data are long-term monthly average estimates of density and are expressed as the number of individuals per square kilometer.

To calculate marine mammal densities for the potential drilling impact area, it was assumed that the surveys would occur in two areas of interest: L01 and L02. The density perimeters were determined using the longest 95th percentile acoustic range to threshold ($R_{95\%}$) for injury and behavior, for both locations, rounded up to the nearest 5 km, and then applied around the entire lease area (see Table I-7 and Table I-9); 0.16 km for injury (5 km) and 49.78 km (50 km) for behavior). Monthly densities were calculated for each area of interest and for each species as the average of the densities from all MGEL/Duke model grid cells that overlap partially or completely with each area of interest. Cells entirely on land were not included, but cells that overlap only partially with land were included.

There are two cases in this study for which the MGEL/Duke models report densities for species guilds: seals and pilot whales. When calculating exposures for individual pilot whale and seal species, the guild densities provided by Roberts et al. (2016a, 2022) were scaled by the relative abundances of the two species in each guild, using the best available estimates of local abundance, to get species-specific density estimates for the project area. In estimating local abundances, all distribution data from the two pilot whale species and three seal species were downloaded from the Ocean Biodiversity Information System (OBIS) data repository (available at https://obis.org/). After reviewing the available datasets, it was deemed that data available in OBIS in Rhode Island and Massachusetts waters are the best available for the three seals species because of their overlap with the project area. For seals, OBIS reported 86 observations of gray seals, 129 observations of harbor seals, and 93 observations of harp seals. Therefore, the proportions of 0.28 (86/308), 0.42 (129/308), and 0.30 (93/308) were used to scale the seals guild densities for the three seal species, respectively. The best data available for pilot whales came from AMAPPS data in Rhode Island and Massachusetts waters. The proportions of 0.80 for long-finned and 0.20 for short-finned pilot whales were used (Palka et al 2021.)

The average densities were calculated over summer (May to November) and winter (December). The resulting densities are included in Table I-7. Figures Figure I-4 and Figure I-5 show the data cells included in the density average for distances to injury and behavior thresholds, respectively.

Table I-6. Average monthly density (animals per 100 km$^2$), estimated during summer (May-November) and winter (December), for both distances to injury and behavior thresholds.

| Species | Summer Injury | Summer Behavior | Winter Injury | Winter Behavior |
|---|---|---|---|---|
| Fin whale | 0.288 | 0.313 | 0.155 | 0.147 |
| Minke whale | 0.900 | 0.716 | 0.077 | 0.091 |
| Humpback whale | 0.268 | 0.263 | 0.029 | 0.049 |
| North Atlantic right whale | 0.197 | 0.174 | 0.647 | 0.523 |
| Sei whale | 0.064 | 0.075 | 0.064 | 0.057 |
| Atlantic white-sided dolphin | 2.871 | 3.087 | 3.592 | 4.120 |
| Atlantic spotted dolphin | 0.184 | 0.489 | 0.010 | 0.026 |
| Common dolphin | 22.920 | 29.459 | 14.908 | 21.892 |
| Bottlenose dolphin, offshore | 1.812 | 2.925 | 1.303 | 2.350 |
| Risso’s dolphin | 0.183 | 1.073 | 0.187 | 0.430 |
| ong-finned pilot whale | 0.269 | 0.413 | 0.269 | 0.413 |
| Short-finned pilot whale | 0.067 | 0.103 | 0.067 | 0.103 |
| Sperm whale | 0.083 | 0.085 | 0.033 | 0.049 |
| Harbor porpoise | 2.977 | 2.724 | 8.347 | 5.194 |
| Gray seal | 1.199 | 2.264 | 4.797 | 3.772 |
| Harbor seal | 1.799 | 3.396 | 7.195 | 5.658 |
| Harp seal | 1.285 | 2.426 | 5.139 | 4.042 |
| Kemp’s ridley turtle | 0.002 | 0.002 | 0.000 | 0.000 |
| Leatherback turtle | 0.242 | 0.213 | 0.004 | 0.007 |
| Loggerhead turtle | 0.023 | 0.024 | 0.004 | 0.007 |
| Green turtle | 0.057 | 0.048 | 0.000 | 0.000 |

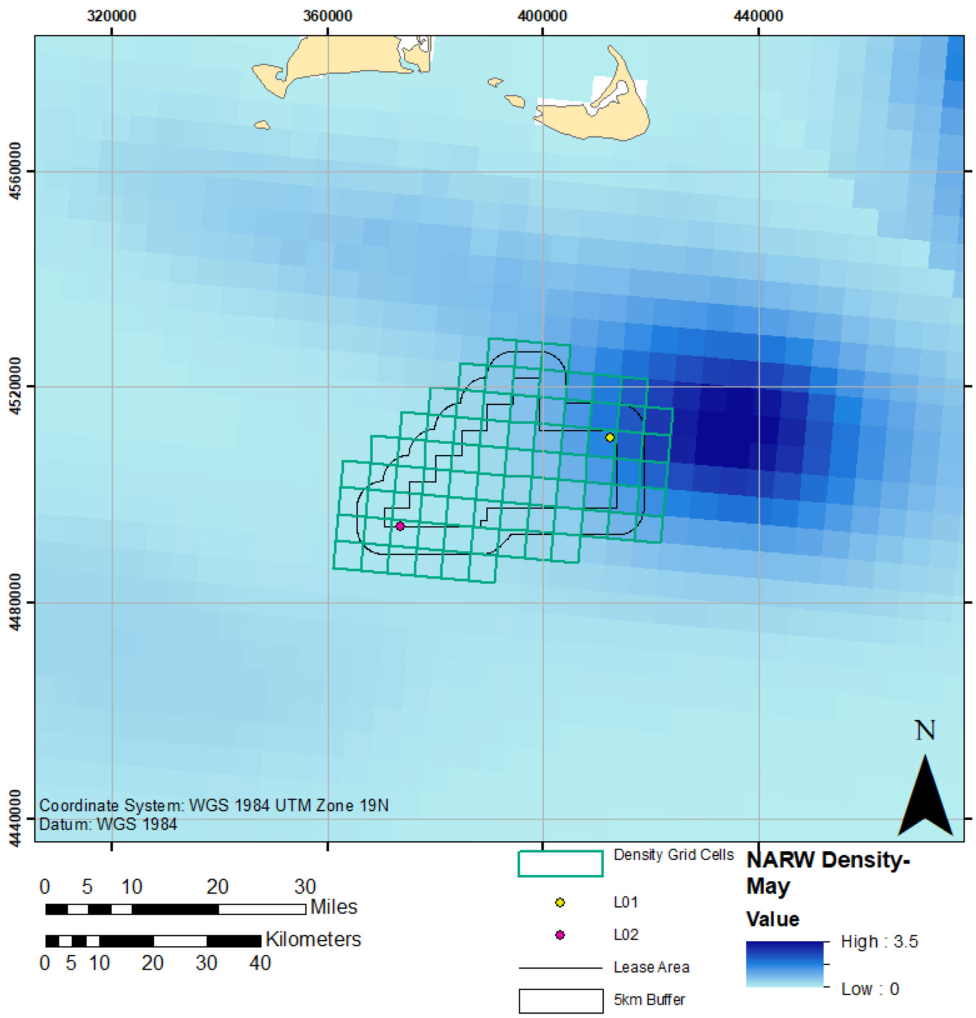



Figure I-4. Marine mammal (e.g., NARW) density showing highlighted grid cells used to calculate seasonal species density estimate within a 5 km perimeter around Lease Area OCS-A 0522 (Roberts et al. 2016a, 2016b, 2017, 2018, 2021).

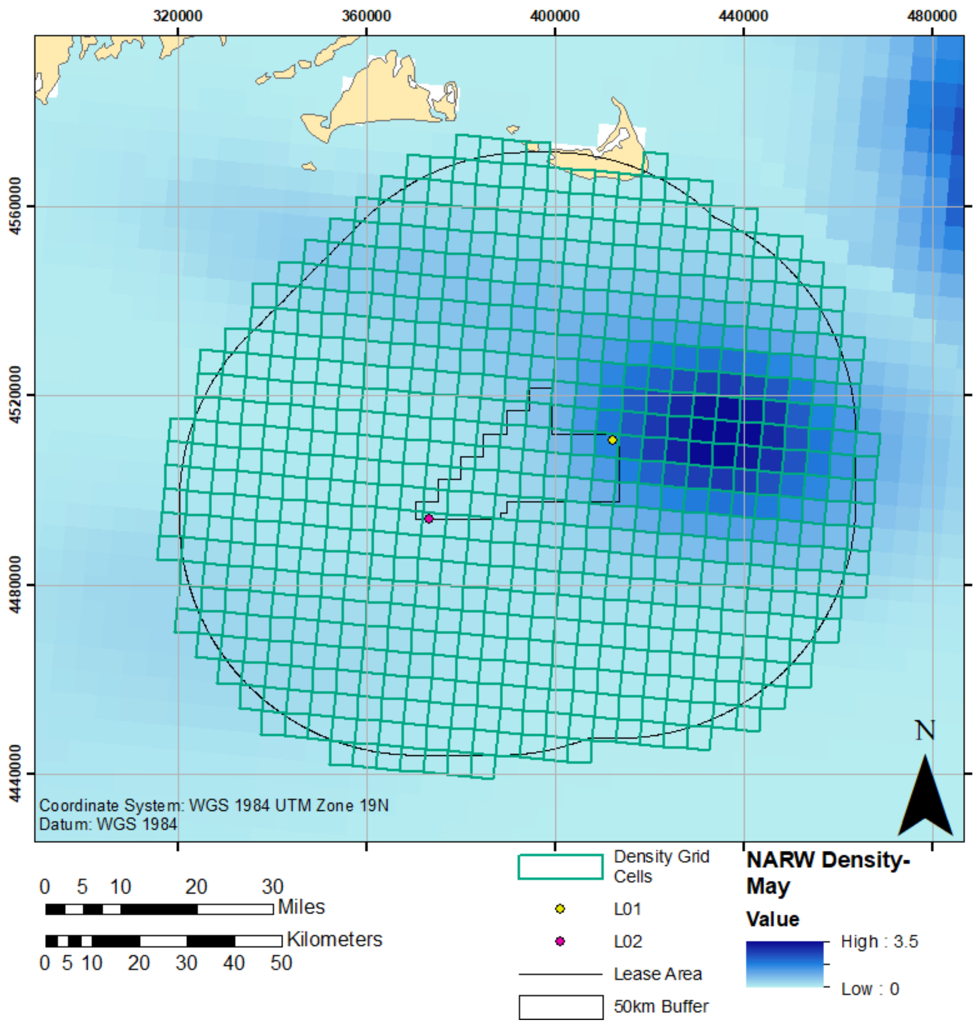



Figure I-5. Marine mammal (e.g., NARW) density showing highlighted grid cells used to calculate seasonal species density estimate within a 50 km perimeter around Lease Area OCS-A 0522 (Roberts et al. 2016a, 2016b, 2017, 2018, 2021).

# I.3. Results

## I.3.1. Acoustic Ranges

Assuming 6 h of drilling will occur during a 24 h period, the frequency-weighted distances to potential injury for the marine mammal hearing groups and fish and sea turtles are shown in Table I-7 for L01 and Table I-8 for L02. The acoustic ranges to the SPL 120 dB re 1 µPa threshold (NMFS 2018), without frequency weighting, are shown in Table I-9 for L01 and Table I-10 for L02. The maximum unweighted behavioral acoustic ranges at L01 were found to extend to 55.86 km in winter and 18.72 km in summer. At L02, the maximum ranges were 53.54 km in winter and 25.58 km in summer. Excluding 5% of the farthest points ($R_{95\%}$), the behavioral threshold ranges at L01 were 49.78 km in winter and 15.77 km in summer. At L02, the $R_{95\%}$ ranges were 48.69 km in winter and 23.38 km in summer. At both sites, the behavioral threshold ranges were approximately equidistant in all directions Figure I-6). Propagation extent and shoreline were determined using global bathymetry data (Mean Lower Low Water (MLLW) datum).

Table I-7. Site L01: Distances to PTS onset for marine mammal hearing groups (NMFS 2018), fish and sea turtle injury thresholds for continuous sounds generated by relief drilling during piling.

| Hearing group | Frequency-weighted $L_{E,24h}$ (dB re 1 µPa²·s) | Summer $R_{max}$ (m) | Summer $R_{95\%}$ (m) | Summer Area (km²) | Winter $R_{max}$ (m) | Winter $R_{95\%}$ (m | Winter Area (km²) |
|---|---|---|---|---|---|---|---|
| Low-frequency (LF) cetaceans | 199 | 150 | 130 | 0.056 | 151 | 139 | 0.061 |
| Mid-frequency (MF) cetaceans | 198 | <20 | <20 | <0.020 | <20 | <20 | <0.020 |
| High-frequency (HF) cetaceans | 173 | 164 | 153 | 0.078 | 164 | 157 | 0.081 |
| Phocid pinnipeds in water (PPW) | 201 | 30 | 30 | <0.020 | 28 | 28 | <0.020 |
| Fish ≥2 g | 187 [a] | 1468 | 1359 | 4.956 | 1387 | 1203 | 4.722 |
| Fish <2 g | 183 [a] | 2352 | 2216 | 15.933 | 2367 | 2184 | 15.455 |
| Fish without swim bladder | 216 [b] | <20 | <20 | <0.020 | <20 | <20 | <0.020 |
| Fish with swim bladder involved in hearing | 203 [b] | 73 | 72 | <0.020 | 81 | 73 | <0.020 |
| Fish with swim bladder not involved in hearing | 203 [b] | 73 | 72 | <0.020 | 81 | 73 | <0.020 |
| Sea turtles | 220 [c] | <20 | <20 | <0.020 | <20 | <20 | <0.020 |

[a] NMFS recommended criteria adopted from the Fisheries Hydroacoustic Working Group (FHWG 2008).
[b] Popper et al. (2014).
[c] Finneran et al. (2017).

Table I-8. Site L02: Distances to PTS onset for marine mammal hearing groups (NMFS 2018), fish and sea turtle injury thresholds for continuous sounds generated by relief drilling during piling.

| Hearing group | Frequency-weighted $L_{E,24h}$ (dB re 1 µPa²·s) | Summer $R_{max}$ (m) | Summer $R_{95\%}$ (m) | Summer Area (km²) | Winter $R_{max}$ (m) | Winter $R_{95\%}$ (m | Winter Area (km²) |
|---|---|---|---|---|---|---|---|
| Low-frequency (LF) cetaceans | 199 | 112 | 100 | 0.034 | 103 | 100 | 0.034 |
| Mid-frequency (MF) cetaceans | 198 | <20 | <20 | <0.020 | <20 | <20 | <0.020 |
| High-frequency (HF) cetaceans | 173 | 122 | 117 | 0.044 | 122 | 114 | 0.043 |
| Phocid pinnipeds in water (PPW) | 201 | 22 | 22 | <0.020 | 22 | 22 | <0.020 |
| Fish ≥2 g | 187 a | 1308 | 1268 | 5.187 | 1111 | 1051 | 3.470 |
| Fish <2 g | 183 a | 2476 | 2371 | 16.018 | 1934 | 1860 | 11.449 |
| Fish without swim bladder | 216 b | <20 | <20 | <0.020 | <20 | <20 | <0.020 |
| Fish with swim bladder involved in hearing | 203 b | 51 | 51 | <0.020 | 51 | 51 | <0.020 |
| Fish with swim bladder not involved in hearing | 203 b | 51 | 51 | <0.020 | 51 | 51 | <0.020 |
| Sea turtles | 220 c | <20 | <20 | <0.020 | <20 | <20 | <0.020 |

[a] NMFS recommended criteria adopted from the Fisheries Hydroacoustic Working Group (FHWG 2008).
[b] Popper et al. (2014).
[c] Finneran et al. (2017).

Table I-9. Site L01: Distances to behavioral thresholds for marine mammal hearing groups (NMFS 2018) and fish and sea turtles for continuous sounds generated by relief drilling during piling.

| Hearing group | Unweighted $L_P$ (dB re 1 µPa) | Summer $R_{max}$ (m) | Summer $R_{95\%}$ (m) | Summer Area (km²) | Winter $R_{max}$ (m) | Winter $R_{95\%}$ (m) | Winter Area (km²) |
|---|---|---|---|---|---|---|---|
| Marine mammals | 120 | 18718 | 15772 | 712.714 | 55864 | 49777 | 5778.320 |
| Fish | 150 [a] | 412 | 393 | 0.510 | 455 | 434 | 0.611 |
| Sea turtles | 175 [b] | <20 | <20 | <0.020 | <20 | <20 | <0.020 |

[a] Andersson et al. (2007), Mueller-Blenkle et al. (2010), Purser and Radford (2011), Wysocki et al. (2007).
[b] McCauley et al. (2000).

Table I-10. Site L02: Distances to behavioral thresholds for marine mammal hearing groups (NMFS 2018) and fish and sea turtles for continuous sounds generated by relief drilling during piling.

| Hearing group | Unweighted $L_P$ (dB re 1 µPa) | Summer $R_{max}$ (m) | Summer $R_{95\%}$ (m) | Summer Area (km$^2$) | Winter $R_{max}$ (m) | Winter $R_{95\%}$ (m) | Winter Area (km$^2$) |
|---|---|---|---|---|---|---|---|
| Marine mammals | 120 | 25575 | 23380 | 1611.280 | 53542 | 48688 | 6619.030 |
| Fish | 150 a | 321 | 293 | 0.285 | 332 | 322 | 0.320 |
| Sea turtles | 175 b | <20 | <20 | <0.020 | <20 | <20 | <0.020 |

[a] Andersson et al. (2007), Mueller-Blenkle et al. (2010), Purser and Radford (2011), Wysocki et al. (2007).
[b] McCauley et al. (2000).

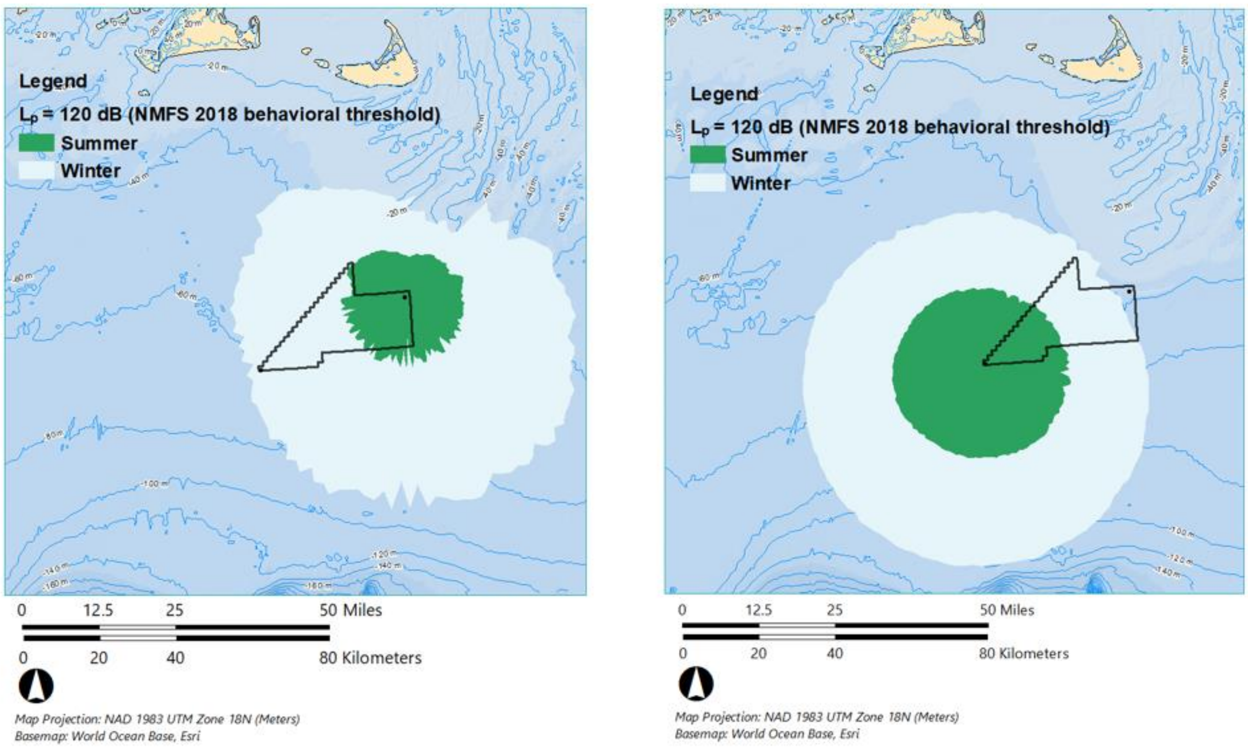



Figure I-6. Modeled sound pressure level (SPL) at 120 dB re 1 µPa (behavioral threshold) at site L01 (left) and site L02 (right) for summer and winter.

## I.3.2. Exposure Estimates

The zone of influence (ZOI) is a representation of the maximum extent of the ensonified area around a sound source over a 24-hour period. The ZOI was obtained directly from the acoustic propagation modeling results, where the ensonified area was summed over the gridded maximum-over-depth sound fields corresponding to each of the acoustic thresholds for injury and behavioral response. Exposures were estimated at each location and for all species using:

$$\text{exposures} = \text{ZOI} \times \text{density}\,, \tag{I-1}$$

where density is from Table I-6.

Exposure estimates were calculated for the winter and summer months for drilling at sites L01 and L02. The number of exposures to marine mammal and sea turtle injury and behavioral thresholds are provided in Table I-11 for L01 and Table I-12 for L02. Injury exposures are low, with less than 0.01 for all species at both locations.

The number of behavioral exposures were generally higher at L02, with the highest number of exposures at 474.66 for common dolphins during the summer months, and 1449.06 for the winter. Harbor seals had the second highest number of exposures, also at L02, with 54.72 in the summer months and 374.51 for the winter. Behavioral exposures at both locations are less than 0.01 for all species of turtles, during both seasons.

Table I-11. *L01:* Maximum predicted injury and behavior exposures resulting from one day of drilling activity during summer and winter months.

| Species | Summer Injury | Summer Behavior | Winter Injury | Winter Behavior |
|---|---|---|---|---|
| Fin whale | <0.01 | 2.23 | <0.01 | 8.47 |
| Minke whale | <0.01 | 5.10 | <0.01 | 5.28 |
| Humpback whale | <0.01 | 1.87 | <0.01 | 2.83 |
| North Atlantic right whale | <0.01 | 1.24 | <0.01 | 30.25 |
| Sei whale | <0.01 | 0.54 | <0.01 | 3.30 |
| Atlantic white-sided dolphin | <0.01 | 22.00 | <0.01 | 238.07 |
| Atlantic spotted dolphin | <0.01 | 3.48 | <0.01 | 1.51 |
| Common dolphin | <0.01 | 209.96 | <0.01 | 1265.01 |
| Bottlenose dolphin, offshore | <0.01 | 20.84 | <0.01 | 135.79 |
| Risso’s dolphin | <0.01 | 7.64 | <0.01 | 24.86 |
| Long-finned pilot whale | <0.01 | 2.94 | <0.01 | 23.84 |
| Short-finned pilot whale | <0.01 | 0.74 | <0.01 | 5.96 |
| Sperm whale | <0.01 | 0.61 | <0.01 | 2.86 |
| Harbor porpoise | <0.01 | 19.42 | <0.01 | 300.14 |
| Gray seal | <0.01 | 16.14 | <0.01 | 217.96 |
| Harbor seal | <0.01 | 24.20 | <0.01 | 326.95 |
| Harp seal | <0.01 | 17.29 | <0.01 | 233.53 |
| Kemp’s ridley turtle | <0.01 | <0.01 | 0 | 0 |
| Leatherback turtle | <0.01 | <0.01 | <0.01 | <0.01 |
| Loggerhead turtle | <0.01 | <0.01 | <0.01 | <0.01 |
| Green turtle | <0.01 | <0.01 | 0 | 0 |

Table I-12. *L02:* Maximum predicted injury and behavior exposures resulting from one day of drilling activity during summer and winter months.

| Species | Summer Injury | Summer Behavior | Winter Injury | Winter Behavior |
|---|---|---|---|---|
| Fin whale | <0.01 | 5.05 | <0.01 | 9.70 |
| Minke whale | <0.01 | 11.54 | <0.01 | 6.05 |
| Humpback whale | <0.01 | 4.23 | <0.01 | 3.25 |
| North Atlantic right whale | <0.01 | 2.80 | <0.01 | 34.65 |
| Sei whale | <0.01 | 1.22 | <0.01 | 3.78 |
| Atlantic white-sided dolphin | <0.01 | 49.73 | <0.01 | 272.70 |
| Atlantic spotted dolphin | <0.01 | 7.87 | <0.01 | 1.73 |
| Common dolphin | <0.01 | 474.66 | <0.01 | 1449.06 |
| Bottlenose dolphin, offshore | <0.01 | 47.12 | <0.01 | 155.55 |
| Risso's dolphin | <0.01 | 17.28 | <0.01 | 28.48 |
| Long-finned pilot whale | <0.01 | 6.65 | <0.01 | 27.31 |
| Short-finned pilot whale | <0.01 | 1.66 | <0.01 | 6.83 |
| Sperm whale | <0.01 | 1.38 | <0.01 | 3.27 |
| Harbor porpoise | <0.01 | 43.89 | <0.01 | 343.81 |
| Gray seal | <0.01 | 36.48 | <0.01 | 249.68 |
| Harbor seal | <0.01 | 54.72 | <0.01 | 374.51 |
| Harp seal | <0.01 | 39.09 | <0.01 | 267.51 |
| Kemp's ridley turtle | <0.01 | <0.01 | 0 | 0 |
| Leatherback turtle | <0.01 | <0.01 | <0.01 | <0.01 |
| Loggerhead turtle | <0.01 | <0.01 | <0.01 | <0.01 |
| Green turtle | <0.01 | <0.01 | 0 | 0 |

## I.4. Summary

Marine mammal PTS injury is unlikely to occur from the proposed drilling construction because the ranges are <100 m at both sites for all hearing groups, except for high-frequency animals and fish (FHWG 2008) whose predicted acoustic ranges are ~150-2300 m, with the furthest acoustic ranges predicted at the L01 site. Injury is not expected to occur for sea turtles as the ranges to threshold are less than 20 m at both sites. These distances may be considered conservative, because animals will be moving through the area during the 6 hours of drilling per day. Furthermore, animals, especially high-frequency species, are likely to avoid the construction sounds, which would further reduce the likelihood of injury. At L01, the longest distance to the SPL 120 dB re 1 µPa behavioral threshold is ~56 km and occurs in winter, with a summer distance of ~19 km (Figure I-6). At L02, the longest distance to the behavioral threshold is ~54 km and occurs in winter, with a summer distance of ~26 km (Figure I-6).

Injury exposures for both locations and both seasons are less than 0.01 for all species. Behavioral exposures at the L02 location were generally higher than at the L01 location. At both locations, behavioral exposures were generally higher during the winter than during the summer. The largest number of behavioral exposures at both locations and during both seasons was for common dolphin, with 1265 exposures in winter and 210 in summer at L01 and 1449 in winter and 475 in summer at L02. Behavioral exposures were larger at L02 due to the larger ensonified areas during both seasons at that location.

# Literature Cited in Appendix I

[FHWG] Fisheries Hydroacoustic Working Group. 2008. *Agreement in Principle for Interim Criteria for Injury to Fish from Pile Driving Activities*. 12 Jun 2008 edition. https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/ser/bio-fhwg-criteria-agree-a11y.pdf.

[NAVO] Naval Oceanography Office (US). 2003. *Database description for the Generalized Digital Environmental Model (GDEM-V) (U)*. Document MS 39522-5003. Oceanographic Data Bases Division, Stennis Space Center.

[NGDC] National Geophysical Data Center. 2003. Coastal Relief Model. National Geophysical Data Centre, National Oceanic and Atmospheric Administration, US Department of Commerce. https://www.ngdc.noaa.gov/mgg/coastal/crm.html.

[NMFS] National Marine Fisheries Service (US). 2018. *2018 Revision to: 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*. US Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-59. 167 p. https://media.fisheries.noaa.gov/dam-migration/tech_memo_acoustic_guidance_(20)_(pdf)_508.pdf.

Andersson, M.H., E. Dock-Åkerman, R. Ubral-Hedenberg, M.C. Öhman, and P. Sigray. 2007. Swimming behavior of roach (*Rutilus rutilus*) and three-spined stickleback (*Gasterosteus aculeatus*) in response to wind power noise and single-tone frequencies. *AMBIO* 36(8): 636-638. https://doi.org/10.1579/0044-7447(2007)36[636:SBORRR]2.0.CO;2.

Austin, M.E., D.E. Hannay, and K.C. Bröker. 2018. Acoustic characterization of exploration drilling in the Chukchi and Beaufort seas. *Journal of the Acoustical Society of America* 144: 115-123. https://doi.org/10.1121/1.5044417

Buckingham, M.J. 2005. Compressional and shear wave properties of marine sediments: Comparisons between theory and data. *Journal of the Acoustical Society of America* 117: 137-152. https://doi.org/10.1121/1.1810231.

Collins, M.D. 1993. A split-step Padé solution for the parabolic equation method. *Journal of the Acoustical Society of America* 93(4): 1736-1742. https://doi.org/10.1121/1.406739.

Finneran, J.J., E.E. Henderson, D.S. Houser, K. Jenkins, S. Kotecki, and J.L. Mulsow. 2017. *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)*. Technical report by Space and Naval Warfare Systems Center Pacific (SSC Pacific). 183 p. https://nwtteis.com/portals/nwtteis/files/technical_reports/Criteria_and_Thresholds_for_U.S._Navy_Acoustic_and_Explosive_Effects_Analysis_June2017.pdf.

Malme, C.I., P.R. Miles, C.W. Clark, P.L. Tyack, and J.E. Bird. 1983. *Investigations of the Potential Effects of Underwater Noise from Petroleum Industry Activities on Migrating Gray Whale Behavior. Final Report for the Period of 7 June 1982 - 31 July 1983*. Report 5366. Report by Bolt Beranek and Newman Inc. for US Department of the Interior, Minerals Management Service, Alaska OCS Office, Cambridge, MA, USA. https://www.boem.gov/sites/default/files/boem-newsroom/Library/Publications/1983/rpt5366.pdf.

Malme, C.I., P.R. Miles, C.W. Clark, P.L. Tyack, and J.E. Bird. 1984. *Investigations of the Potential Effects of Underwater Noise from Petroleum Industry Activities on Migrating Gray Whale Behavior. Phase II: January 1984 Migration*. Report 5586. Report by Bolt Beranek and Newman Inc. for the US Department of the Interior, Minerals Management Service, Cambridge, MA, USA. https://www.boem.gov/sites/default/files/boem-newsroom/Library/Publications/1983/rpt5586.pdf.

McCauley, R.D., J. Fewtrell, A.J. Duncan, C. Jenner, M.-N. Jenner, J.D. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch, and K.A. McCabe. 2000. Marine seismic surveys: A study of environmental implications. *Australian Petroleum Production Exploration Association (APPEA) Journal* 40(1): 692-708. https://doi.org/10.1071/AJ99048.

Mueller-Blenkle, C., P.K. McGregor, A.B. Gill, M.H. Andersson, J. Metcalfe, V. Bendall, P. Sigray, D.T. Wood, and F. Thomsen. 2010. *Effects of Pile-driving Noise on the Behaviour of Marine Fish*. COWRIE Ref: Fish 06-08; Cefas Ref: C3371. 62 p. https://dspace.lib.cranfield.ac.uk/handle/1826/8235.

Popper, A.N., A.D. Hawkins, R.R. Fay, D.A. Mann, S. Bartol, T.J. Carlson, S. Coombs, W.T. Ellison, R.L. Gentry, et al. 2014. *Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI*. ASA S3/SC1.4 TR-2014. SpringerBriefs in Oceanography. ASA Press and Springer. https://doi.org/10.1007/978-3-319-06659-2.

Porter, M.B. and Y.C. Liu. 1994. Finite-element ray tracing. *In*: Lee, D. and M.H. Schultz (eds.). *International Conference on Theoretical and Computational Acoustics*. Volume 2. World Scientific Publishing Co. pp. 947-956.

Purser, J. and A.N. Radford. 2011. Acoustic noise induces attention shifts and reduces foraging performance in three-spined sticklebacks (*Gasterosteus aculeatus*). *PLOS ONE* 6(2): e17478. https://doi.org/10.1371/journal.pone.0017478.

Quijano, J.E., D.E. Hannay, and M.E. Austin. 2019. Composite Underwater Noise Footprint of a Shallow Arctic Exploration Drilling Project. *IEEE Journal of Oceanic Engineering* 44(4): 1228-1239. https://doi.org/10.1109/JOE.2018.2858606.

Richardson, W.J., B. Würsig, and C.R. Greene, Jr. 1986. Reactions of bowhead whales, *Balaena mysticetus*, to seismic exploration in the Canadian Beaufort Sea. *Journal of the Acoustical Society of America* 79(4): 1117-1128. https://doi.org/10.1121/1.393384.

Richardson, W.J., B. Würsig, and C.R. Greene, Jr. 1990. Reactions of bowhead whales, *Balaena mysticetus*, to drilling and dredging noise in the Canadian Beaufort Sea. *Marine Environmental Research* 29(2): 135-160. https://doi.org/10.1016/0141-1136(90)90032-J.

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, et al. 2016a. Habitat-based cetacean density models for the U.S. Atlantic and Gulf of Mexico. *Scientific Reports* 6. https://doi.org/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)*. Version 1.0. Report by the Duke University Marine Geospatial Ecology Lab for Naval Facilities Engineering Command, Atlantic Durham, NC, USA. https://seamap.env.duke.edu/seamap-models-files/Duke/Reports/AFTT_Update_2015_2016_Final_Report_v1.pdf.

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)*. Version 1.4. Report by Duke University Marine Geospatial Ecology Lab for Naval Facilities Engineering Command, Atlantic, Durham, NC, USA. https://seamap.env.duke.edu/seamap-models-files/Duke/Reports/AFTT_Update_2016_2017_Final_Report_v1.4_excerpt.pdf.

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)*. Version 1.2. Report by the Duke University Marine Geospatial Ecology Lab for Naval Facilities Engineering Command, Atlantic Durham, NC, USA. https://seamap.env.duke.edu/seamap-models-files/Duke/Reports/AFTT_Update_2017_2018_Final_Report_v1.2_excerpt.pdf.

Roberts, J.J., R.S. Schick, and P.N. Halpin. 2021. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2020 (Opt. Year 4)*. Version 1.0. Report by the Duke University Marine Geospatial Ecology Lab for Naval Facilities Engineering Command, Atlantic Durham, NC, USA. https://seamap-dev.env.duke.edu/seamap-models-files/Duke/Reports/AFTT_Update_2020_Final_Report_v1.0_excerpt.pdf.

Roberts, J.J., T.M. Yack, and P.N. Halpin. 2022. *Habitat-based marine mammal density models for the U.S. Atlantic* (web page). https://seamap.env.duke.edu/models/Duke/EC/. (Accessed 20 Jun 2022 Version. Downloaded 19 Jul 2022 ).

Sills, J.M., B.L. Southall, and C.J. Reichmuth. 2014. Amphibious hearing in spotted seals (*Phoca largha*): Underwater audiograms, aerial audiograms and critical ratio measurements. *Journal of Experimental Biology* 217(5): 726-734. https://doi.org/10.1242/jeb.097469.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, et al. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals* 33(4): 411-521. https://doi.org/10.1578/AM.33.4.2007.411.

Wysocki, L.E., S. Amoser, and F. Ladich. 2007. Diversity in ambient noise in European freshwater habitats: Noise levels, spectral profiles, and impact on fishes. *Journal of the Acoustical Society of America* 121(5): 2559-2566. https://doi.org/10.1121/1.2713661.

Zhang, Z.Y. and C.T. Tindle. 1995. Improved equivalent fluid approximations for a low shear speed ocean bottom. *Journal of the Acoustical Society of America* 98(6): 3391-3396. https://doi.org/10.1121/1.413789.

# Appendix J. Preliminary Underwater Acoustic Modeling of Detonations of Unexploded Ordnance (UXO Removal) for Vineyard Northeast Wind Farm Construction

JASCO Applied Sciences (USA) Inc.

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# J.1. Introduction

Vineyard Northeast may encounter unexploded ordinances (UXO) on the seabed in Lease Area OCS-A 0522 (Lease Area) and along offshore export cable corridors (OECCs). At present, Vineyard Northeast is conservatively estimating 4 UXO detonations in the Massachusetts OECC, 4 in the Connecticut OECC, and two in the Lease Area. While non-explosive methods may be employed to lift and move these objects, it is conservatively assessed that some may need to be removed by explosive detonation. Underwater explosive detonations generate sound waves with high pressure levels that could cause disturbance and/or injury to marine fauna. Mitigation measures will likely be required to avoid injurious exposures of animals, and behavioral exposures may need to be accounted for. The study described in this report has modeled acoustic source and sound propagation to estimate the ranges to injury and behavioral thresholds, also referred to as acoustic ranges, for several species and for a selection of charge mass spanning the expected UXO types that may be encountered. The intended purpose of the modeled acoustic ranges and calculated exposure estimates provided in this report is to predict the number of marine fauna that may be affected by underwater sound during UXO detonation associated with the construction Vineyard Northeast.

Most UXO assessment work in the US has been performed by or for the US Navy, who have worked closely with National Marine Fisheries Service (NMFS) to choose and define appropriate criteria for effects based on best available science. We have evaluated effects thresholds based on three key sound pressure metrics considered by the Navy and NMFS as indicators of injury and behavioral disturbance: unweighted peak compressional pressure level ($L_{\text{pk,c}}$ and abbreviated here $L_{\text{pk}}$), frequency weighted sound exposure level (SEL or $L_{E,w}$), and acoustic impulse ($J_p$). A fourth metric, sound pressure level (SPL or $L_p$), which is often used for other impulsive sound assessments, has not been evaluated here because it is not presently used by NMFS as an assessment criterion for sounds from explosive detonations. The names and symbols used for the above metrics follow the terminology of International Organization of Standards (ISO) 18405 (ISO 2017), except where tables and equations have been copied from previous regulatory documents.

The thresholds applied here for each of the acoustic metrics have been obtained from three primary sources:

1. *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III), June 2017* (Finneran et al. 2017). This report provides thresholds for gastrointestinal and lung injury, and mortality to marine mammals, sea turtles and fish due to explosive pressure based on impulse and peak pressure.
2. Marine Mammal Acoustic Technical Guidance (2018 Revision to Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing), Office of Protected Resources, NOAA Technical Memorandum NMFS-OPR-59, April 2018 (NMFS 2018). This technical memorandum incorporates the report by Finneran (2016) that provides auditory weighting functions for SEL calculations and provides thresholds for hearing-related effects.
3. Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. ASA S3/SC1.4 TR-2014 (Popper et al. 2014). This report provides peak pressure thresholds for injury and mortality to fish.

The acoustic metrics and thresholds for effects depend on species and in some cases animal size and animal submersion depth. Specialized acoustic models and semiempirical formulae are applied to evaluate the threshold acoustic ranges from explosive charges detonated on the seabed and exposed directly to seawater. The theory underlying these models is provided in the technical discussion sections of this report.

This assessment considers acoustic effects to marine mammals, sea turtles and fish from two possible charge sizes. We considered six separate locations: two locations are in the Lease Area and four locations are within the OECCs. Water depths are site-dependent and range from 25 m at the shallowest site along the OECC, to 69 m in the Lease Area. An unmitigated scenario and a mitigated scenario are considered at each site, with mitigation considering a 10 decibel (dB) reduction to $L_{pk}$, $J_p$, and $L_E$, that might be obtained using an air bubble curtain or similar system. The results for unmitigated and mitigated UXO detonations are provided in Sections J.8 and J.9, respectively.

The model predictions presented in this report assume the full mass of UXO explosive charges is detonated together with an additional donor charge with mass equal to 2% of the UXO weight but limited at 10 kg TNT-equivalent. A recent review of UXO explosive removals in the North Sea indicates that in most cases the UXO charge mass either did not detonate or only partly detonated, with the result being that the pressure waves generated were produced by the donor charge and only a small fraction of the UXO charge (Bellmann 2021). As such, it is likely that the full UXO charge will not detonate in all cases and the results presented herein assume full UXO charge detonation and therefore should be considered the worst case. This approach has been taken because there remains considerable uncertainty about the fraction of UXO explosive charges that would detonate.

## J.2. UXO Charge Sizes

The UXO charges considered here are characterized by their equivalent trinitrotoluene (TNT) masses. Two charge mass "bins" were defined, E10 and E12, with respective charge masses set to the maximum charge size from a group of similar weapons in the bin using a categorization defined by the US Navy (Table J-1). The mass of the donor charge, used to detonate the UXO, is assumed to be 2% of the UXO TNT-equivalent charge weight. The maximum donor charge mass is limited to 10 kg (Bellmann 2021). This modeling assumes the full combined mass of the UXO and donor charge are fully detonated.

Table J-1. US Navy 'bins' and corresponding maximum UXO charge masses (maximum equivalent mass TNT) modeled for this assessment.

| Navy bin | Max equivalent mass TNT (kg) | Max equivalent mass TNT (lbs) | Max equivalent mass TNT including 2% donor charge (kg) | Max equivalent mass TNT including 2% donor charge (lbs) |
|---|---|---|---|---|
| E10 | 227 | 500 | 231.5 | 510 |
| E12 | 454 | 1000 | 463.1 | 1021 |

## J.3. Modeling Locations and Depths

Sound propagation away from UXO detonations is affected by in-water refraction and acoustic reflections from the sea surface and seabed. Water depth and seabed properties, which are site-dependent, will influence the sound exposure levels and sound pressure levels at distance from detonations. It is usually not feasible in modeling assessments like this to examine all possible UXO locations, mainly because it is difficult to present and interpret such large volumes of model results. A common approach is to choose a finite set of test locations with environmental characteristics that span the ocean environment variability over the area of interest. This approach requires enough locations be chosen so that differences in ocean conditions over the area of interest, relative to the conditions of the most similar test location, are small enough that their influence on the acoustic ranges to threshold.

Here, six specific sites (S1 to S6) were modeled to injury and behavioral acoustic thresholds from UXO detonations of two charge sizes (Table J-1); S1 and S2 are in Lease Area for Vineyard Northeast, at depths of 45.0 and 60.0 m, respectively. Sites S3 and S4 are along the Massachusetts OECC, respectively in 30.0 and 35.0 m water depths, and S5 and S6 lie on the Connecticut OECC at 24.9 and 69.3 m depth, respectively. Site depths are summarized in Table J-2 and site locations are shown on the map of Figure J-1.

Table J-2. Water depths of acoustic model sites.

| Model site | Water depth (m) |
|---|---|
| S1 | 45.0 |
| S2 | 60.0 |
| S3 | 30.0 |
| S4 | 35.0 |
| S5 | 24.9 |
| S6 | 69.3 |

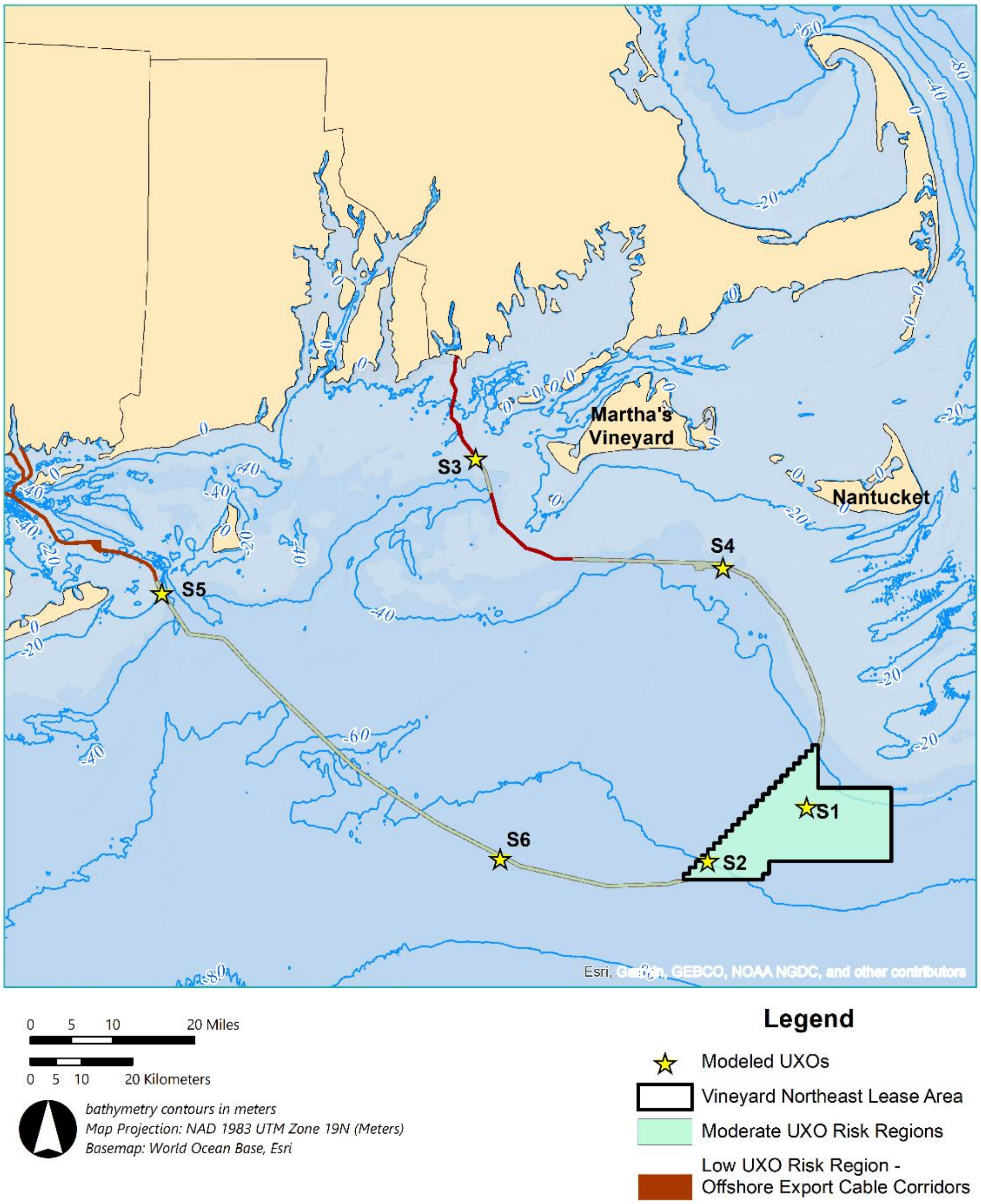

Figure J-1. Map showing locations of the six UXO modeling sites.

## J.4. Blast Noise Mitigation

Predictions of acoustic ranges to marine mammal thresholds were performed for unmitigated and mitigated scenarios. Although Vineyard Northeast anticipates using mitigation technology (e.g., bubble curtain system or other system) during UXO detonations, unmitigated results are presented for comparison and completeness. Mitigated results were obtained by reducing the received levels by 10 dB at all sound frequencies. The 10 dB reduction was applied to $L_{pk}$ and decidecade band $L_E$ and $L_{E,w}$. The corresponding reduction to $J_p$ was applied using a multiplicative factor of $10^{-1/2}$. This amount of acoustic reduction is expected to be achievable by deploying an air bubble curtain or similar system around the detonation site. A review of the expected acoustic level insertion losses for modern bubble curtain systems is provided below.

There is a little published information available on direct measurements of bubble curtain effectiveness for reducing peak pressure, SEL, and impulse produced by underwater explosives detonations. One measurement of a small bubble curtain showed good performance for 1 kilogram (kg) charges, providing approximately 16 dB insertion loss at all frequencies greater than 1 kilohertz (kHz) using small curtains of less than 11.5 m diameter (Schmidtke et al. 2009). The same study evaluated another relatively small bubble curtain (diameter 22 m in 20 m water depth) surrounding 300 kg mines. That bubble curtain configuration produced smaller insertion losses of approximately 2 dB at 100 hertz (Hz) to 6 dB at 10 kHz. These values are substantially smaller than the observed insertion loss at corresponding frequencies for modern bubble curtains applied to mitigate sounds from large pile installations. The smaller reductions observed by Schmidtke et al. (2009) are likely due to use of a small bubble curtain for a relatively large detonation charge size, even though the air flow rate per unit curtain length was similar. Modern curtains also apply bubble size optimization to maximize the frequency-dependent acoustic level reductions, but it is not clear if that was performed for the bubble curtains used in the Schmidtke et al. (2009) study.

A recent review of bubble curtain effectiveness for pile driving noise mitigation by Bellmann et al. (2020) found insertion loss performance of modern bubble curtains increases with sound frequency from about 20 Hz to 1.5 kHz, and then decreases slowly with further increases in frequency. They tabulated insertion loss results for a Big Bubble Curtain (BBC) that indicated acoustic level reductions of at least 10 dB at 32 Hz, increasing to approximately 35 dB near 1 kHz. A follow-up report indicates first results for insertion loss of UXO acoustic levels by BBC of 11 dB for broadband $L_E$ and up to 18 dB for $L_{pk}$, although particulars of the charge sizes and water depths in the study were not provided (Bellman, 2021).

The spectral energy distribution of the pressure waveforms of explosives detonated in water will differ from the spectral distribution of pile driving sounds. Nevertheless, the frequency-dependent insertion losses are expected to be similar if the bubble curtain radius is large enough to avoid nearfield effects of the explosive detonations. The spectra of smaller charges contain relatively more high-frequency energy than the spectra of larger charges after accounting for the higher overall energy of the larger charges. This spectral shape dependence on charge size is discussed in detail in Section J.7.2.1. The maximum spectral levels of all charge sizes considered in this report occur at less than 10 Hz, but their spectral roll-off is small so their maximum decidecade $L_E$ band levels occur above a few hundred Hz. Pile driving spectra have maximum band levels at lower frequencies, which suggests bubble curtain performance for explosive charges should in general produce greater broadband insertion loss than for pile driving. The minimum modern bubble curtain insertion loss effectiveness for the frequency bands dominating explosive detonation $L_E$ in shallow waters is well above 10 dB. Therefore, the choice of 10 dB as a broadband $L_E$ insertion loss is expected to be conservative.

The very rapid onset of the shock pulse, within a few microseconds (μs), and its rapid decay constant of less than 2 ms for the largest charge size considered (454 kg UXO plus 9.1 kg donor charge), suggests the shock pulse peak pressure is dominated by high frequencies that are likely much higher than 500 Hz. The results compiled by Bellmann et al. (2020) indicate the peak pressure insertion loss at those frequencies by modern bubble curtains should be greater than 10 dB. As mentioned above, the first results that applied the use of BBC for UXO produced insertion loss slightly larger than 10 dB.

As a final note regarding UXO removal detonation pressures: Bellman (2021) noted that many UXO charges are situated slightly below the seafloor elevation after removal of overlying sedimentation. These charges then lie slightly below the seafloor grade and are then partly shielded by surrounding sediments. The generated pressure waves propagating away in the horizontal direction must pass partly through the sediments, which have higher absorption characteristics than seawater. Bellman (2021) found that propagation losses were higher for these partially buried charges than for charges detonated in seawater. In this study, we assumed no such shielding by sediments.

## J.5. Environmental Parameters

### J.5.1. Seafloor Geoacoustic Parameters

Sound propagation in the shallow water environments of Vineyard Northeast is strongly influenced by the local properties of the ocean and seafloor substrate. A geoacoustic profile for the area has been developed from geotechnical studies of surficial sediments commissioned by Vineyard Northeast for their project area, and from regional studies for deeper sediments. The Vineyard Northeast geotechnical studies used a vibro-coring system to extract cores through the top 5 meters of seabed sediments. Surficial sediments here are primarily silty sand to dense sand. The core samples provided density, grain size and porosity versus depth below seafloor. The corresponding acoustic properties were derived using a sediment grain-shear model (Buckingham 2005). Table J-3 shows the derived geoacoustic profile parameters for density, compressional or P-wave speed, shear wave speed and compressional and shear wave volume attenuation coefficients for surficial and deeper sediments. This profile is used by the MONM model for SEL estimation but not by the peak pressure and impulse models, as these latter two metrics are assumed to be dominated by direct path and surface reflected signals only. The geoacoustic parameter profile of Table J-3 was used for SEL modeling at all six test sites considered in this study.

Over the course of several projects in the area JASCO has developed a generalized geoacoustic profile based on the available data in the area. In shallow water environments where there is increased interaction with the seafloor, the properties of the substrate have a large influence over the sound propagation. According to the vibrocore samples taken as part of the project planning the dominant surficial sediments are dense sand and silty sand. Table J-3 shows the sediment layer geoacoustic property profile based on the sediment type and generic porosity-depth profile using a sediment grain-shearing model (Buckingham 2005). The same geoacoustics profile has been used at all five modeling sites.

Table J-3. Estimated geoacoustic properties based on core data used for modeling. Within each depth range, each parameter varies linearly within the stated range. The compressional wave is the primary wave. The shear wave is the secondary wave.

| Depth below seafloor (m) | Material | Density (g/cm$^3$) | Compressional Wave Speed (m/s) | Compressional Wave Attenuation (dB/λ) | Shear Wave Speed (m/s) | Shear Wave Attenuation (dB/λ) |
|---|---|---|---|---|---|---|
| 0–10 | Medium sand | 2.09–2.1 | 1770–1783 | 0.88 | 300 | 3.65 |
| 10–50 | Medium sand | 2.1–2.15 | 1783–1833 | 0.87 | 300 | 3.65 |
| 50–100 | Medium sand | 2.15–2.22 | 1833–1893 | 0.85 | 300 | 3.65 |
| 100–200 | Medium sand | 2.22–2.34 | 1893–2000 | 0.85–0.81 | 300 | 3.65 |
| 200–500 | Medium sand | 2.34–2.6 | 2000–2270 | 0.81–0.66 | 300 | 3.65 |

## J.5.2. Ocean Sound Speed Profile

The gradients of the speed of sound in seawater affect acoustic refraction during sound propagation to longer distances (i.e., beyond a few hundred meters from the source). The sound speed is a function of water temperature, salinity, and depth (Coppens 1981). Monthly average sound speed profiles near the proposed construction areas for the months of April to November were obtained for the project area from the US Navy's Generalized Digital Environmental Model (GDEM; NAVO 2003) and are plotted in Figure J-2. The propagation modeling was performed using the sound speed profile for March, which is slightly upward-refracting at the deeper sites.

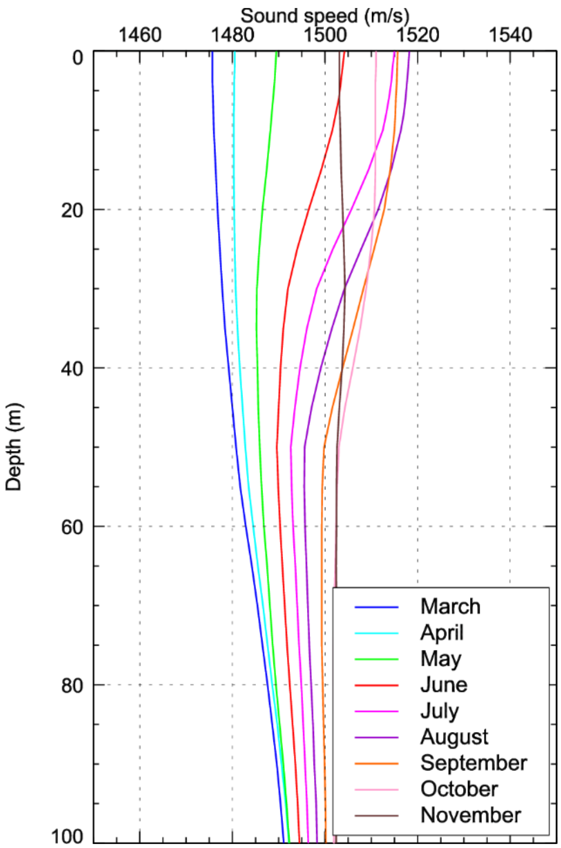


Figure J-2. Monthly average sound speed profiles in proposed construction area (excluding winter season) (source: (GDEM; NAVO 2003)).

# J.6. Acoustic Criteria for Marine Fauna

## J.6.1. Marine Mammals and Sea Turtles: Auditory Injury (PTS)

The injury zones surrounding explosives detonations are of key importance for developing mitigation approaches to minimize the number of marine mammal and sea turtle exposures. Two injury mechanisms are assessed for marine mammals: auditory injury and non-auditory injury. We follow the US Navy approach for assessing both types of effects (US Navy 2017). Auditory injury (onset of permanent threshold shift (PTS)) is assessed using a dual criteria of $L_{\text{pk}}$ and frequency-weighted SEL ($L_{E,w}$), where the frequency weighting functions are dependent on the species group (NMFS 2018). The Navy follows NMFS's guidelines for assessing PTS and temporary threshold shift (TTS) using metrics $L_{\text{pk}}$ and $L_{E,w}$ for marine mammals. These thresholds and additional thresholds for sea turtles are listed in Table J-4. TTS thresholds, also listed in Table J-4, are used for estimating potential behavioral responses to underwater sound (see Section J.6.3). The Group column in Table J-4 represents species groups from top to bottom: low-frequency cetaceans (LF), mid-frequency cetaceans (MF), high-frequency cetaceans (HF), sirenians (SI), otariids in water (OW), pinnipeds in water (PW), and sea turtles (TU).

Table J-4. US Navy (2017) peak frequency-weighted sound exposure level and peak pressure thresholds for onset of PTS and TTS. See text for a description of the Animal Group abbreviations.

| Animal group | Hearing threshold at $f_0$ $L_p$ (dB re 1 µPa$^2$) | TTS threshold $L_{E,w,24h}$ (dB re 1 µPa$^2$s) | TTS threshold $L_{pk}$ (dB re 1 µPa) | PTS threshold $L_{E,w,24h}$ (dB re 1 µPa$^2$s) | PTS threshold $L_{pk}$ (dB re 1 µPa) |
|---|---|---|---|---|---|
| LF | 54 | 168 | 213 | 183 | 219 |
| MF | 54 | 170 | 224 | 185 | 230 |
| HF | 48 | 140 | 196 | 155 | 202 |
| SI | 61 | 175 | 220 | 190 | 226 |
| OW | 67 | 188 | 226 | 203 | 232 |
| PW | 53 | 170 | 212 | 185 | 218 |
| TU | 95 | 189 | 226 | 204 | 232 |

## J.6.2. Marine Mammals and Sea Turtles: Non-Auditory Injury and Mortality

Non-auditory injury and mortality mitigation zones are calculated using metrics representing onset of injury to animal's lungs and gastrointestinal tracts, attributed to compression-related injury of tissues near enclosed air volumes or gas bubbles. The relevant metrics are $L_{pk}$ and $J_p$ of the blast shock pulse. The peak pressure threshold for onset of injury caused by explosive detonations (effect observed in 1% of exposed animals) to the gastrointestinal tract is $L_{pk}$ = 237 dB re μPa and this is independent of animal mass. However, that criterion originated from studies on mid-sized terrestrial animals and adult human divers, and it may not be conservative for smaller animals that could be more suspectable to blast injury than larger animals. Our recommendation is to avoid its use for animals with mass less than 50 kg until its validity for smaller animals can be confirmed. The impulse calculation for lung injury and mortality integrates pressure through the time of the shock pulse, with the integration period limited by the arrival of the surface-reflected path or 20% of the animal's lung oscillation period – whichever is smaller. These integration time limits are applied because the arrival of the phase-inverted surface reflection signal reduces or truncates the positive phase of the shock pulse, and because the excitation of lung compression is reduced if the impulse duration is greater than 20% of the lung's oscillation period. As discussed in Section J.7.1.3, the lung oscillation limiting times are straightforward to calculate using the Goertner formulas (Goertner 1982) they depend on animal mass and submersion depth. The surface reflection arrival time is determined by the geometry of the source and receiving animal relative to each other and the sea surface.

The Navy's impulse criteria for onset of lung injury and mortality are based on measurements of blast effects on several species of mammals experimentally exposed to detonation pressures (Yelverton et al. 1973). The Navy has published two sets of equations, reproduced here in Table J-6 and Table J-7, for effects thresholds for impulse that depend on animal mass and submersion depth. The two equations represent thresholds respectively for injury effects (observed in 50% of exposed animals) and onset of injury effects (observed in 1% of the exposed animals). NMFS suggested the more conservative (onset of effects) values be used for assessing impacts if the distances exceed those of other injurious exposure criteria and that is the approach used here.

The impulse thresholds for lung injury and mortality to marine mammals and sea turtles depend on the animal lung volume, which is a function of animal mass and submersion depth. To be conservative, maximum horizontal distances to acoustic thresholds were calculated in 1 m submersion depth increments, from the surface to seabed, at the respective assessment location. The maximum distance over these depths was listed as the representative acoustic range.

The animal masses used for acoustic range calculations were obtained from a tabulation of animal masses (Table J-5) (US Navy 2017). The Navy table provides conservative calf/pup and adult masses for all marine mammal species. The adult mass is the smallest mass from the range of adult masses for the respective species. Five animal groups are defined in Table J-5 that represent and comprise similar-mass species to those that may be encountered at the project sites, including rare species for those areas. For each group, a representative species with the smallest calf and adult masses are used as conservative values for the entire animal group. Sperm whales were grouped with larger baleen whales due to their similar adult masses, but the sei whale calf mass was used for this group due to their smaller mass. The smallest animals of dolphin, kogia, pinniped, and sea turtle families had very similar mass to harbor seals. Harbor seal calf and adult masses were therefore used as the representative species for that animal group for conservatism. Table J-5 lists the defined animal groups and the corresponding calf/pup and adult masses of representative species used for impulse threshold calculations. Tables Table J-8 and Table J-9 provide thresholds for onset of lung injury and onset of mortality, for all relevant animal masses at a selection of submersion depths. The actual assessment of effects distances considered all possible submersion depths.

Table J-5. Representative calf/pup and adult mass estimates for the animal groups defined for this assessment. These mass values are based on the smallest expected animals for the species that might be present within project areas. Masses listed here are used for assessing impulse-based acoustic ranges to onset of lung injury and mortality thresholds.

| Impulse animal group | Representative species | Calf/pup mass (kg) | Adult mass (kg) |
|---|---|---|---|
| Baleen whales and sperm whale | Sei whale calf (*Balaenoptera borealis*)<br>Sperm whale adult (*Physeter macrocephalus*) | 650 | 16,000 |
| Pilot and minke whales | Minke whale (*Balaenoptera acutorostrata*) | 200 | 4,000 |
| Beaked whales | Gervais' beaked whale (*Mesoplodon europaeus*) | 49 | 366 |
| Dolphins, kogia, pinnipeds, and sea turtles | Harbor seal (*Phoca vitulina*) | 8 | 60 |
| Porpoises | Harbor porpoise (*Phocoena phocoena*) | 5 | 40 |

Table J-6. US Navy impulse and peak pressure threshold equations for mortality and lung injury in marine mammals and sea turtles in 50% of exposed animals due to explosive detonations (US Navy 2017).

| Effects assessment criterion observed in 50% of exposed animals | Metric | Threshold formula or value for animal mass *M* (kg) at submersion depth *D* (m) |
|---|---|---|
| Mortality - Impulse | $J_p$ | $144\, M^{1/3} \left(1 + \frac{D}{10}\right)^{1/6}$ Pa·s |
| Injury - Impulse | $J_p$ | $65.8\, M^{1/3} \left(1 + \frac{D}{10}\right)^{1/6}$ Pa·s |
| Injury – Peak pressure | $L_{pk}$ | 243 dB re 1 µPa |

The impulse formulae and peak pressure thresholds, representing onset of effects in 1% of exposed animals, are used in this assessment as suggested by NOAA as more conservative.

Table J-7. US Navy impulse and peak pressure threshold equations for mortality and lung injury in marine mammals and sea turtles in 1% of exposed animals due to explosive detonations (US Navy 2017).

| Effects observed in 1% of exposed animals | Metric | Threshold formula or value for animal mass *M* (kg) at submersion depth *D* (m) |
|---|---|---|
| Onset Mortality - Impulse | $J_p$ | $103\, M^{1/3} \left(1 + \frac{D}{10}\right)^{1/6}$ Pa·s |
| Onset Injury - Impulse | $J_p$ | $47.5\, M^{1/3} \left(1 + \frac{D}{10}\right)^{1/6}$ Pa·s |
| Onset Injury – Peak pressure | $L_{pk}$ | 237 dB re 1 µPa |

The impulse formulae and peak pressure thresholds, representing onset of effects in 1% of exposed animals, are used in this assessment as suggested by NOAA as more conservative.

Table J-8. Example impulse thresholds (units of Pa·s) for Onset Injury from equation in Table J-7 for all animal masses in Table J-5, for selected animal submersion depths between 1 and 60 m. The assessment considered all possible submersion depths to find the maximum acoustic ranges.

| Submersion depth (m) | 5 kg | 8 kg | 40 kg | 49 kg | 60 kg | 200 kg | 366 kg | 680 kg | 4,000 kg | 16,000 kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 82.5 | 96.5 | 165.0 | 176.6 | 188.9 | 282.2 | 345.2 | 766.0 | 424.3 | 1215.9 |
| 10 | 91.1 | 106.5 | 182.2 | 194.9 | 208.6 | 311.5 | 381.1 | 845.7 | 468.5 | 1342.4 |
| 20 | 97.4 | 114 | 194.9 | 208.5 | 223.1 | 333.2 | 407.6 | 904.5 | 501.1 | 1435.8 |
| 30 | 102.2 | 119.5 | 204.4 | 218.7 | 234 | 349.5 | 427.6 | 948.8 | 525.6 | 1506.2 |
| 40 | 106.1 | 124.1 | 212.1 | 227.0 | 242.8 | 362.8 | 443.7 | 984.7 | 545.5 | 1563.1 |
| 50 | 109.3 | 127.9 | 218.7 | 234.0 | 250.3 | 373.9 | 457.4 | 1015.0 | 562.3 | 1611.2 |
| 60 | 112.2 | 131.2 | 224.4 | 240.1 | 256.8 | 383.7 | 469.3 | 1041.4 | 576.9 | 1653.1 |

Table J-9. Example impulse thresholds (units of Pa·s) for Onset Mortality from equation in Table J-7 for all animal masses in Table J-5, for selected animal submersion depths between 1 and 60 m. The assessment considered all possible submersion depths to find the maximum acoustic ranges.

| Submersion depth (m) | 5 kg | 8 kg | 40 kg | 49 kg | 60 kg | 200 kg | 366 kg | 680 kg | 4,000 kg | 16,000 kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 178.9 | 209.3 | 357.8 | 382.9 | 409.6 | 611.9 | 748.5 | 920.1 | 1661.0 | 2636.6 |
| 10 | 197.5 | 231 | 395.1 | 422.7 | 452.2 | 675.6 | 826.3 | 1015.8 | 1833.7 | 2910.9 |
| 20 | 211.3 | 247.1 | 422.6 | 452.1 | 483.7 | 722.6 | 883.8 | 1086.5 | 1961.4 | 3113.5 |
| 30 | 221.6 | 259.2 | 443.3 | 474.3 | 507.4 | 758.0 | 927.1 | 1139.8 | 2057.4 | 3266.0 |
| 40 | 230.0 | 269.0 | 460.0 | 492.2 | 526.6 | 786.6 | 962.2 | 1182.8 | 2135.2 | 3389.5 |
| 50 | 237.1 | 277.3 | 474.2 | 507.4 | 542.8 | 810.8 | 991.8 | 1219.3 | 2201 | 3493.8 |
| 60 | 243.3 | 284.5 | 486.5 | 520.6 | 556.9 | 831.9 | 1017.6 | 1250.9 | 2258.2 | 3584.6 |

## J.6.3. Marine Mammals and Sea Turtles: Behavioral Disturbance

The acoustic criteria relevant for behavioral disturbance include $L_{pk}$ and $L_{E,w}$ thresholds. All SEL modeling in this study assumes a single detonation per day as the assessment criteria and thresholds are different when more than one detonation occurs in a 24-hour period, as discussed below.

Single blast events within a 24-hour period are not presently considered by NMFS to produce significant adverse behavioral effects if received levels are below the onset of TTS thresholds for $L_{E,w}$ and $L_{pk}$ (Table J-4). When multiple blast events occur within a 24-hour period, the US Navy approach applies a disturbance threshold of TTS $L_{E,w}$ minus 5 dB. Thus, the effective behavioral threshold for single events in each 24-hour period is the $L_{E,w}$ for TTS onset, and for multiple events it is the $L_{E,w}$ for TTS – 5 dB.

The calculation of TTS onset and behavioral effects (TTS – 5 dB) would be more difficult when multiple blasts occur within a 24-hour period. In that case marine mammals and sea turtles could receive partial doses of SEL from different detonations. The individual event doses depend on the charge sizes, relative detonation timing, animal locations, and geoacoustic environment parameters along paths between the detonation and the exposed animals, most of which are not known in advance. If the parameters other than animal locations were known, then animal movement models could be used to provide exposure estimates. However, since Vineyard Northeast plans on only one charge detonation per day, a single event SEL model scenario is sufficient to calculate an $L_{E,w}$ map around each charge, and the TTS zones can be evaluated using the TTS criteria from Table J-4.

Note: For multiple blast events an SPL-based disturbance threshold of $L_p$ = 175 dB re 1 µPa$^2$ would be relevant. Here we are considering only a single blast event per day, so we have not considered that threshold. The approach for calculating $L_p$ is defined in (ISO 18405), but that metric is not currently applied by the Bureau of Ocean Energy Management (BOEM) or NMFS for explosives effects assessment of single blast events. Modeling of SPL requires using full wave source and propagation models that are not required for SEL-based assessments. That has not been done here, but these models are available if required.

## J.6.4. Fish Injury

Injury to fish from exposures to blast pressure waves is attributed to compressive damage to tissues surrounding the swim bladder and gastrointestinal tract, which may contain small gas bubbles. Effects of detonation pressure exposures to fish have been assessed according to the $L_{pk}$ limits for onset of mortality or injury leading to mortality due to explosives, as recommended by the American National Standards Institute (ANSI) expert working group (Popper et al. 2014) and provided in Table J-. The injurious effects thresholds for all fish species groups are the same: $L_{pk}$ = 229–234 dB re 1 µPa. The present assessment has applied the lower range value of $L_{pk}$ = 229 dB re 1 µPa for potential mortal injury and mortality.

Table J-10. Recommended Fish Injury thresholds ($L_{pk}$ in dB re 1 µPa) for explosives from Popper et al. (2014).

| Type of animal | Mortality and potential mortal injury threshold | Impairment: Recoverable injury | Impairment: TTS | Impairment: Masking | Behavior |
|---|---|---|---|---|---|
| Fish: no swim bladder (particle motion detection) | 229-234 | (N) High<br>(I) Low<br>(F) Low | (N) High<br>(I) Moderate<br>(F) Low | n/a | (N) High<br>(I) Moderate<br>(F) Low |
| Fish with swim bladder not involved in hearing (particle motion detection) | 229-234 | (N) High<br>(I) High<br>(F) Low | (N) High<br>(I) Moderate<br>(F) Low | n/a | (N) High<br>(I) High<br>(F) Low |
| Fish with swim bladder involved in hearing (primarily pressure detection) | 229-234 | (N) High<br>(I) High<br>(F) Low | (N) High<br>(I) High<br>(F) Low | n/a | (N) High<br>(I) High<br>(F) Low |

## J.6.5. Fish Behavioral Disturbance

This assessment has not quantitatively assessed zones of non-injurious effects to fish from explosive detonations because the Popper et al. (2014) guidelines (see Table J-) are qualitative and vague on that subject. For fish species that use swim bladders for hearing, Popper et al. (2014) suggests a high likelihood of TTS and recoverable injury at near and intermediate distances, where near refers to within a few tens of meters and intermediate refers to a few hundreds of meters. For fish species with swim bladders not used for hearing, the guidelines indicate high likelihood of recoverable impairment at near and intermediate distances but low levels of TTS at intermediate distances. For fish without swim bladders the guidelines indicate low likelihood of recoverable injury at intermediate distances and moderate likelihood of TTS at intermediate distances and low levels of both effects at far distances of a few kilometers.

# J.7. Acoustic Modeling

## J.7.1. Peak Pressure and Impulse

### J.7.1.1. Shock Pulse Source Function

Modeling of acoustic fields generated by UXO detonations is performed using a combination of semi-empirical and physics-based computational models. The source pressure function used for estimating $L_{pk}$ and $J_p$ metrics is calculated using a semiempirical model that approximates the rapid conversion (within approximately 1 µs for high explosive) of solid explosive to gaseous form in a small gas bubble under high pressure, followed by an exponential pressure decay as that bubble expands. This behavior imparts an initial pressure “shock pulse” into the water that is commonly approximated by an instantaneous rise to peak pressure $P_0$ followed by an exponentially decaying pressure function of the form:

$$P(t) = P_0 e^{-t/\tau} \quad \text{J-1}$$

The shape and amplitude of the pressure versus time signature of the shock pulse changes with distance from the detonation location due to non-linear propagation effects caused by its high $L_{pk}$. Arons and Yennie (1948) made measurements of the detonations of a range of charge sizes in Vineyard Sound, and derived empirical formulae for $P_0$ in Pascals, and exponential time constant $\tau$ in seconds as functions of equivalent TNT charge mass $W$ in kilograms, and distance from the detonation $r$ in meters (note the original equations used different mass and distance units and those have been converted to metric system units in the formulae presented here.

$$P_0 = 5.24 \times 10^7 \left( \frac{W^{\frac{1}{3}}}{r} \right)^{1.13} \text{ Pa} \quad \text{J-2}$$

$$\tau = 9.25 \times 10^{-5} W^{\frac{1}{3}} \left( \frac{W^{\frac{1}{3}}}{r} \right)^{-0.22} \text{ s} \quad \text{J-3}$$

## J.7.1.2. Shock Pulse Pressure Range Dependence

The shock pulse source function variation with distance described above is valid only close to the source, where pressures lead to non-linear effects. Beyond a certain distance $R_0$, the functional dependence of $P_0$ and $\tau$ on $W$ and $r$ are better described by weak shock theory that leads to a gradual transition to linear pressure decay with distance (Rogers 1977). The transition distance was defined by Gaspin (1983) as $R_0 = 4.76\, W^{1/3}$ meters. For example, $R_0$ is 47.6 m for a 1000 kg charge. At distances greater than $R_0$, the $L_{pk}$ and time constant are obtained by modified formulae (Rogers 1977):

$$\tau(r > R_0) = \tau(R_0)\left[1 + 2\left(\frac{R_0}{L_0}\right)\ln\frac{r}{R_0}\right]^{\frac{1}{2}} \quad \text{s} \tag{J-4}$$

$$P_0(r > R_0) = \frac{P_0(R_0)\left\{\left[1 + \frac{2R_0}{L_0}\ln\frac{r}{R_0}\right]^{\frac{1}{2}} - 1\right\}}{\left(\frac{r}{L_0}\right)\ln\frac{r}{R_0}} \quad \text{Pa} \tag{J-5}$$

where $L_0 = (\rho_0 {c_0}^3 \tau(R_0))/(\beta P_0(R_0)$.

In equations J-4 and J-5, $\rho_0$ is the water density expressed in kg/m$^3$, $c_0$ is the water sound speed expressed in m/s, and $\beta$=3.5. These equations lead to a pressure decay with range $r$ that transitions to spherical spreading at long distances. The time constant also increases as the higher frequencies of the shock pulse, responsible for its sharp peak, are preferentially attenuated by absorptive loss. Pressure calculations were performed for the charge sizes of Table J-1 with $\rho_0$=1026 kg/m$^3$ and $c_0$=1500 m/s, and these results are graphed as a function of distance from the charges in Figure J-3. The corresponding shock pulse time constant versus distance from equations J-3 and J-5 is plotted in Figure J-4.

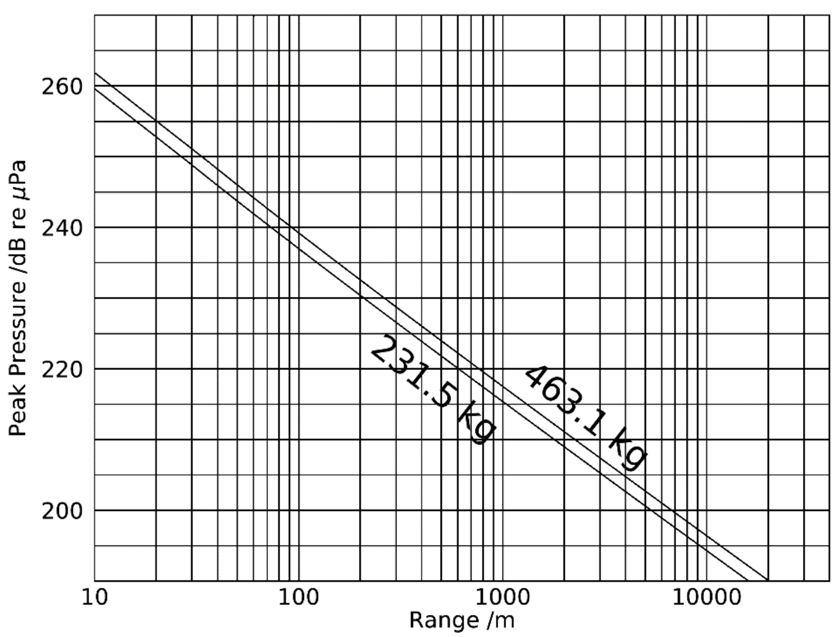


Figure J-3. Peak pressures versus distance from detonations of the charge masses and donors listed in Table J-1, calculated with equations J-2 and J-4.

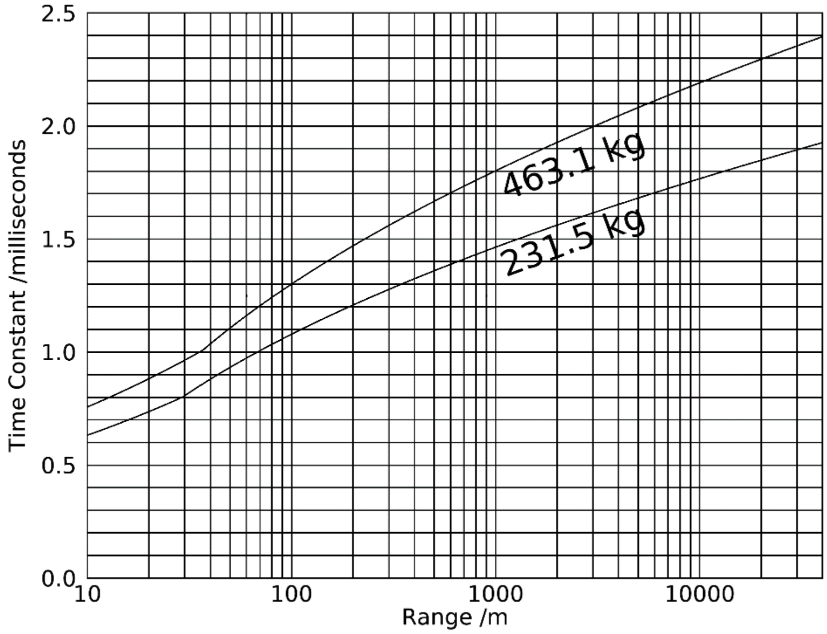


Figure J-4. Time constants calculated with equations J-3 and J-5 and converted to milliseconds for the exponential decay approximation of the shock pulse, for each of the charge masses with donors listed in Table J-1.

### J.7.1.3. Impulse

Acoustic impulse is defined as the integral of pressure through time. Assuming the onset of the pressure signal of the direct acoustic path starts at $t = 0$ and ends at $t = T$, the impulse is given by:

$$J_p = \int_0^T P(t)\,dt \quad \text{J-6}$$

If the integration end time $T$ is within the part of the shock pulse pressure waveform approximated well by the exponential function (equation J-1) then (equation J-6) can be expressed:

$$J_p(r) = P_0(r)\tau(r)\left(1 - e^{-T/\tau(r)}\right) \quad \text{J-7}$$

In practice, this approximation is accurate for integration times somewhat larger than the time constant because most of the contribution to impulse occurs near the shock pulse onset and the right bracketed term in (equation J-7) approaches 1.0 as the integration time exceeds a few time constants.

The US Navy applies an integration time window starting at the onset of the shock pulse and ending at the lesser of the arrival time of the surface reflection and 20% of the oscillation period of an exposed animal's lung, i.e., $T = minimum(T_{surf}, 0.2\ T_{lung})$ (US Navy 2017). The arrival time of the surface-reflected path relative to the direct path can be calculated from the depths of the source charge $z_s$ and the exposed animal $z_r$, their horizontal separation $x$ and the water sound speed $c_0$:

$$T_{surf} = \left(\sqrt{x^2 + (z_s + z_r)^2} - \sqrt{x^2 + (z_s - z_r)^2}\right)/c_0 \quad \text{J-8}$$

The lung oscillation period can be approximated by the oscillation period of a gas sphere of the same volume. The lung volume of animals at atmospheric pressure is approximately proportional to the animal's mass $M$ in kilograms, and this volume decreases with animal submersion depth $z_r$ due to compression by hydrostatic pressure. Goertner (1982) provides the following approximation for lung volume $V$ and equivalent volume fundamental oscillation period $t_{osc}$ for a submerged animal:

$$V = 3.5 \times 10^{-5}\, M \frac{p_{atm}}{(\rho_0 g z_r + p_{atm})} \quad \mathrm{m}^3 \qquad \text{J-9}$$

$$t_{osc} = 97.1\, (V 4\pi/3)^{\frac{1}{3}} / \sqrt{\rho_0 g z_r + p_{atm}} \quad \mathrm{s} \qquad \text{J-10}$$

where $g = 9.81\ \mathrm{m/s^2}$ is the gravitational acceleration and $p_{atm}$ is the atmospheric pressure in pascals at the sea surface. Figure J-5 shows lung fundamental oscillation periods calculated from (equation J-10) for four animal masses, versus submersion depth.

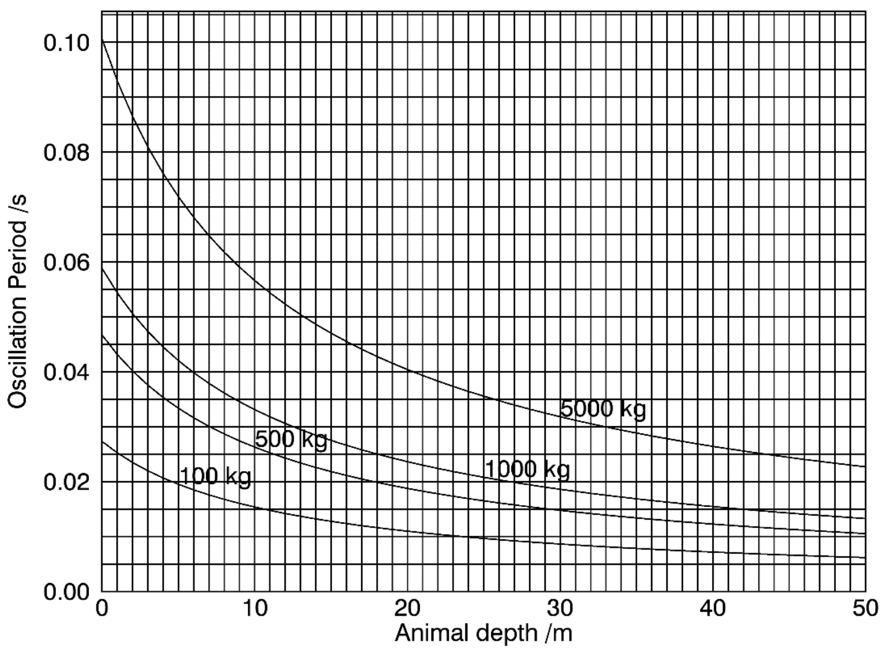


Figure J-5. Lung oscillation periods for animal masses of 100, 500, 1000, and 5000 kg versus submersion depth, calculated using equation J-10.

## J.7.2. Sound Exposure Level Model

SEL and SPL calculations for blast pressure waveforms depend on the characteristics of the initial shock pulse, as described above, and the subsequent oscillation of the detonation gas bubble. The oscillations lead to a series of alternating negative and positive pressure phases trailing the initial positive pressure shock pulse (Figure J-6). The positive pressures (relative to hydrostatic pressure) occur when the bubble volume is at its minima, and the negative pressures occur when the bubble volume is at its maxima. The shape of the resulting pressure waveform can be calculated using an explosive waveform model (e.g., Wakeley 1977) that includes the shock pulse model of equation J-1 and extends the pressure prediction in time through several oscillations of the bubble. The negative phase pressure troughs and bubble pulse peaks following the shock pulse are responsible for most of the low frequency energy of the overall blast waveform.

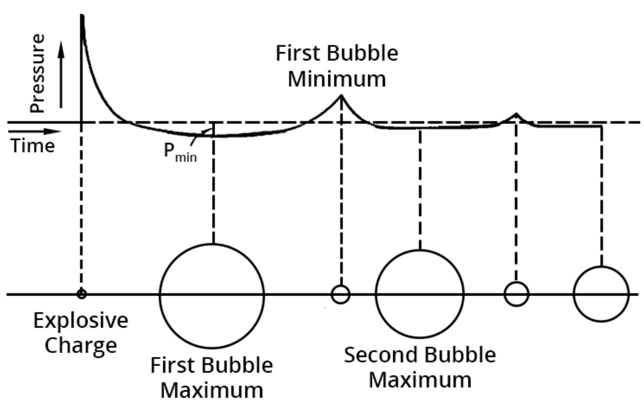


Figure J-6. Pictorial representation of the relationship between the radiated pressure signal and the volume of the gas bubble as it oscillates in size after the detonation. This figure is reproduced from Discovery of Sound in the Sea (DOSITS) website https://dosits.org/galleries/technology-gallery/basic-technology/explosive-sound-sources.

The SEL thresholds for PTS and TTS occur at typically at distances of several water depths in the relatively shallow waters of Vineyard Northeast's project area. The sound field at larger distances becomes increasingly influenced by the contributions of energy reflected from the sea surface and sea bottom multiple times. In most instances, the reflected paths become dominant over the direct acoustic path at horizontal distances greater than a few water depths. Some acoustic energy is also transmitted into the seafloor on each reflection and that energy can propagate partly through the seafloor before re-emerging into the water column and interacting in a complex way with waterborne energy. We apply acoustic propagation models to account for the effects of multiple reflections and sound propagation partly in the seabed. The modeling of SEL does not require use of a full waveform signature model. Nevertheless, the rate of decay of $L_E$ with distance from the detonation varies in a complex way with sound frequency, so a source model that accounts for frequency dependence is necessary. The modeling of $L_{E,w}$ performed here was carried out by first modeling $L_E$ in decidecade frequency bands using the marine operations noise model (MONM; JASCO Applied Sciences). This model uses an energy source level model, described in the next section, and then calculates acoustic propagation loss using parabolic equation (PE) approach for frequencies below 4 kHz, and a Gaussian beam ray trace model at higher frequencies. The PE model applied here also accounts for shear wave conversion losses from reflections at layer interfaces.

### J.7.2.1. Energy Source Levels in Decidecade Frequency Bands

A key input for the MONM model is the energy source level (ESL), which quantifies the acoustic energy (SEL) and its distribution across different frequency bands for each of the charges considered. The distribution depends on the charge mass and detonation depth. The ESL is calculated using an approach described by Urick (1971a, 1971b) and Urick (1983). A series of energy source level spectral density curves for normalized underwater explosion events at various depths (Figure J-7) are defined in terms of frequency relative to the frequency of the first bubble pulse. The first bubble pulse frequency is the inverse of the time of the first bubble pulse peak relative to the time of the shock pulse peak. It is calculated using an equation provided by Chapman (1985):

$$f_{b1} = (2.11W^{\frac{1}{3}}z_0^{-5/6})^{-1} \qquad \text{J-11}$$

where $W$ is the mass of the charge in kg of equivalent TNT and $z_0$ is the hydrostatic depth of the charge

$$(z_0 \approx z_s + 10.1\ \text{m}) \qquad \text{J-12}$$

The energy source level scaling factor for charge mass is calculated as:

$$\Delta\text{ESL} = 13.3\log W. \qquad \text{J-13}$$

The ESL in decidecade bands is calculated as follows:

1. The appropriate energy source level spectral density (ESLSD) curve is selected from the chart (see Figure J-7) based on the charge depth;
2. The first bubble pulse frequency $f_{b1}$ is calculated using equation J-11 and absolute frequencies for the ESLSD curve are obtained by scaling their normalized frequency by multiplying by $f_{b1}$;
3. The spectral levels are adjusted for the charge mass using equation J-12 and J-13; and
4. The ESLs are calculated by integrating the corrected ESLSD spectral function through the bandwidth of each decidecade band.

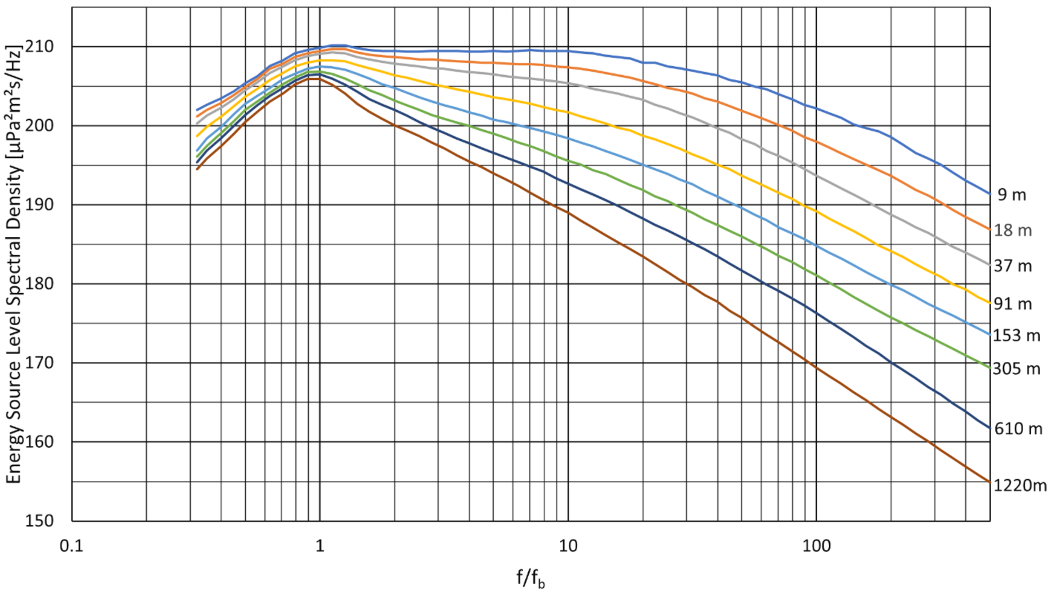


Figure J-7. Energy source level spectral density curves for underwater explosion events at various depths expressed in normalized frequency, relative to the frequency $f_{b1}$ of the first bubble pulse (after Urick (1983)).

## J.8. Acoustic Range Results (Unmitigated)

This section provides acoustic range results to injury and behavioral thresholds for detonations when noise attenuating systems (NAS) are not used. The corresponding acoustic ranges with a NAS system, providing 10 dB peak pressure, impulse, and SEL reductions, are provided in Section J.9.

### J.8.1. Marine Mammals and Sea Turtles TTS and PTS by Peak Pressure Distances (Unmitigated)

Peak pressure ($L_{pk}$) acoustic ranges are not dependent on water depth or seabed properties, so the results of Table J-11 are relevant for all sites.

Table J-11. Marine mammals and sea turtles PTS and TTS maximum acoustic ranges for peak pressure ($L_{pk}$) for various UXO charge sizes with donor charges for all sites, based on thresholds from Table J-4.

| Marine mammal group | TTS / PTS $L_{pk}$ threshold (dB re 1 µPa) | E10 + donor (231.5 kg) TTS | E10 + donor (231.5 kg) PTS | E12 + donor (463.1 kg) TTS | E12 + donor (463.1 kg) PTS |
|---|---|---|---|---|---|
| Low-frequency cetaceans | 213 / 219 | 3845.3 | 1998.0 | 4845.6 | 2517.5 |
| Mid-frequency cetaceans | 224 / 230 | 1160.9 | 606.9 | 1462.4 | 764.9 |
| High-frequency cetaceans | 196 / 202 | 24927.9 | 12862.2 | 31409.5 | 16206.6 |
| Phocid pinnipeds | 212 / 218 | 4290.1 | 2227.9 | 5405.5 | 2807.0 |
| Otariid pinnipeds and sea turtles | 226 / 232 | 934.9 | 489.7 | 1178.1 | 616.9 |

## J.8.2. Marine Mammals and Sea Turtles Gastrointestinal Injury by Peak Pressure Distances (Unmitigated)

The acoustic range results to injury thresholds in Table J-12 are for Onset Gastrointestinal Injury (based on effects observed in 1% of exposed animals) and Gastrointestinal Injury (effects observed in 50% of exposed animals). The peak pressure threshold listed here is based on studies on humans and mid-sized terrestrial animals and may not be conservative for smaller marine animals, less than approximately 50 kg. Further examination of that threshold is recommended before it is applied for smaller animals.

Table J-12. Maximum unmitigated acoustic ranges for Onset Gastrointestinal Injury (1% of exposed animals) and Gastrointestinal Injury (effects observed in 50% of exposed animals) due to peak pressure exposures for six UXO charge sizes with donor charge at all sites. The peak pressure threshold applied here is from Table J-7. We do not recommend applying this threshold for animals with mass less than 50 kg.

| Effect | $L_{pk}$ Threshold (dB re 1 µPa) | E10 + donor (231.5 kg) | E12 + donor (463.1 kg) |
|---|---|---|---|
| Onset gastrointestinal injury (1% of exposed animals) | 237 | 287.0 | 361.4 |
| Gastrointestinal injury (50% of exposed animals) | 243 | 151.8 | 191.4 |

## J.8.3. Marine Mammals and Sea Turtles Onset Lung Injury by Impulse Distances (Unmitigated)

The impulse acoustic range results in this section represent the onset of lung injury based on the threshold formula in row 5 of Table J-7. These thresholds represent effects observed in 1% of exposed animals.

Impulse levels and thresholds are depth-dependent, so maximum acoustic ranges vary between sites with different depths. The results for the six sites evaluated are presented in Tables Table J-13 through Table J-18.

Table J-13. Impulse acoustic range results (meters) for marine mammals and sea turtles, for Onset Injury to Lung – Impulse at Site S1 (45.0 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in row 5 of Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 468 | 174 | 653 | 265 |
| Minke whales | 636 | 273 | 848 | 407 |
| Beaked whales | 854 | 550 | 1093 | 752 |
| Dolphins, kogia, pinnipeds, and sea turtles | 1157 | 820 | 1433 | 1058 |
| Porpoises | 1238 | 883 | 1524 | 1132 |

Table J-14. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset Injury to Lung – Impulse at Site S2 (60.0 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 485 | 175 | 688 | 270 |
| Minke whales | 670 | 279 | 900 | 420 |
| Beaked whales | 904 | 574 | 1169 | 793 |
| Dolphins, kogia, pinnipeds, and sea turtles | 1231 | 870 | 1546 | 1130 |
| Porpoises | 1317 | 938 | 1643 | 1210 |

Table J-15. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset Injury to Lung – Impulse at Site S3 (30.0 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 435 | 170 | 566 | 254 |
| Minke whales | 587 | 262 | 734 | 372 |
| Beaked whales | 782 | 508 | 971 | 648 |
| Dolphins, kogia, pinnipeds, and sea turtles | 1052 | 752 | 1294 | 934 |
| Porpoises | 1119 | 809 | 1375 | 1010 |

Table J-16. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset Injury to Lung – Impulse at Site S4 (35.0 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 452 | 172 | 616 | 258 |
| Minke whales | 610 | 267 | 804 | 391 |
| Beaked whales | 810 | 529 | 1032 | 710 |
| Dolphins, kogia, pinnipeds, and sea turtles | 1086 | 778 | 1344 | 996 |
| Porpoises | 1166 | 837 | 1440 | 1062 |

Table J-17. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset Injury to Lung – Impulse at Site S5 (24.9 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 398 | 167 | 499 | 241 |
| Minke whales | 522 | 254 | 638 | 340 |
| Beaked whales | 698 | 458 | 833 | 566 |
| Dolphins, kogia, pinnipeds, and sea turtles | 988 | 670 | 1158 | 802 |
| Porpoises | 1068 | 726 | 1259 | 865 |

Table J-18. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset Injury to Lung – Impulse at Site S6 (69.3 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 492 | 174 | 703 | 273 |
| Minke whales | 683 | 281 | 926 | 425 |
| Beaked whales | 928 | 587 | 1206 | 814 |
| Dolphins, kogia, pinnipeds, and sea turtles | 1275 | 891 | 1588 | 1168 |
| Porpoises | 1363 | 970 | 1691 | 1250 |

## J.8.4. Marine Mammals and Sea Turtles Onset of Mortality by Impulse Distances (Unmitigated)

The acoustic ranges in this section represent the onset of mortality based on the threshold formula in Table J-7. These thresholds represent effects observed in 1% of exposed animals.

Impulse exposure levels and impulse effects thresholds are depth-dependent, so maximum acoustic ranges vary between sites with different depths. Interestingly, the trends of maximum horizontal exposure effects distance with water depth at each site are not always consistent. That occurs due to three reasons:

1. Impulse exposure, for a given animal submersion depth, depends on water depth because the seabed (and charge location) is further from the animal in deeper environments.
2. The impulse exposure is site and submersion depth-dependent because the impulse integration time depends on the minimum of arrival time of surface reflection and 20% of the lung oscillation period (which also depends on submersion depth)
3. The impulse criteria decrease with increased animal submersion depth.

The trends would be consistent had we calculated each table at a fixed animal submersion depth, but instead we search for the maximum criterion exceedance distance over all possible animal submersion depths, in 1 m depth increments from the surface to seafloor. The maximum horizontal effects criteria acoustic ranges over all submersion depths are presented in Tables Table J-19 through J-23.

Table J-19. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset of Mortality at Site S1 (45.0 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 229 | 73 | 338 | 122 |
| Minke whales | 328 | 126 | 457 | 196 |
| Beaked whales | 458 | 277 | 606 | 396 |
| Dolphins, kogia, pinnipeds, and sea turtles | 643 | 438 | 819 | 586 |
| Porpoises | 694 | 480 | 872 | 632 |

Table J-20. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset of Mortality at Site S2 (60.0 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 233 | 65 | 350 | 120 |
| Minke whales | 339 | 124 | 479 | 198 |
| Beaked whales | 482 | 284 | 644 | 412 |
| Dolphins, kogia, pinnipeds, and sea turtles | 682 | 459 | 872 | 619 |
| Porpoises | 729 | 503 | 930 | 664 |

Table J-21. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset of Mortality at Site S3 (30.0 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 221 | 77 | 318 | 121 |
| Minke whales | 311 | 125 | 424 | 190 |
| Beaked whales | 428 | 264 | 556 | 371 |
| Dolphins, kogia, pinnipeds, and sea turtles | 591 | 409 | 739 | 539 |
| Porpoises | 638 | 444 | 790 | 578 |

Table J-22. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset of Mortality at Site S4 (35.0 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 225 | 76 | 326 | 122 |
| Minke whales | 318 | 126 | 437 | 192 |
| Beaked whales | 438 | 270 | 578 | 380 |
| Dolphins, kogia, pinnipeds, and sea turtles | 608 | 422 | 772 | 555 |
| Porpoises | 657 | 458 | 824 | 595 |

Table J-23. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset of Mortality at Site S5 (24.9 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 216 | 78 | 298 | 120 |
| Minke whales | 302 | 124 | 395 | 185 |
| Beaked whales | 413 | 258 | 532 | 345 |
| Dolphins, kogia, pinnipeds, and sea turtles | 564 | 395 | 710 | 510 |
| Porpoises | 604 | 428 | 760 | 554 |

Table J-24. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset of Mortality at Site S6 (69.3 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in row 4 of Table J-6.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 234 | 63 | 354 | 116 |
| Minke whales | 344 | 120 | 488 | 198 |
| Beaked whales | 492 | 286 | 658 | 421 |
| Dolphins, kogia, pinnipeds, and sea turtles | 700 | 469 | 900 | 638 |
| Porpoises | 745 | 514 | 955 | 684 |

## J.8.5. Fish Injury by Peak Pressure Distances (Unmitigated)

Table J-25. Maximum acoustic ranges for Onset of Injury for fish without and with a swim bladder due to peak pressure exposures for various UXO charge sizes with donor charge. The threshold of 229 dB re 1 µPa is the minimum of the threshold range from Popper et al. (2014), in this report's Table J-10.

| Fish hearing group | Onset injury $L_{pk}$ (dB re 1 µPa) | E10 + donor (231.5 kg) | E12 + donor (463.1 kg) |
|---|---|---|---|
| All fish hearing groups | 229 | 676.1 | 852.1 |

## J.8.6. Marine Mammals and Sea Turtles: PTS by SEL Distances (Unmitigated)

The methods discussed in Section J.7.2 were applied to calculate SEL, at receiver depths from the surface to the seabed, versus distance and direction from each charge detonation. The max-over-depth results were extracted over depth to create noise maps of the type shown in Figure J-8. This map and similar maps at all other sites for the 231.5 kg and 463.1 kg charge sizes are provided in Sub-appendix J.

Acoustic ranges to each of the marine mammal, sea turtle, and fish SEL PTS thresholds listed in Table J-4, were obtained from these maps in two ways:

- $R_{max}$: represents the maximum distance in any direction that the threshold was exceeded. This metric is often overly conservative for exposure estimates because it reflects the influence of coherent constructive interference effects, produced by most propagation loss models, due to model approximations of highly uniform environments. In practice, these coherent effects are almost always disrupted by rough interfaces and ocean inhomogeneities.
- $R_{95\%}$: represents the radius of a circle that encompasses 95% of the area predicted by the model to exceed the threshold. The circle radius is typically larger than the maximum distances in most directions, but it cuts off "fingers" of ensonification that protrude in a small number of directions. This metric is typically also conservative, but less so than the $R_{max}$ distance.

The SEL effects thresholds are not dependent on animal depth, but SEL exposure levels generally are. For this reason, the acoustic ranges are based on the maximum exposure level over the entire water column depth. The acoustic ranges to PTS thresholds are provided in Tables Table J-26 to Table J-31.

The site-to-site variations in final acoustic ranges range 1–70% between sites and are attributed to dependence of propagation loss on water depth and bathymetry variations. The source spectrum of larger charges has greater relative low frequency sound energy than that of small charges, so propagation loss frequency dependence also affects the exceedance distance trends by charge size between sites. These features of location and charge size effects combine to produce non-uniform trends in acoustic ranges with site depth and charge size, although the trend variations are relatively small.

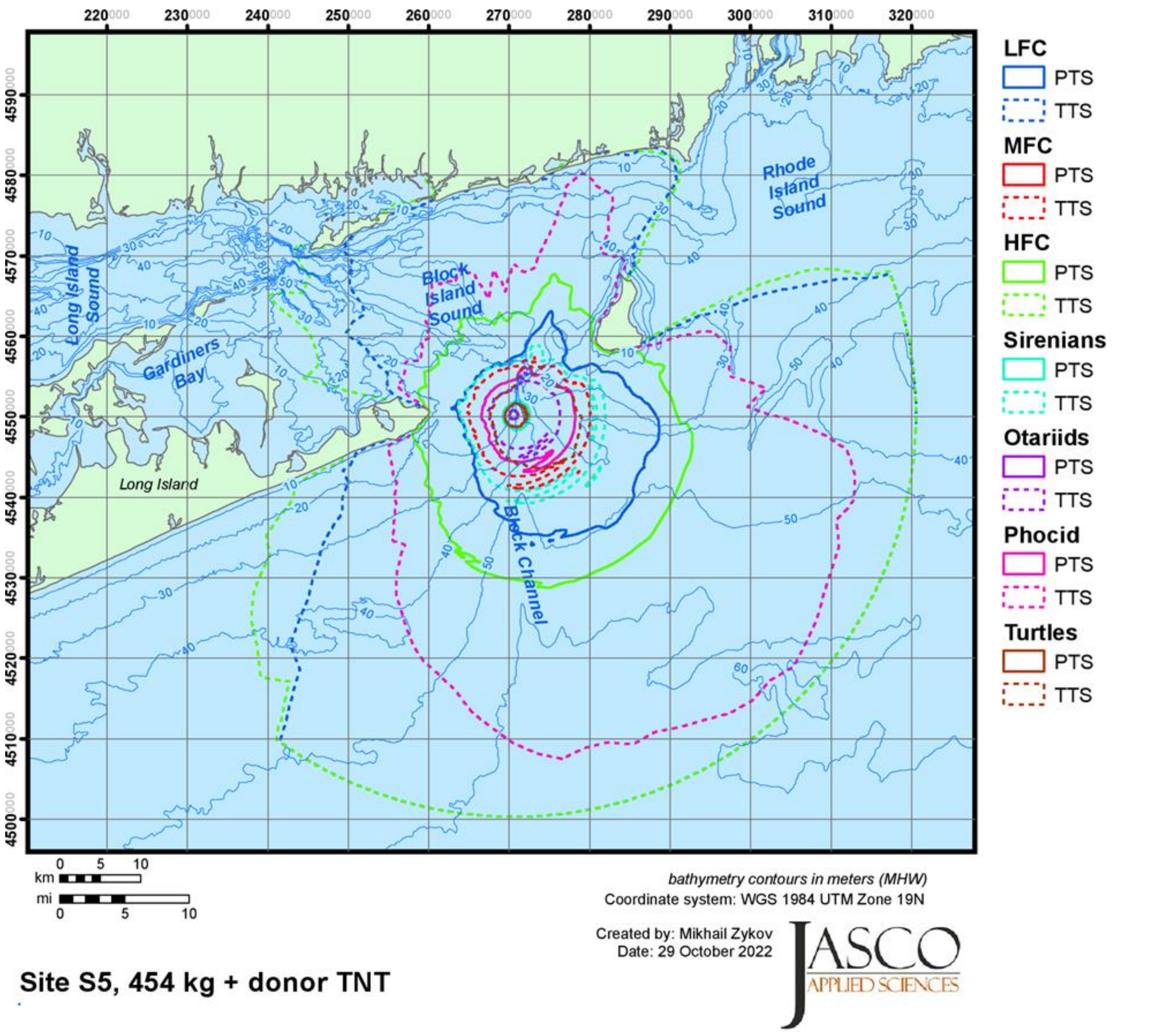


Figure J-8. Example of Frequency-weighted SEL PTS and TTS exceedance zone map, here for the 463.1 kg charge size at Site S5, for all species groups. The PTS and TTS thresholds are provided in Table J-4. The maps for 231.5 kg and 463.1 kg charge sizes at all other sites are provided in Sub-appendix J.

Table J-26. SEL-based acoustic ranges for PTS-onset at Site S1 (water depth: 45 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| LFC | 183 | 9080 | 8170 | 11800 | 10500 |
| MFC | 185 | 859 | 818 | 1200 | 1110 |
| HFC | 155 | 15400 | 13500 | 17700 | 16600 |
| PPW | 185 | 4170 | 3790 | 5700 | 4550 |
| OW | 203 | 264 | 257 | 358 | 345 |
| TUW | 204 | 1070 | 1040 | 1350 | 1300 |

Table J-27. SEL-based acoustic ranges for PTS-onset at Site S2 (water depth: 60 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| LFC | 183 | 9970 | 9290 | 13400 | 11400 |
| MFC | 185 | 881 | 818 | 1100 | 1040 |
| HFC | 155 | 15700 | 14000 | 19100 | 16800 |
| PPW | 185 | 4120 | 3860 | 5940 | 5600 |
| OW | 203 | 282 | 265 | 359 | 345 |
| TUW | 204 | 1160 | 1090 | 1540 | 1470 |

Table J-28. SEL-based acoustic ranges for PTS-onset at Site S3 (water depth: 30 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| LFC | 183 | 11800 | 10100 | 15400 | 12900 |
| MFC | 185 | 1110 | 1010 | 1530 | 1360 |
| HFC | 155 | 17300 | 14900 | 19500 | 17400 |
| PPW | 185 | 4340 | 4100 | 6010 | 5680 |
| OW | 203 | 361 | 331 | 510 | 466 |
| TUW | 204 | 1250 | 1160 | 1530 | 1430 |

Table J-29. SEL-based acoustic ranges for PTS-onset at Site S4 (water depth: 35 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| LFC | 183 | 9650 | 8350 | 11700 | 10700 |
| MFC | 185 | 1000 | 920 | 1410 | 1280 |
| HFC | 155 | 15700 | 14200 | 18900 | 16800 |
| PPW | 185 | 4250 | 4060 | 5890 | 5540 |
| OW | 203 | 304 | 282 | 456 | 421 |
| TUW | 204 | 1070 | 1010 | 1430 | 1280 |

Table J-30. SEL-based acoustic ranges for PTS-onset at Site S5 (water depth: 25 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| LFC | 183 | 14900 | 13200 | 18500 | 16600 |
| MFC | 185 | 1240 | 1100 | 1990 | 1890 |
| HFC | 155 | 19000 | 17500 | 22800 | 20800 |
| PPW | 185 | 5930 | 5490 | 7750 | 7200 |
| OW | 203 | 419 | 388 | 596 | 534 |
| TUW | 204 | 1270 | 1110 | 1750 | 1500 |

Table J-31. SEL-based acoustic ranges for PTS-onset at Site S6 (water depth: 69 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| LFC | 183 | 10100 | 9320 | 12800 | 11600 |
| MFC | 185 | 872 | 819 | 1110 | 1040 |
| HFC | 155 | 15800 | 13300 | 17900 | 16000 |
| PPW | 185 | 4040 | 3780 | 5940 | 4930 |
| OW | 203 | 215 | 211 | 403 | 389 |
| TUW | 204 | 932 | 901 | 1540 | 1500 |

## J.8.7. Marine Mammals and Sea Turtles: TTS by SEL Distances (Unmitigated)

The SEL distances thresholds are not dependent on animal depth, but the SEL exposure levels are. The TTS threshold acoustic ranges provided in Tables Table J-32 through Table J-37 are max-over-depth.

Table J-32. SEL-based acoustic ranges for TTS-onset at Site S1 (water depth: 45 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| LFC | 168 | >50000 | >50000 | >50000 | >50000 |
| MFC | 170 | 5970 | 5600 | 7760 | 6140 |
| HFC | 140 | 48600 | 45400 | >50000 | >50000 |
| PPW | 170 | 23600 | 21700 | 29800 | 27300 |
| OW | 188 | 2690 | 2600 | 3960 | 3610 |
| TUW | 189 | 4630 | 4330 | 5880 | 5490 |

Table J-33. SEL-based acoustic ranges for TTS-onset at Site S2 (water depth: 60 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| LFC | 168 | >50000 | >50000 | >50000 | >50000 |
| MFC | 170 | 6030 | 5690 | 7890 | 7490 |
| HFC | 140 | >50000 | >50000 | >50000 | >50000 |
| PPW | 170 | 25200 | 23100 | 31700 | 29100 |
| OW | 188 | 2740 | 2590 | 4050 | 3790 |
| TUW | 189 | 5030 | 4780 | 6460 | 6100 |

Table J-34. SEL-based acoustic ranges for TTS-onset at Site S3 (water depth: 30 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| LFC | 168 | >50000 | >50000 | >50000 | >50000 |
| MFC | 170 | 6120 | 5800 | 7970 | 7550 |
| HFC | 140 | >50000 | >50000 | >50000 | >50000 |
| PPW | 170 | 27300 | 23900 | 36100 | 29300 |
| OW | 188 | 3810 | 3010 | 4200 | 3950 |
| TUW | 189 | 5440 | 4780 | 7050 | 6110 |

Table J-35. SEL-based acoustic ranges for TTS-onset at Site S4 (water depth: 35 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| LFC | 168 | >50000 | >50000 | >50000 | >50000 |
| MFC | 170 | 6050 | 5680 | 7840 | 7440 |
| HFC | 140 | >50000 | >50000 | >50000 | >50000 |
| PPW | 170 | 25200 | 22400 | 31900 | 28100 |
| OW | 188 | 2970 | 2800 | 4080 | 3830 |
| TUW | 189 | 4540 | 4280 | 5760 | 5340 |

Table J-36. SEL-based acoustic ranges for TTS-onset at Site S5 (water depth: 25 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| LFC | 168 | >50000 | >50000 | >50000 | >50000 |
| MFC | 170 | 8990 | 7270 | 10800 | 8990 |
| HFC | 140 | >50000 | >50000 | >50000 | >50000 |
| PPW | 170 | 36700 | 32900 | 46800 | 41900 |
| OW | 188 | 4380 | 3850 | 5820 | 5390 |
| TUW | 189 | 7070 | 6100 | 9040 | 7790 |

Table J-37. SEL-based acoustic ranges for TTS-onset at Site S6 (water depth: 69 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| LFC | 168 | >50000 | >50000 | >50000 | >50000 |
| MFC | 170 | 5980 | 5480 | 7820 | 6240 |
| HFC | 140 | >50000 | >50000 | >50000 | >50000 |
| PPW | 170 | 25300 | 22700 | 31800 | 29100 |
| OW | 188 | 2690 | 2560 | 3760 | 3630 |
| TUW | 189 | 5050 | 4840 | 6360 | 6090 |

## J.9. Exceedance Distance Results with 10 dB Mitigation

This section provides acoustic ranges assuming 10 dB reduction to the exposure pressures and SEL achieved via mitigation measures (e.g., bubble curtain or similar system).

### J.9.1. Marine Mammals and Sea Turtles TTS and PTS by Peak Pressure Distances with 10 dB mitigation

Peak pressure ($L_{pk}$) acoustic ranges are not dependent on water depth or seabed properties, so the results in Table 38 are relevant for all sites.

Table 38. Marine mammals and sea turtles PTS and TTS maximum acoustic ranges for peak pressure ($L_{pk}$) using 10 dB mitigation for various UXO charge sizes with donor charges for all sites, based on thresholds from Table J-4.

| Marine mammal group | TTS / PTS $L_{pk}$ threshold (dB re 1 µPa) | E10 + donor (231.5 kg) TTS | E10 + donor (231.5 kg) PTS | E12 + donor (463.1 kg) TTS | E12 + donor (463.1 kg) PTS |
|---|---|---|---|---|---|
| LFC | 213 / 219 | 1293.6 | 676.1 | 1630.0 | 852.1 |
| MFC | 224 / 230 | 395.0 | 208.6 | 497.7 | 262.6 |
| HFC | 196 / 202 | 8284.0 | 4290.1 | 10437.7 | 5405.5 |
| PPW | 212 / 218 | 1442.0 | 753.3 | 1816.8 | 948.9 |
| OW and TUW | 226 / 232 | 319.0 | 168.6 | 402.2 | 212.6 |

### J.9.2. Marine Mammals and Sea Turtles Gastrointestinal Injury by Peak Pressure Distances with 10 dB mitigation

The acoustic ranges to threshold in Table J-39 are for Onset Gastrointestinal Injury (effects observed in 1% of exposed animals) and Gastrointestinal Injury (effects observed in 50% of exposed animals).

Table J-39. Maximum mitigated acoustic ranges for Onset Gastrointestinal Injury (1% of exposed animals) and Gastrointestinal Injury (effects observed in 50% of exposed animals) due to peak pressure exposures for six UXO charge sizes with donor charge. The peak pressure threshold applied here is from Table J-7. We do not recommend applying this threshold for animals with mass less than 50 kg.

| Effect | $L_{pk}$ threshold (dB re 1 µPa) | E10 + donor (231.5 kg) | E12 + donor (463.1 kg) |
|---|---|---|---|
| Onset gastrointestinal injury (1% of exposed animals) | 237 | 99.8 | 125.8 |
| Gastrointestinal Injury (50% of exposed animals) | 243 | 53.8 | 67.8 |

## J.9.3. Marine Mammals and Sea Turtles Onset of Lung Injury Distances for Impulse with 10 dB mitigation

The impulse threshold acoustic ranges in this section represent the onset of lung injury based on the threshold formula in Table J-7. These thresholds represent effects observed in 1% of exposed animals and this section assumes 10 dB mitigation.

Impulse levels and thresholds are depth-dependent, so maximum acoustic ranges could vary between sites with different depths. The results for each of the sites evaluated are presented in Tables Table J-40 through J-44.

Table J-40. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset Injury to Lung – Impulse with 10 dB mitigation at Site S1 (45.0 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 158 | 44 | 240 | 79 |
| Minke whales | 232 | 82 | 333 | 134 |
| Beaked whales | 333 | 194 | 451 | 284 |
| Dolphins, kogia, pinnipeds, and sea turtles | 473 | 318 | 609 | 432 |
| Porpoises | 517 | 350 | 654 | 470 |

Table J-41. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset Injury to Lung – Impulse with 10 dB mitigation at Site S2 (60.0 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 157 | 42 | 245 | 71 |
| Minke whales | 237 | 74 | 344 | 132 |
| Beaked whales | 345 | 196 | 476 | 294 |
| Dolphins, kogia, pinnipeds, and sea turtles | 502 | 329 | 645 | 455 |
| Porpoises | 538 | 362 | 700 | 492 |

Table J-42. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset Injury to Lung – Impulse with 10 dB mitigation at Site S3 (30.0 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 155 | 49 | 228 | 82 |
| Minke whales | 223 | 85 | 312 | 132 |
| Beaked whales | 313 | 188 | 417 | 270 |
| Dolphins, kogia, pinnipeds, and sea turtles | 443 | 301 | 560 | 402 |
| Porpoises | 474 | 327 | 596 | 431 |

Table J-43. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset Injury to Lung – Impulse with 10 dB mitigation at Site S4 (35.0 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 156 | 47 | 233 | 82 |
| Minke whales | 226 | 84 | 320 | 133 |
| Beaked whales | 321 | 190 | 429 | 276 |
| Dolphins, kogia, pinnipeds, and sea turtles | 458 | 306 | 582 | 413 |
| Porpoises | 488 | 337 | 619 | 448 |

Table J-44. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset Injury to Lung – Impulse with 10 dB mitigation at Site S5 (24.9 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 152 | 51 | 222 | 82 |
| Minke whales | 218 | 85 | 302 | 130 |
| Beaked whales | 304 | 184 | 400 | 262 |
| Dolphins, kogia, pinnipeds, and sea turtles | 423 | 290 | 540 | 388 |
| Porpoises | 456 | 318 | 577 | 416 |

Table J-45. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset Injury to Lung – Impulse with 10 dB mitigation at Site S6 (69.3 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 156 | 41 | 246 | 68 |
| Minke whales | 238 | 69 | 351 | 130 |
| Beaked whales | 351 | 195 | 487 | 297 |
| Dolphins, kogia, pinnipeds, and sea turtles | 514 | 335 | 667 | 466 |
| Porpoises | 552 | 367 | 715 | 504 |

## J.9.4. Marine Mammals and Sea Turtles Onset of Mortality Distances by Impulse with 10 dB mitigation

The acoustic ranges in this section represent the onset of mortality based on the threshold formula in row 1 of Table J-7 and assuming 10 dB of sound level reduction is obtained through a noise mitigation device. These thresholds represent effects observed in 1% of exposed animals.

Impulse levels and thresholds are depth-dependent, so maximum acoustic ranges vary between sites with different depths. The results for the six sites evaluated are presented in Tables Table J-46 to Table J-51.

Table J-46. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset of Mortality with 10 dB mitigation at Site S1 (45.0 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in row 1 of Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 64 | 18 | 110 | 30 |
| Minke whales | 106 | 30 | 164 | 51 |
| Beaked whales | 166 | 84 | 236 | 136 |
| Dolphins, kogia, pinnipeds, and sea turtles | 250 | 157 | 334 | 226 |
| Porpoises | 272 | 174 | 356 | 246 |

Table J-47. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset of Mortality with 10 dB mitigation at Site S2 (60.0 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in row 1 of Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 54 | 17 | 106 | 28 |
| Minke whales | 102 | 28 | 166 | 47 |
| Beaked whales | 166 | 77 | 242 | 135 |
| Dolphins, kogia, pinnipeds, and sea turtles | 256 | 156 | 348 | 230 |
| Porpoises | 282 | 176 | 370 | 255 |

Table J-48. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset of Mortality with 10 dB mitigation at Site S3 (30.0 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in row 4 of Table J-6.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 69 | 19 | 110 | 32 |
| Minke whales | 107 | 33 | 159 | 57 |
| Beaked whales | 161 | 87 | 222 | 134 |
| Dolphins, kogia, pinnipeds, and sea turtles | 235 | 153 | 309 | 213 |
| Porpoises | 259 | 169 | 332 | 232 |

Table J-49. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset of Mortality with 10 dB mitigation at Site S4 (35.0 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in row 1 of Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 68 | 18 | 110 | 31 |
| Minke whales | 107 | 32 | 161 | 56 |
| Beaked whales | 163 | 86 | 227 | 135 |
| Dolphins, kogia, pinnipeds, and sea turtles | 243 | 154 | 316 | 217 |
| Porpoises | 262 | 172 | 344 | 238 |

Table J-50. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset of Mortality with 10 dB mitigation at Site S5 (24.9 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in row 1 of Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 70 | 20 | 108 | 32 |
| Minke whales | 106 | 34 | 156 | 58 |
| Beaked whales | 157 | 87 | 216 | 131 |
| Dolphins, kogia, pinnipeds, and sea turtles | 228 | 149 | 298 | 208 |
| Porpoises | 252 | 166 | 321 | 224 |

Table J-51. Impulse acoustic ranges (meters) for marine mammals and sea turtles, for Onset of Mortality with 10 dB mitigation at Site S6 (69.3 m water depth) for two UXO charge sizes with donor charge. The Impulse threshold is dependent on animal mass and submersion depth and based on the formula in row 1 of Table J-7.

| Marine mammal group | E10 + donor (231.5 kg) Calf/Pup | E10 + donor (231.5 kg) Adult | E12 + donor (463.1 kg) Calf/Pup | E12 + donor (463.1 kg) Adult |
|---|---|---|---|---|
| Baleen whales and sperm whales | 50 | 16 | 102 | 27 |
| Minke whales | 97 | 28 | 164 | 45 |
| Beaked whales | 166 | 70 | 244 | 132 |
| Dolphins, kogia, pinnipeds, and sea turtles | 264 | 156 | 353 | 232 |
| Porpoises | 286 | 176 | 383 | 255 |

## J.9.5. Fish Injury Distances for Peak Pressure with 10 dB mitigation

Table J-52. Maximum acoustic ranges for Onset of Injury for fish without and with a swim bladder due to peak pressure exposures with 10 dB mitigation for various UXO charge sizes with donor charge. The threshold of 229 dB re 1 µPa is the minimum of the threshold range from Popper et al. (2014) in this report's Table J-10.

| Fish hearing group | Onset injury $L_{pk}$ (dB re 1 µPa) | E10 + donor (231.5 kg) | E12 + donor (463.1 kg) |
|---|---|---|---|
| All fish hearing groups | 229 | 231.8 | 292.2 |

## J.9.6. Marine Mammals and Sea Turtles: PTS distances by SEL with 10 dB mitigation

The SEL effects thresholds are not dependent on animal depth, but the exposure levels are. The PTS threshold acoustic ranges provided in Tables Table J-53 to Table J-58 are max-over-depth.

Table J-53. SEL-based acoustic ranges for PTS-onset with 10 dB mitigation at Site S1 (water depth: 45 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w,24h}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| LFC | 183 | 3240 | 3000 | 4160 | 3840 |
| MFC | 185 | 175 | 168 | 250 | 238 |
| HFC | 155 | 6050 | 5670 | 7840 | 6470 |
| PPW | 185 | 997 | 922 | 1400 | 1320 |
| OW | 203 | <50 | <50 | 61 | 61 |
| TUW | 204 | 218 | 211 | 355 | 345 |

Table J-54. SEL-based acoustic ranges for PTS-onset with 10 dB mitigation at Site S2 (water depth: 60 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w,24h}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| Low-frequency cetaceans | 183 | 3800 | 3210 | 4310 | 4000 |
| Mid-frequency cetaceans | 185 | 163 | 162 | 231 | 222 |
| High-frequency cetaceans | 155 | 6080 | 5730 | 7930 | 7530 |
| Phocid pinnipeds | 185 | 920 | 871 | 1390 | 1240 |
| Otariid pinnipeds | 203 | <50 | <50 | 64 | 64 |
| Sea turtles | 204 | 199 | 191 | 318 | 307 |

Table J-55. SEL-based acoustic ranges for PTS-onset with 10 dB mitigation at Site S3 (water depth: 30 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w,24h}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| Low-frequency cetaceans | 183 | 3600 | 3300 | 4600 | 4110 |
| Mid-frequency cetaceans | 185 | 242 | 228 | 344 | 319 |
| High-frequency cetaceans | 155 | 7700 | 6050 | 8020 | 7580 |
| Phocid pinnipeds | 185 | 1220 | 1130 | 1690 | 1550 |
| Otariid pinnipeds | 203 | 54 | 54 | 78 | 78 |
| Sea turtles | 204 | 316 | 259 | 473 | 450 |

Table J-56. SEL-based acoustic ranges for PTS-onset with 10 dB mitigation at Site S4 (water depth: 35 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w,24h}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| Low-frequency cetaceans | 183 | 3190 | 2980 | 4140 | 3870 |
| Mid-frequency cetaceans | 185 | 225 | 208 | 309 | 287 |
| High-frequency cetaceans | 155 | 6160 | 5800 | 7900 | 7490 |
| Phocid pinnipeds | 185 | 1130 | 1030 | 1640 | 1410 |
| Otariid pinnipeds | 203 | 50 | 50 | 73 | 70 |
| Sea turtles | 204 | 253 | 242 | 361 | 347 |

Table J-57. SEL-based acoustic ranges for PTS-onset with 10 dB mitigation at Site S5 (water depth: 25 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w,24h}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| Low-frequency cetaceans | 183 | 4720 | 4200 | 6000 | 5420 |
| Mid-frequency cetaceans | 185 | 285 | 268 | 406 | 366 |
| High-frequency cetaceans | 155 | 9170 | 7370 | 11000 | 9030 |
| Phocid pinnipeds | 185 | 1380 | 1210 | 2020 | 1880 |
| Otariid pinnipeds | 203 | 66 | 66 | 101 | 96 |
| Sea turtles | 204 | 340 | 310 | 517 | 469 |

Table J-58. SEL-based acoustic ranges for PTS-onset with 10 dB mitigation at Site S6 (water depth: 69 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w,24h}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| Low-frequency cetaceans | 183 | 3190 | 3070 | 4120 | 3960 |
| Mid-frequency cetaceans | 185 | 175 | 164 | 257 | 226 |
| High-frequency cetaceans | 155 | 6080 | 5660 | 7900 | 6540 |
| Phocid pinnipeds | 185 | 890 | 836 | 1320 | 1250 |
| Otariid pinnipeds | 203 | 50 | 50 | 64 | 64 |
| Sea turtles | 204 | 193 | 191 | 310 | 301 |

## J.9.7. Marine Mammals and Sea Turtles: TTS distances by SEL with 10 dB mitigation

The SEL effects thresholds are not dependent on animal depth, but the exposure levels are. The TTS threshold acoustic ranges provided in Tables Table J-59 to Table J-64 are max-over-depth.

Table J-59. SEL-based acoustic ranges for TTS-onset with 10 dB mitigation at Site S1 (water depth: 45 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w,24h}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| Low-frequency cetaceans | 168 | 15700 | 14300 | 20300 | 18500 |
| Mid-frequency cetaceans | 170 | 1860 | 1740 | 2300 | 2200 |
| High-frequency cetaceans | 140 | 22000 | 20800 | 26400 | 24600 |
| Phocid pinnipeds | 170 | 7870 | 6900 | 9840 | 9260 |
| Otariid pinnipeds | 188 | 624 | 590 | 876 | 824 |
| Sea turtles | 189 | 1760 | 1650 | 2360 | 2250 |

Table J-60. SEL-based acoustic ranges for TTS-onset with 10 dB mitigation at Site S2 (water depth: 60 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w,24h}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| Low-frequency cetaceans | 168 | 17600 | 15900 | 22000 | 20200 |
| Mid-frequency cetaceans | 170 | 2030 | 1890 | 2310 | 2180 |
| High-frequency cetaceans | 140 | 23500 | 21700 | 27400 | 25400 |
| Phocid pinnipeds | 170 | 7990 | 7540 | 9960 | 9400 |
| Otariid pinnipeds | 188 | 578 | 542 | 810 | 775 |
| Sea turtles | 189 | 1930 | 1830 | 2550 | 2340 |

Table J-61. SEL-based acoustic ranges for TTS-onset with 10 dB mitigation at Site S3 (water depth: 30 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w,24h}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| Low-frequency cetaceans | 168 | 19600 | 17100 | 25300 | 21300 |
| Mid-frequency cetaceans | 170 | 2230 | 2030 | 2580 | 2380 |
| High-frequency cetaceans | 140 | 25100 | 22100 | 28900 | 25900 |
| Phocid pinnipeds | 170 | 9610 | 7750 | 11800 | 10100 |
| Otariid pinnipeds | 188 | 798 | 750 | 1090 | 1020 |
| Sea turtles | 189 | 1950 | 1830 | 2660 | 2390 |

Table J-62. SEL-based acoustic ranges for TTS-onset with 10 dB mitigation at Site S4 (water depth: 35 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w,24h}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| Low-frequency cetaceans | 168 | 16000 | 14400 | 21000 | 18200 |
| Mid-frequency cetaceans | 170 | 2070 | 1950 | 2460 | 2330 |
| High-frequency cetaceans | 140 | 23700 | 21500 | 28100 | 25200 |
| Phocid pinnipeds | 170 | 7930 | 7480 | 9910 | 9360 |
| Otariid pinnipeds | 188 | 736 | 678 | 997 | 915 |
| Sea turtles | 189 | 1890 | 1680 | 2360 | 2180 |

Table J-63. SEL-based acoustic ranges for TTS-onset with 10 dB mitigation at Site S5 (water depth: 25 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w,24h}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| Low-frequency cetaceans | 168 | 27000 | 24200 | 37300 | 32900 |
| Mid-frequency cetaceans | 170 | 2310 | 2120 | 3870 | 3620 |
| High-frequency cetaceans | 140 | 29400 | 26700 | 34400 | 31300 |
| Phocid pinnipeds | 170 | 11300 | 10600 | 14800 | 12700 |
| Otariid pinnipeds | 188 | 900 | 817 | 1210 | 1090 |
| Sea turtles | 189 | 2250 | 1970 | 3440 | 3080 |

Table J-64. SEL-based acoustic ranges for TTS-onset with 10 dB mitigation at Site S6 (water depth: 69 m) for two UXO charge sizes: Maximum ($R_{max}$, m) and 95% ($R_{95\%}$, m) horizontal distances to thresholds from Table J-4.

| Marine mammal group | Threshold $L_{E,w,24h}$ (dB re 1 µPa²s) | E10 + donor (231.5 kg) $R_{max}$ | E10 + donor (231.5 kg) $R_{95\%}$ | E12 + donor (463.1 kg) $R_{max}$ | E12 + donor (463.1 kg) $R_{95\%}$ |
|---|---|---|---|---|---|
| Low-frequency cetaceans | 168 | 17900 | 16000 | 22600 | 20500 |
| Mid-frequency cetaceans | 170 | 1790 | 1710 | 2340 | 2250 |
| High-frequency cetaceans | 140 | 22200 | 20500 | 26200 | 24200 |
| Phocid pinnipeds | 170 | 8090 | 7330 | 10100 | 9220 |
| Otariid pinnipeds | 188 | 562 | 532 | 796 | 745 |
| Sea turtles | 189 | 1980 | 1930 | 2470 | 2400 |

## J.10. Summary and Guide for Use of Results

This study generated a large number of results tables containing effects threshold acoustic ranges for multiple species or species groups, two charge sizes, at six locations, and without and with 10 dB noise attenuation. Although Vineyard Northeast anticipates using mitigation technology (e.g., bubble curtain system or other system) during UXO detonations, unmitigated results are presented for comparison and completeness. All results presented here assume the full explosive mass of the combined UXO and donor charge are detonated, with a maximum equivalent TNT mass matching the values in Table J-1. A recent review of UXO detonations in the North Sea has found UXO detonations of charges that have remained underwater for more than 75 years may yield very little explosive energy (Bellman, 2021). More research is needed to determine the extent to which older underwater UXO degrade over time to become partly benign, in which case methods such as deflagration or manual removal may be preferred over in situ explosive removal. Until that question is answered, for conservativeness and for personnel safety reasons, we recommend assuming their full explosive masses will detonate. That is the approach taken here for predicting acoustic effects.

All threshold distances presented here are relevant to address NMFS's assessment requirements (NMFS 2018) for species-dependent effects criteria for assessing injury or behavioral impacts of marine mammals and sea turtles, and for assessing injurious effects on fish. The acoustic criteria used here are based on three specific acoustic metrics: $L_{pk}$, $J_p$, and $L_{E,w}$. The frequency weighted SEL thresholds and exposure levels, $L_{E,w}$, are dependent on species group while the impulse levels are dependent on animal mass and submersion depth. All three metrics also have species or animal size dependent thresholds. The SEL and impulse levels vary with water depth or location. Two charge sizes are considered at six separate modeling sites with different depths. The consideration of these many results for estimating marine mammal and sea turtle exposures, and fish acoustic ranges is clearly not straightforward. To assist in that assessment, a summary of the injury and behavioral acoustic criteria for each assessment metric is provided here, together with cross-references to the tables that contain the relevant acoustic ranges to injury and behavioral thresholds. Examples of the maximum exceedance distance, resulting from the largest UXO charge mass, on the most-sensitive species group are provided here but the user will need to review the referenced exceedance distance tables to look up the relevant distances for other species groups and charge sizes. We expect the peak pressure based gastrointestinal tract injury distances and impulse based onset of lung injury and onset of mortality distances will be used primarily for setting mitigation zone requirements.

## J.10.1. Unmitigated Acoustic Ranges

This section provides distances to exposures that could result in injurious or disturbance effects, assuming that Noise Attenuation Devices are not used. See Section J.10.1 for the corresponding distances with a NAS providing 10 dB reduction of peak pressure, impulse, and SEL.

### J.10.1.1. Ranges to Injury Thresholds

The tables relevant for determining acoustic ranges to marine mammal and sea turtle injury are :

- $L_{pk}$: Table J-11 contains PTS (auditory injury) acoustic ranges for marine mammals and sea turtles valid for all sites. The greatest PTS distance is 16,207 m from the 463.1 kg charge with donor, for high-frequency cetaceans.
- $L_{pk}$: Table J-12 contains the maximum onset gastrointestinal injury (1% of exposed animals) and gastrointestinal injury (50% of exposed animals) acoustic ranges for marine mammals and sea turtles for all sites. The greatest distance is 361 m for onset gastrointestinal injury and 191 m for gastrointestinal injury from the 463.1 kg charge. We note that the gastrointestinal injury distances for small animals using the $L_{pk}$ criterion can be smaller than those for onset of mortality using the $J_p$ criterion (next bullet). That may occur because the $L_{pk}$ criterion originates from studies on mid-sized terrestrial animals and adult humans. We recommend against using this criterion for animals smaller than approximately 50 kg.
- $P$: Tables Table J-13 to Table J-18 contain onset of lung injury (1% of animals) distances for marine mammals and sea turtles at Sites S1 to S6, respectively. For each species group there are separate distances for small animals (calves/pups) and adult animals representative of each group. Smaller animals in each group have lower thresholds, leading to larger acoustic ranges. The deeper sites often, but not always, have larger acoustic ranges than shallower sites. The unusual dependence of acoustic ranges on site depth and charge size is discussed in Section J.8.6. The greatest distance for onset of lung injury is 1691 m from the unmitigated 463.1 kg charge with donor at site S6 (69.3 m depth) for porpoise calves.
- $J_p$: Tables Table J-19 to Table J-24 contain onset of mortality (1% of animals) distances for marine mammals and sea turtles at Sites S1 to S6, respectively. The greatest distance for onset of mortality is 955 m from the unmitigated 463.1 kg charge with donor at site S6 (69.3 m water depth) for porpoise calves.
- $L_{E,w}$ (species-group frequency weighted SEL): Tables Table J-26 to Table J-31 contain PTS threshold acoustic ranges at Sites S1 to S6, respectively. These tables contain $R_{max}$ and $R_{95\%}$ distances, and we recommend using the $R_{95\%}$ distances because $R_{max}$ is often influenced by an artefact of the type of models used, as discussed in Section J.8.6. The greatest $R_{95\%}$ distance for PTS is 22,800 m for high-frequency cetaceans and a 463.1 kg charged detonated at Site S5 (25 m depth).
- SEL and peak pressure auditory injury distances are always larger than the impulse non-auditory injury acoustic ranges, so the former distances will dictate injurious exposures.

#### J.10.1.2. Ranges to Behavioral Thresholds

The tables relevant for behavioral disturbance or behavioral effects are the TTS Threshold acoustic ranges in Table J-11 and Tables Table J-32 to Table J-37 in Sections J.8.6 and J.8.7. The effective behavioral disturbance threshold for single events in each 24-hour period is the $L_{E,w}$ for TTS onset:

- $L_{pk}$: Table J-11 contains TTS (temporary effect not considered injurious) acoustic ranges for marine mammals and sea turtles valid for all sites. The greatest TTS distance is 31,410 m from the 463.1 kg charge with donor, for high-frequency cetaceans.
- $L_{E,w}$ (species-group frequency weighted SEL): Tables Table J-32 to Table J-37 contain TTS threshold acoustic ranges for marine mammals and sea turtles at Sites S1 to S6, respectively. The greatest $R_{95\%}$ distance for TTS is greater than 50,000 m (the maximum distance modeled) for low-frequency and high-frequency cetaceans for all charges larger than 231.5 kg at all sites.

#### J.10.1.3. Unmitigated Effects on Fish

- $L_{pk}$: Table J-25 provides onset of injury distances relevant for all fish groups. The unmitigated distances for mortality or injury likely to lead to mortality range from 676 m from the 231.5 kg charge with donor to 852 m from the 463.1 kg charge with donor. These distances are relevant for all sites.
- A quantitative assessment of non-mortal effects to fish has not been included, but the guidelines of Popper et al. (2014) provide qualitative assessment information. This is discussed in Sections J.6.4 and J.6.5.

### J.10.2. Mitigated Acoustic Ranges (10 dB Reduction)

Reduced effects threshold distances were calculated with a flat 10 dB reduction of pressure to all metrics, as an approximation of noise abatement that could be achieved, for example, using a bubble curtain. The mitigated results tables are provided in Section J.9 and discussed here.

#### J.10.2.1. Ranges to Injury Thresholds

The tables relevant for determining acoustic ranges to marine mammal and sea turtle injury are:

- $L_{pk}$: Table 38 contains mitigated marine mammal and sea turtle PTS (auditory injury) acoustic ranges valid for all sites. The greatest PTS distance is 10,438 m from the 463.1 kg charge with donor, for high-frequency cetaceans. The mitigated PTS distances from peak pressure for all other species groups are less than 2000 m.
- $L_{pk}$: Table J-39 contains mitigated onset of gastrointestinal injury for marine mammals and sea turtles (1% of exposed animals) acoustic ranges valid for all sites. The greatest onset of effects distance is 68 m from the 463.1 with donor kg charge. We note that the gastrointestinal injury distances for small animals using the $L_{pk}$ criterion can be smaller than those for onset of mortality using the $J_p$ criterion (next bullet). That occurs because the $L_{pk}$ criterion originates from studies on mid-sized terrestrial animals and adult humans. We recommend against using this criterion for animals smaller than approximately 50 kg.
- $J_p$: Tables Table J-40 to Table J-45 contain onset of lung injury to marine mammals and sea turtles (1% of animals) acoustic ranges for Sites S1 to S6, respectively. The greatest distance for onset of lung injury is 715 m from the 463.1 kg charge with donor at Site S6, for porpoise calves.

- $J_p$: Tables Table J-46 to Table J-51 to contain onset of mortality to marine mammals and sea turtles (effects observed in 1% of animals) acoustic ranges for Sites S1 to S6, respectively. The greatest distance for onset of mortality is 383 m from the 463.1 kg charge with donor at Site S6, for porpoise calves.
- SEL (species-group weighted): Tables Table J-53 to Table J-58 contain PTS threshold acoustic ranges at Sites S1 to S6, respectively. The greatest $R_{95\%}$ distance is 9,030 m for high-frequency cetaceans for a 463.1 kg charge detonated at Site S5.

### J.10.2.2. Ranges to Behavioral Thresholds

The tables relevant for mitigated behavioral disturbance or behavioral effects of marine mammals and sea turtles are in Section J.9.7. The effective behavioral disturbance threshold for single events in each 24-hour period is the $L_{E,w}$ for TTS onset:

- $L_{pk}$: Table 38 contains TTS (temporary effect not considered injurious) acoustic ranges for peak pressure valid for all sites. The greatest $L_{pk}$ TTS distance is 10,438 m from the 463.1 kg charge with donor, for high-frequency cetaceans.
- $L_{E,w}$ (species-group weighted SEL): Tables Table J-59 to Table J-64 contain TTS threshold acoustic ranges at Sites S1 to S6, respectively. The greatest $R_{95\%}$ distance is 32,900 m for low-frequency cetaceans at Site S5.

### J.10.2.3. Mitigated Effects on Fish

- $L_{pk}$: Table J-52 provides mitigated onset of injury for all fish groups. The mitigated distances range from 232 m from the 231.5 kg charge with donor to 292 m from the 463.1 kg charge with donor. These values are relevant for all sites.
- A quantitative assessment of non-mortal effects to fish has not been included, as discussed in Sections J.6.4 and J.6.5. Those sections provide a qualitative assessment approach.

# J.11. Literature Cited for Appendix J

[DoN] Department of the Navy (US). 2017. *Request for Regulations and Letters of Authorization for the Incidental Taking of Marine Mammals Resulting from U.S. Navy Training Activities in the Hawaii-Southern California Training and Testing Study Area* Submitted by Commander, United States Pacific Fleet, and Commander, Naval Sea Systems Command, to Office of Protected Resources, National Marine Fisheries Service

[ISO] International Organization for Standardization. 2017. *ISO 18405:2017. Underwater acoustics – Terminology*. Geneva. https://www.iso.org/obp/ui/en/#!iso:std:62406:en.

[NAVO] Naval Oceanography Office (US). 2003. *Database description for the Generalized Digital Environmental Model (GDEM-V) (U)*. Document MS 39522-5003. Oceanographic Data Bases Division, Stennis Space Center.

[NMFS] National Marine Fisheries Service (US). 2018. *2018 Revision to: 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*. US Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-59. 167 p. https://media.fisheries.noaa.gov/dam-migration/tech_memo_acoustic_guidance_(20)_(pdf)_508.pdf.

Arons, A.B. and D.R. Yennie. 1948. Energy Partition in Underwater Explosion Phenomena. *Reviews of Modern Physics* 20(3): 519-536. https://doi.org/10.1103/RevModPhys.20.519.

Bellmann, M.A., A. May, T. Wendt, S. Gerlach, P. Remmers, and J. Brinkmann. 2020. *Underwater noise during percussive pile driving: Influencing factors on pile-driving noise and technical possibilities to comply with noise mitigation values*. Supported by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (BMU)), FKZ UM16 881500. Commissioned and managed by the Federal Maritime and Hydrographic Agency (Bundesamt für Seeschifffahrt und Hydrographie (BSH)), Order No. 10036866. Edited by the itap GmbH. https://www.itap.de/media/experience_report_underwater_era-report.pdf.

Bellmann, M.A. 2021. *Expert opinion report regarding underwater noise emissions during UXO-clearance activity and possible options for noise mitigation*. Document 3960. Institut für Technische und angewandte Physik (ITAP) GmbH for Orsted Wind Power A/S.

Buckingham, M.J. 2005. Compressional and shear wave properties of marine sediments: Comparisons between theory and data. *Journal of the Acoustical Society of America* 117: 137-152. https://doi.org/10.1121/1.1810231.

Chapman, N.R. 1985. Measurements of the waveform parameters of shallow explosive charges. *Journal of the Acoustical Society of America* 78: 672-681. https://doi.org/10.1121/1.392436.

Coppens, A.B. 1981. Simple equations for the speed of sound in Neptunian waters. *Journal of the Acoustical Society of America* 69(3): 862-863. https://doi.org/10.1121/1.382038.

Finneran, J.J. 2016. *Auditory weighting functions and TTS/PTS exposure functions for marine mammals exposed to underwater noise*. Technical Report for Space and Naval Warfare Systems Center Pacific, San Diego, CA, USA. 49 p. https://apps.dtic.mil/dtic/tr/fulltext/u2/1026445.pdf.

Finneran, J.J., E.E. Henderson, D.S. Houser, K. Jenkins, S. Kotecki, and J.L. Mulsow. 2017. *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)*. Technical report by Space and Naval Warfare Systems Center Pacific (SSC Pacific). 183 p. https://nwtteis.com/portals/nwtteis/files/technical_reports/Criteria_and_Thresholds_for_U.S._Navy_Acoustic_and_Explosive_Effects_Analysis_June2017.pdf.

Gaspin, J.B. 1983. *Safe Swimmer Ranges from Bottom Explosions*. Document NSWC/WOL TR-83-84. Naval Surface Weapons Center, White Oak Lab, and Defence Technical Information Center, Silver Spring, MD, USA. 51 p.

Goertner, J.F. 1982. *Predictions of underwater explosion safe ranges for sea mammals*. Document NSWC/WOL TR 82-188. Naval Ordnance Laboratory, Silver Spring, MD, USA. 36 p. https://apps.dtic.mil/dtic/tr/fulltext/u2/a139823.pdf.

Popper, A.N., A.D. Hawkins, R.R. Fay, D.A. Mann, S. Bartol, T.J. Carlson, S. Coombs, W.T. Ellison, R.L. Gentry, et al. 2014. *Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI*. ASA S3/SC1.4 TR-2014. SpringerBriefs in Oceanography. ASA Press and Springer. https://doi.org/10.1007/978-3-319-06659-2.

Rogers, P.H. 1977. Weak-shock solution for underwater explosive shock waves. *Journal of the Acoustical Society of America* 62(6): 1412-1419. https://doi.org/10.1121/1.381674.

Schmidtke, E., B. Nützel, and S. Ludwig. 2009. Risk Mitigation for sea mammals - The use of air bubbles against shock waves. *Proceedings of the International Conference on Acoustics*. Rotterdam, The Netherlands. pp. 269-270. https://pub.dega-akustik.de/NAG_DAGA_2009/data/articles/000311.pdf.

Urick, R.J. 1971a. *Sonic booms in the sea*. Report NOLTR 71-30. Report for the Naval Ordnance Laboratory, Silver Spring, MD. 4 p.
Urick, R.J. 1971b. Handy curves for finding the source level of an explosive charge fired at a depth in the sea. *Journal of the Acoustical Society of America* 49: 935-936. https://doi.org/10.1121/1.1912439.
Urick, R.J. 1983. *Principles of Underwater Sound*. 3rd edition. McGraw-Hill, New York, London. 423 p.
Wakeley, J. 1977. Pressure-signature model for an underwater explosive charge. *U.S. Navy Journal of Underwater Acoustics* 27(2): 445-449.
Yelverton, J.T., D.A. Richmond, E.R. Fletcher, and R.K. Jones. 1973. *Safe distances from underwater explosions for mammals and birds*. Document AD-766 952. Report by Lovelace Foundation for Medical Education and Research for Defense Nuclear Agency. Distributed by National Technical Information Service, US Department of Commerce. 64 p.

# Sub-appendix J. PTS and TTS Exceedance Zone Maps (Unmitigated)

This appendix presents PTS and TTS exceedance zone maps for several marine mammal hearing groups, and for sea turtles, for 231.5 kg and 463.1 kg charges at each of the six sites. Only the unmitigated scenario maps are included here. The corresponding maps for mitigated scenarios have smaller exceedance zone sizes (Figures SJ-1 to SJ-12).

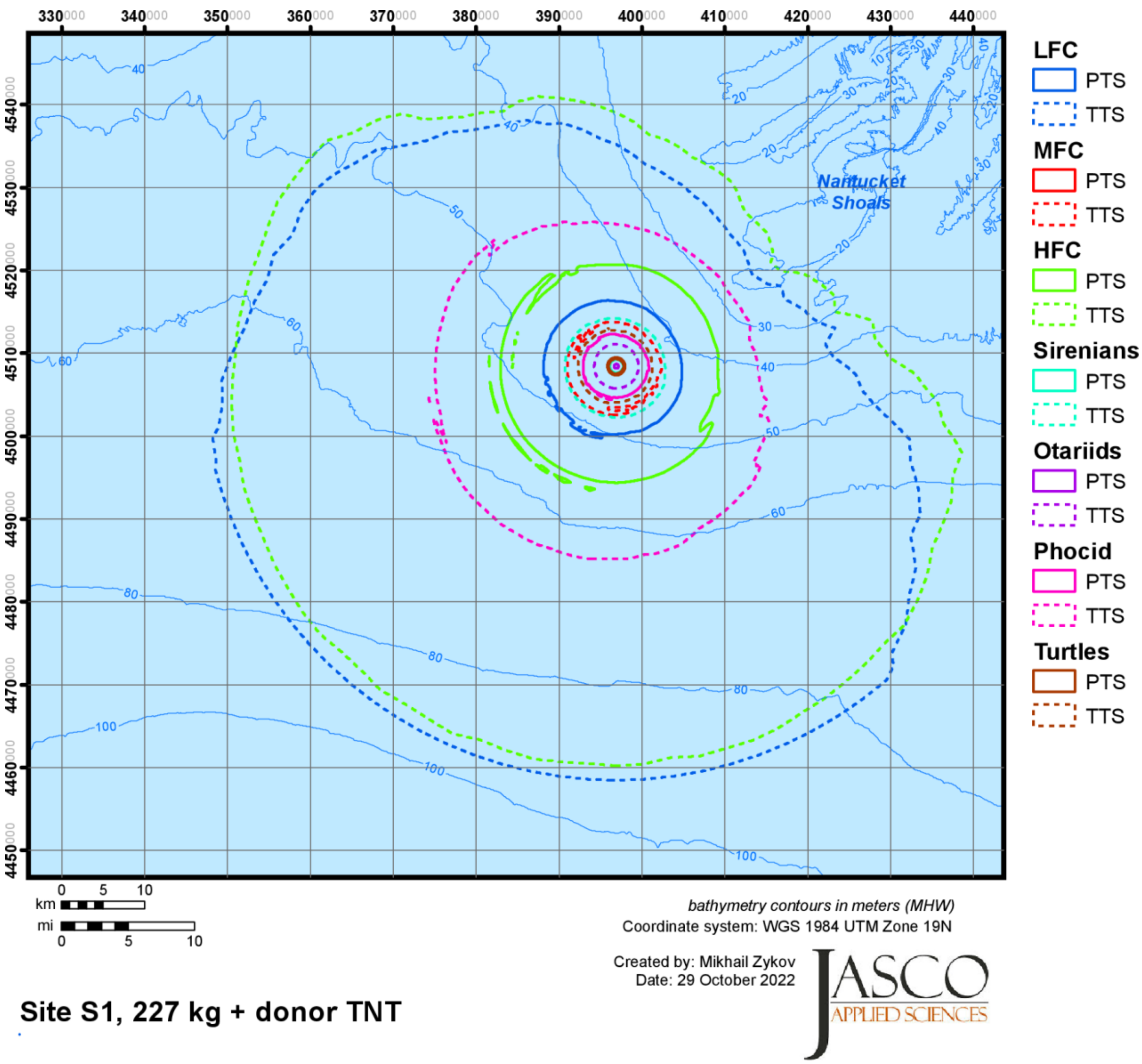


Figure SJ-1. Map of frequency-weighted SEL PTS and TTS exceedance zone for each species group for the 231.5 kg charge at Site S1.

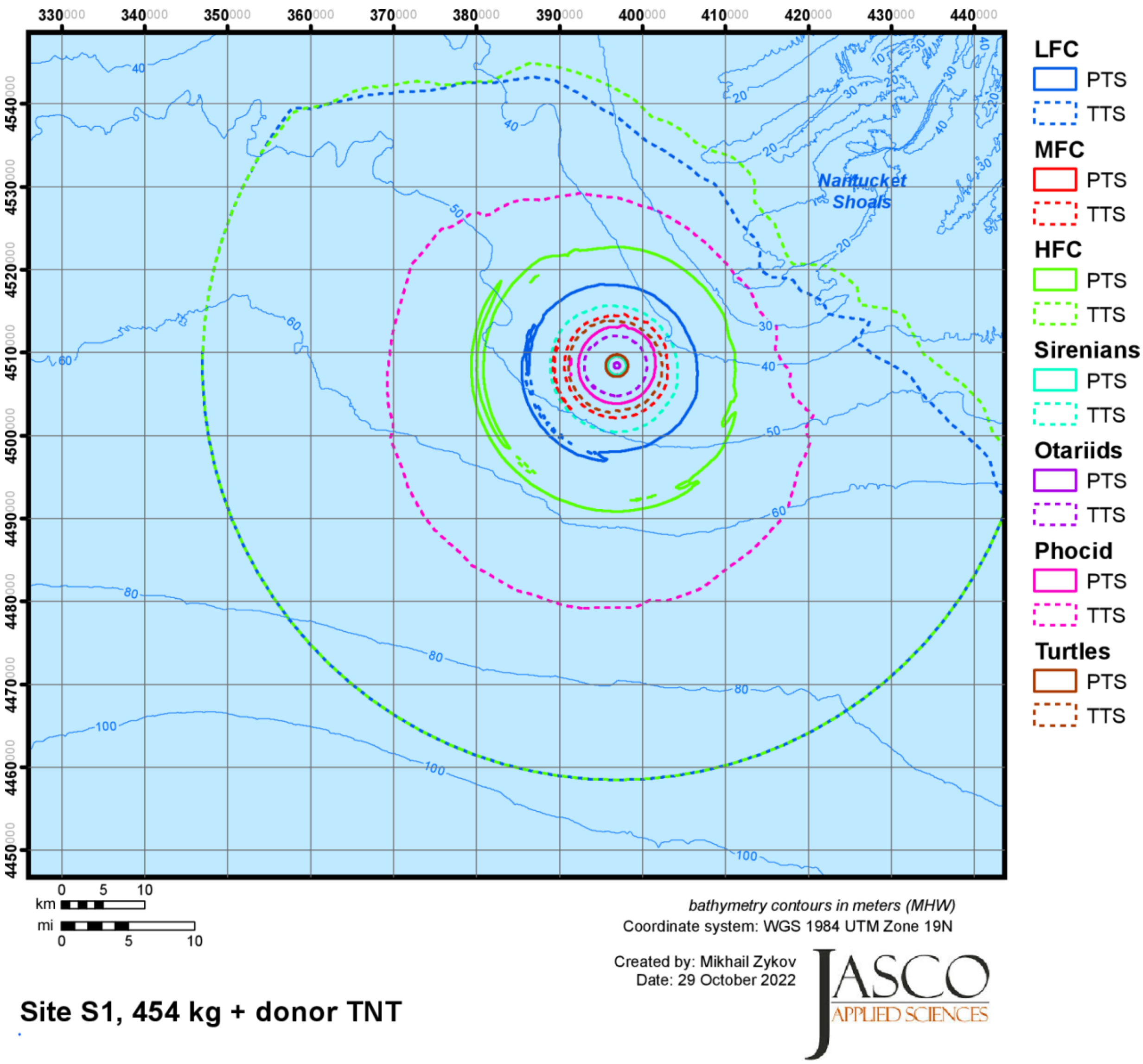


Figure SJ-2. Map of frequency-weighted SEL PTS and TTS exceedance zone for each species group for the 463.1 kg charge at Site S1.

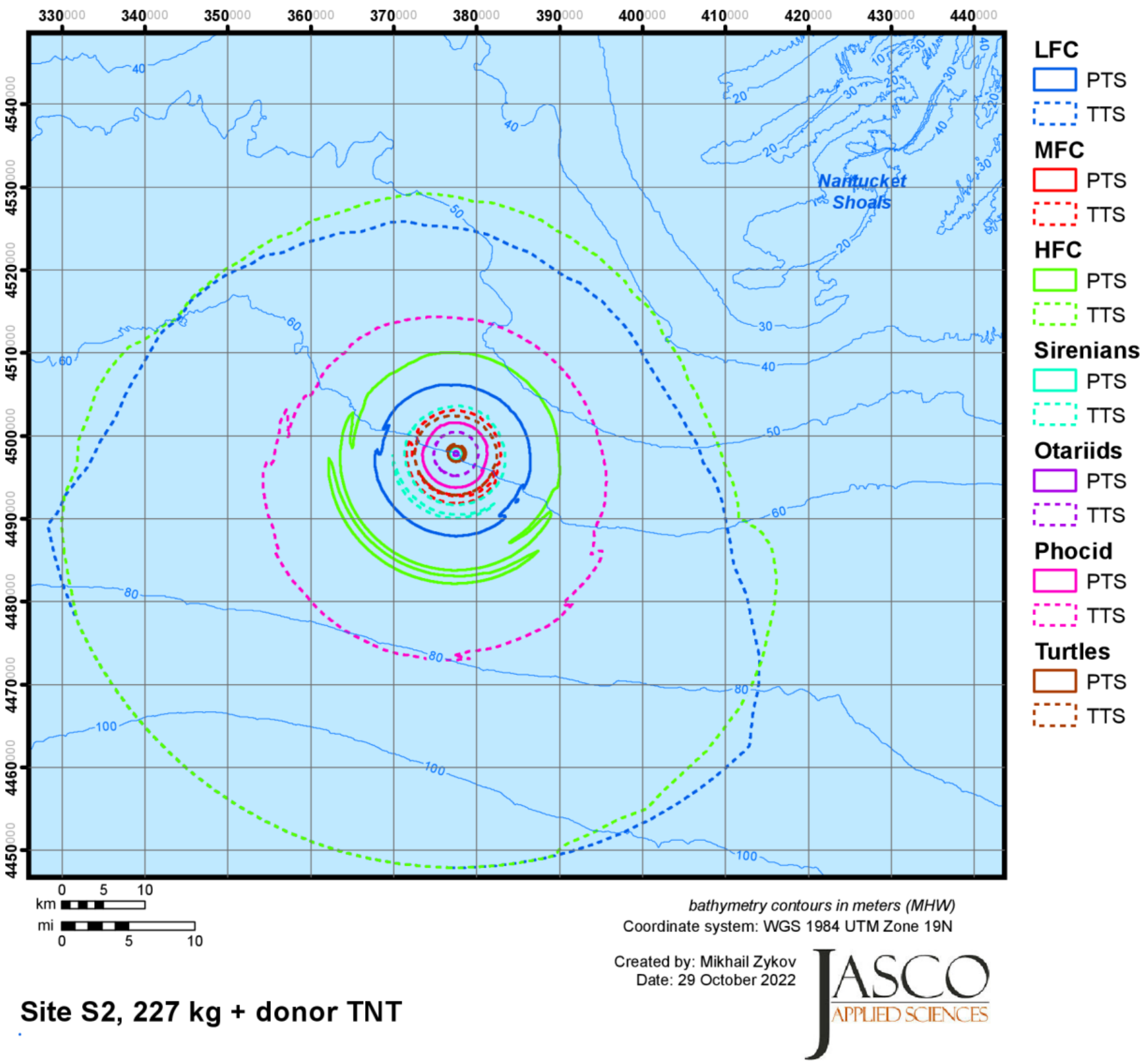


Figure SJ-3. Map of frequency-weighted SEL PTS and TTS exceedance zone for each species group for the 231.5 kg charge at Site S2.

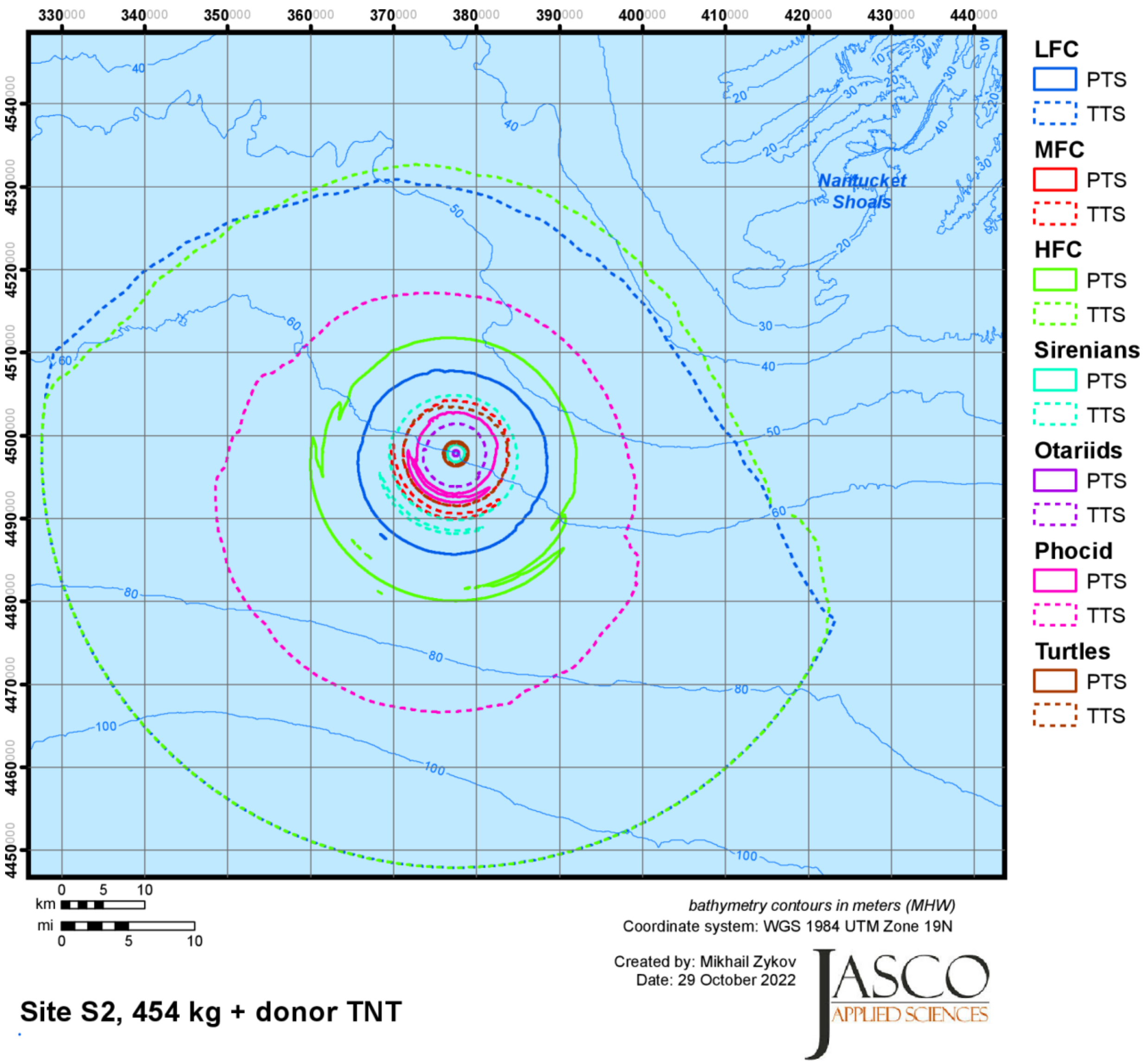


Figure SJ-4. Map of frequency-weighted SEL PTS and TTS exceedance zone for each species group for the 454 kg charge at Site S2.

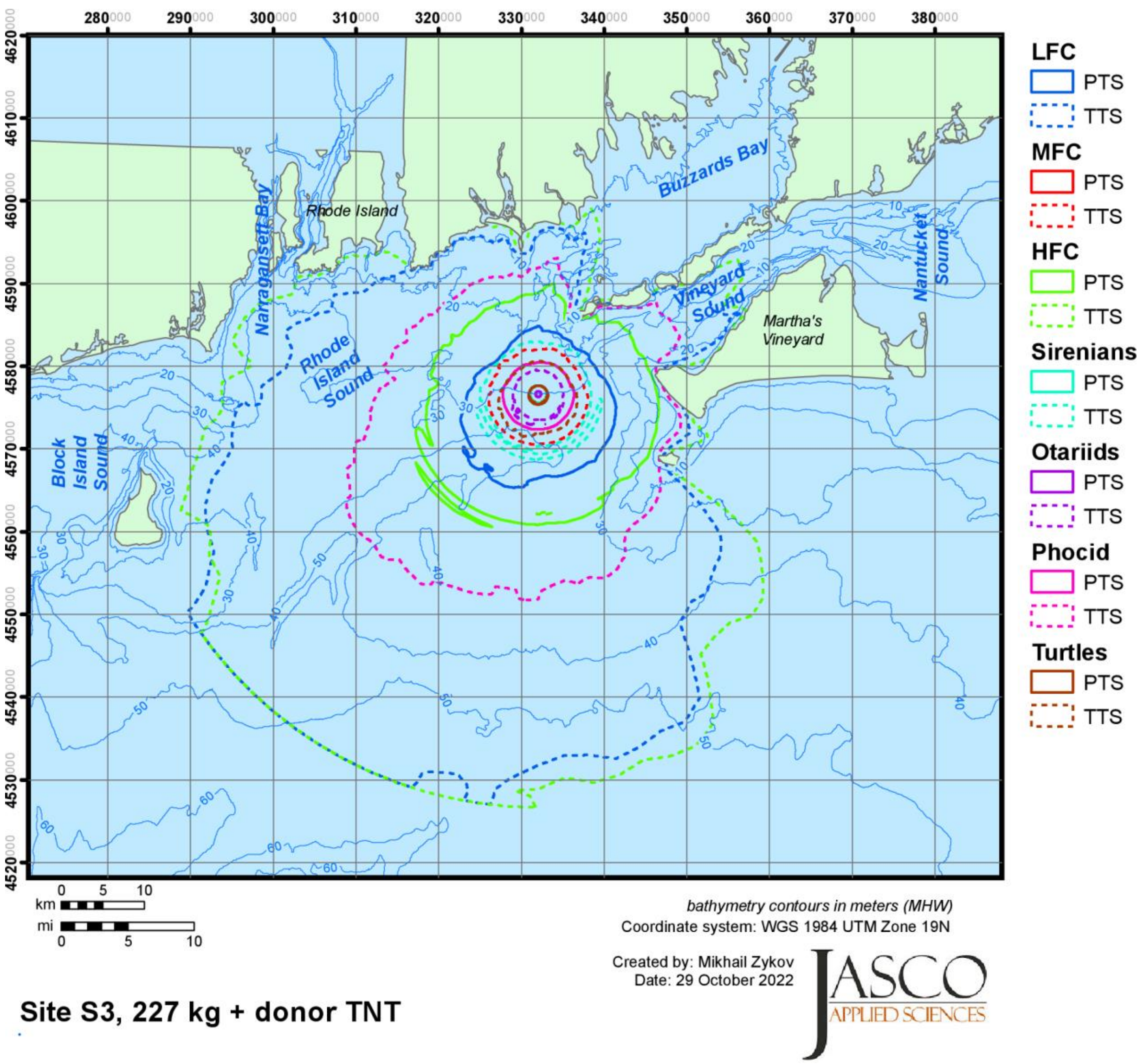


Figure SJ-5. Map of frequency-weighted SEL PTS and TTS exceedance zone for each species group for the 231.5 kg charge at Site S3.

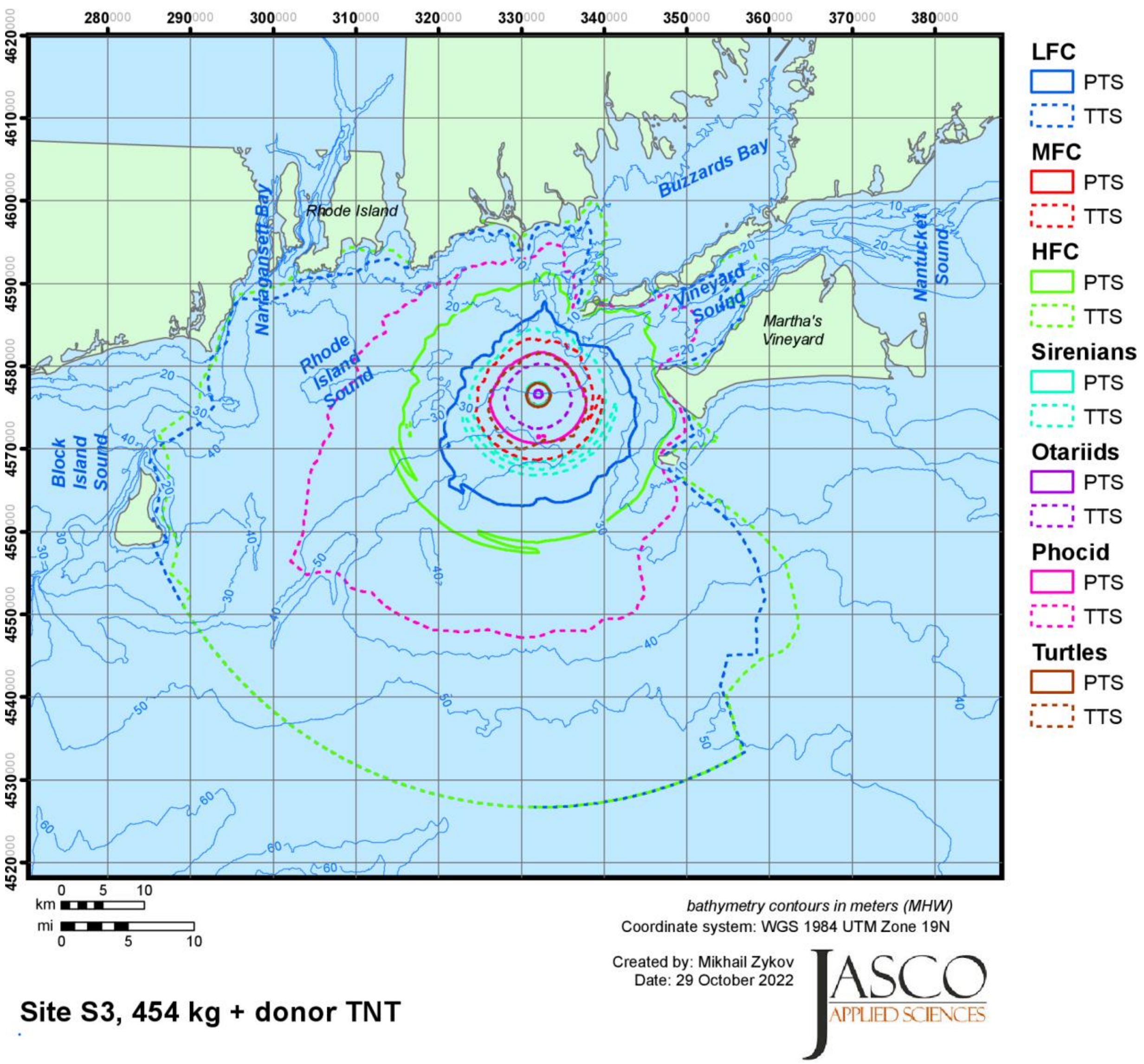


Figure SJ-6. Map of frequency-weighted SEL PTS and TTS exceedance zone for each species group for the 463.1 kg charge at Site S3.

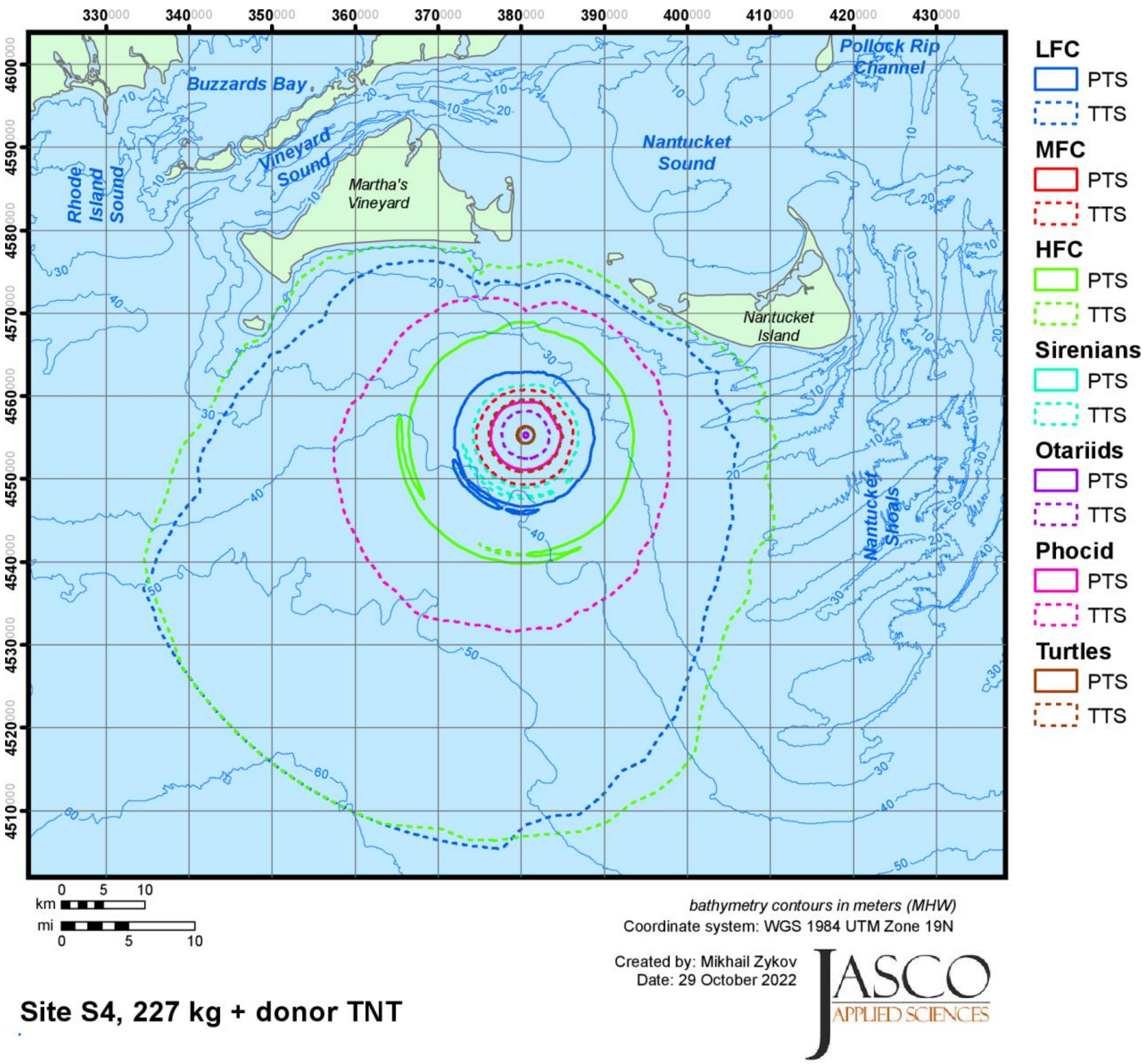


Figure SJ-7. Map of frequency-weighted SEL PTS and TTS exceedance zone for each species group for the 231.5 kg charge at Site S4.

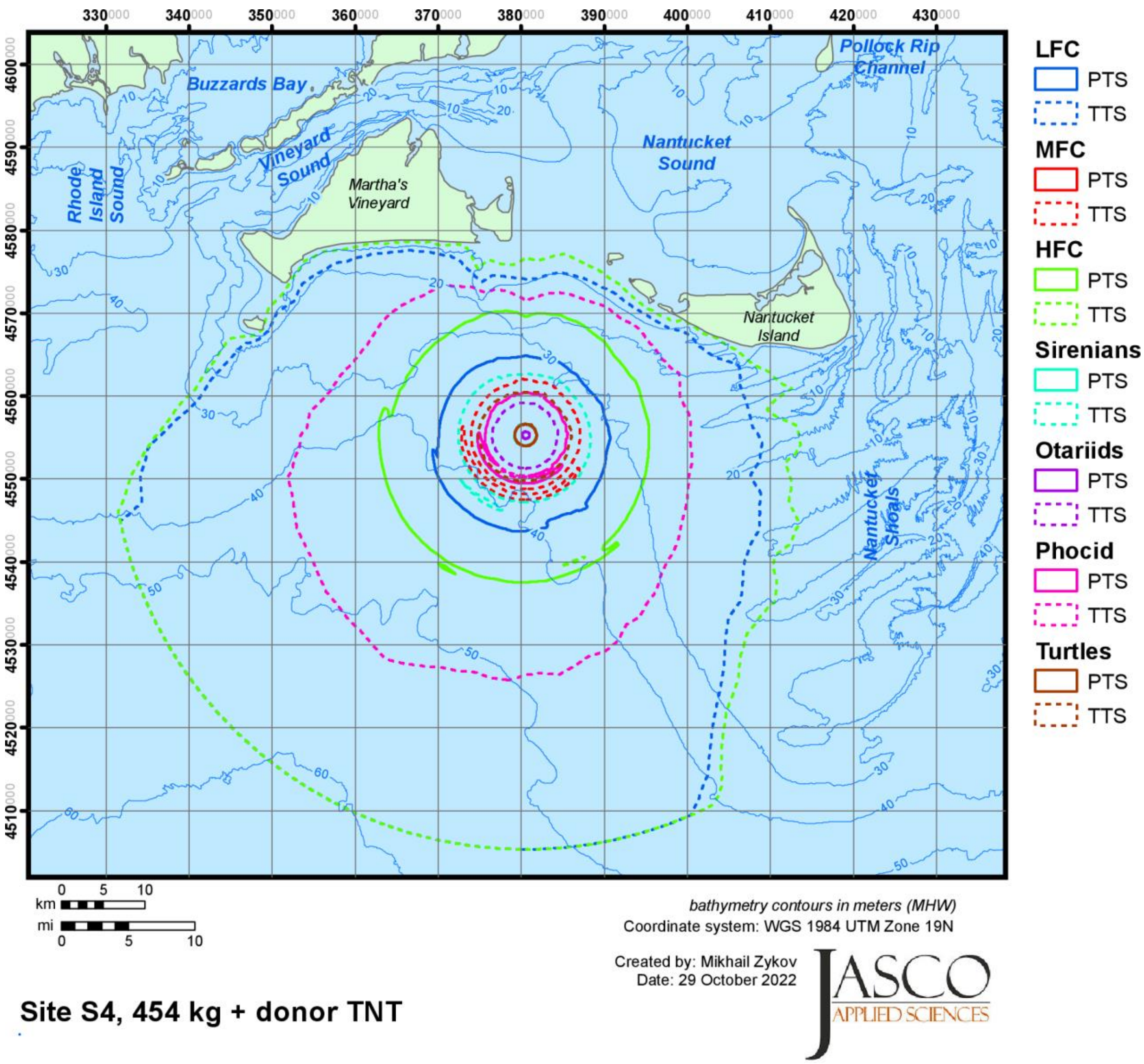


Figure SJ-8. Map of frequency-weighted SEL PTS and TTS exceedance zone for each species group for the 454 kg charge at Site S4.

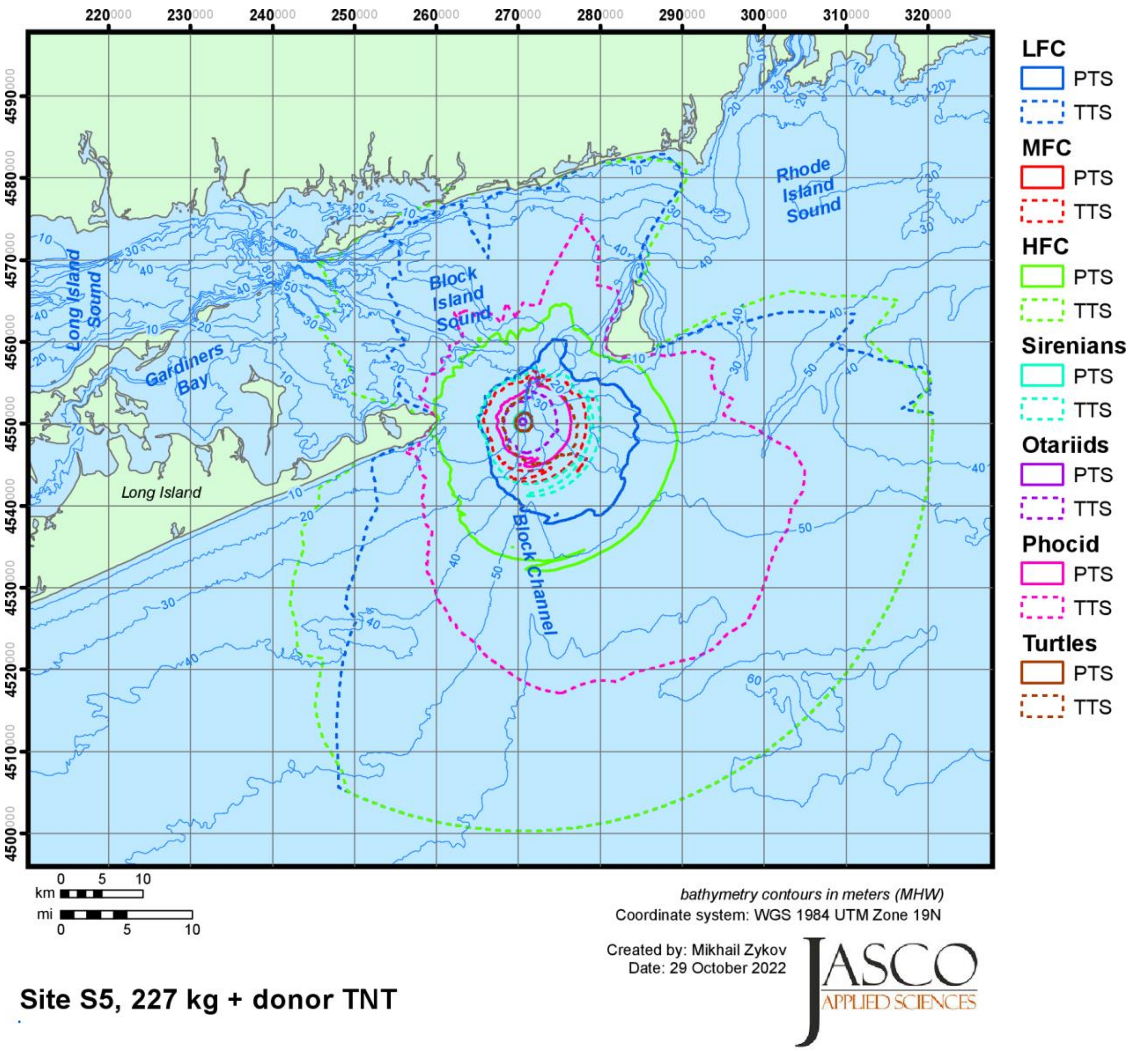


Figure SJ-9. Map of frequency-weighted SEL PTS and TTS exceedance zone for each species group for the 231.5 kg charge at Site S5.

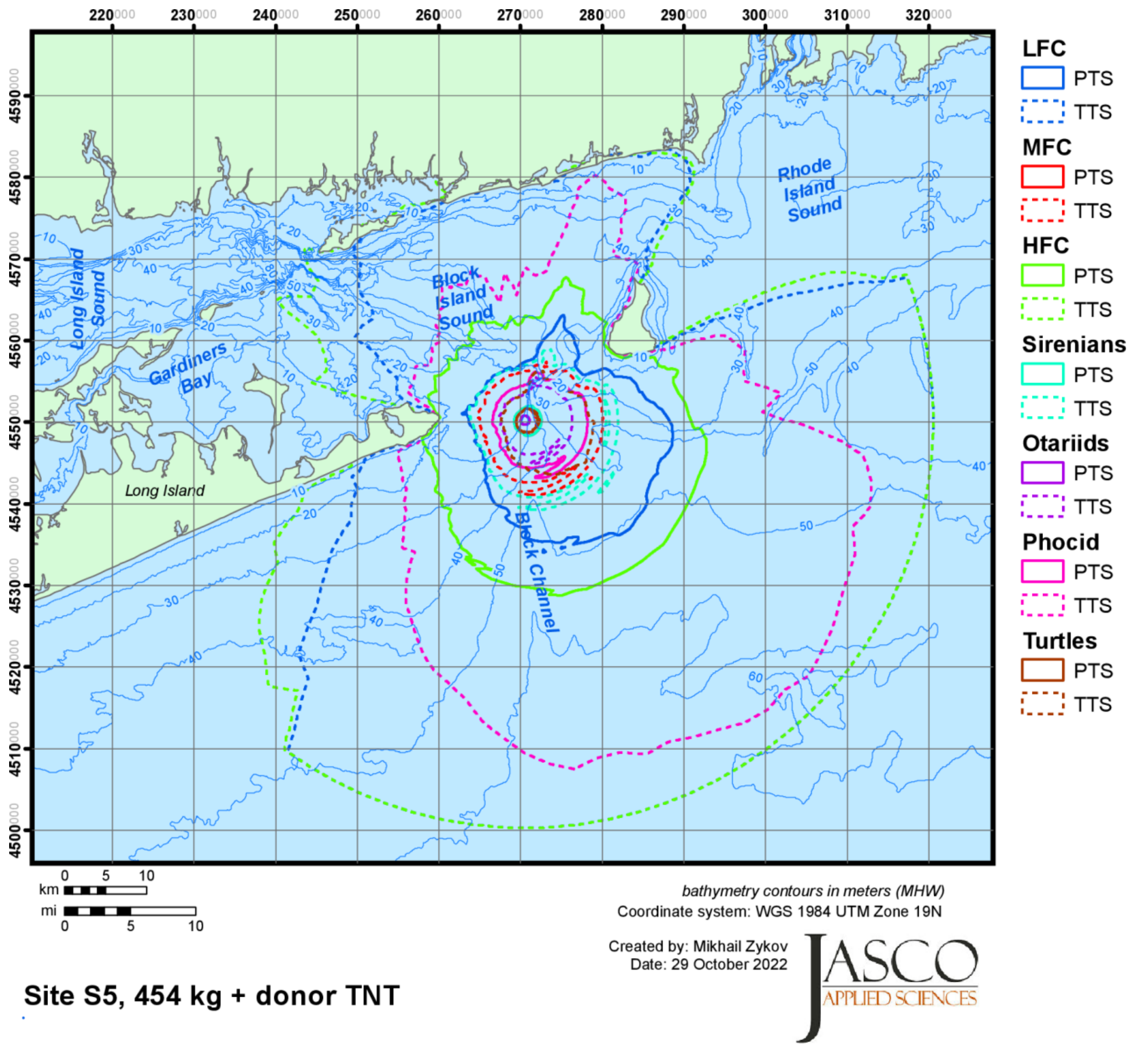


Figure SJ-10. Map of frequency-weighted SEL PTS and TTS exceedance zone for each species group for the 454 kg charge at Site S5.

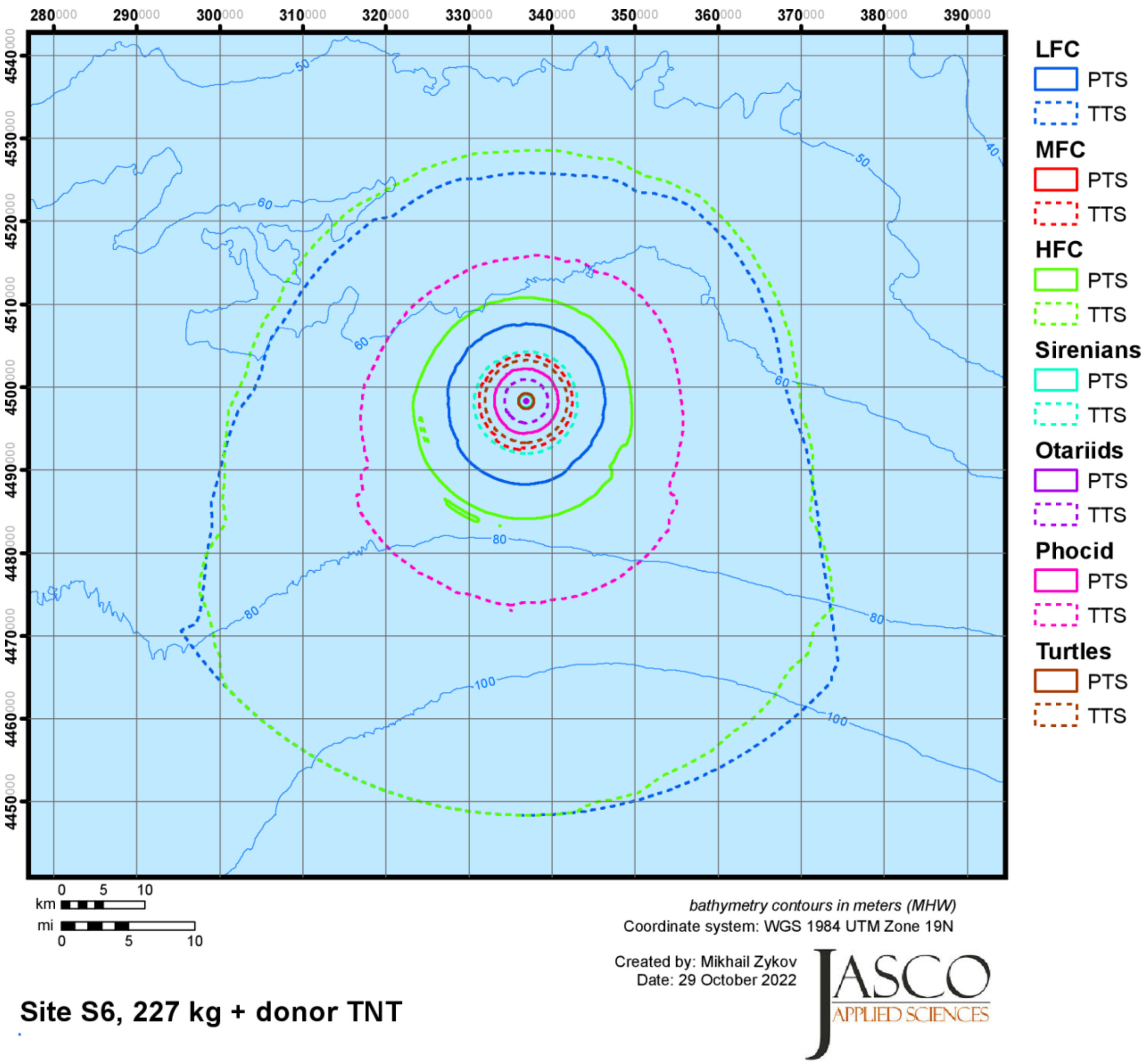


Figure SJ-11. Map of frequency-weighted SEL PTS and TTS exceedance zone for each species group for the 231.5 kg charge at Site S6.

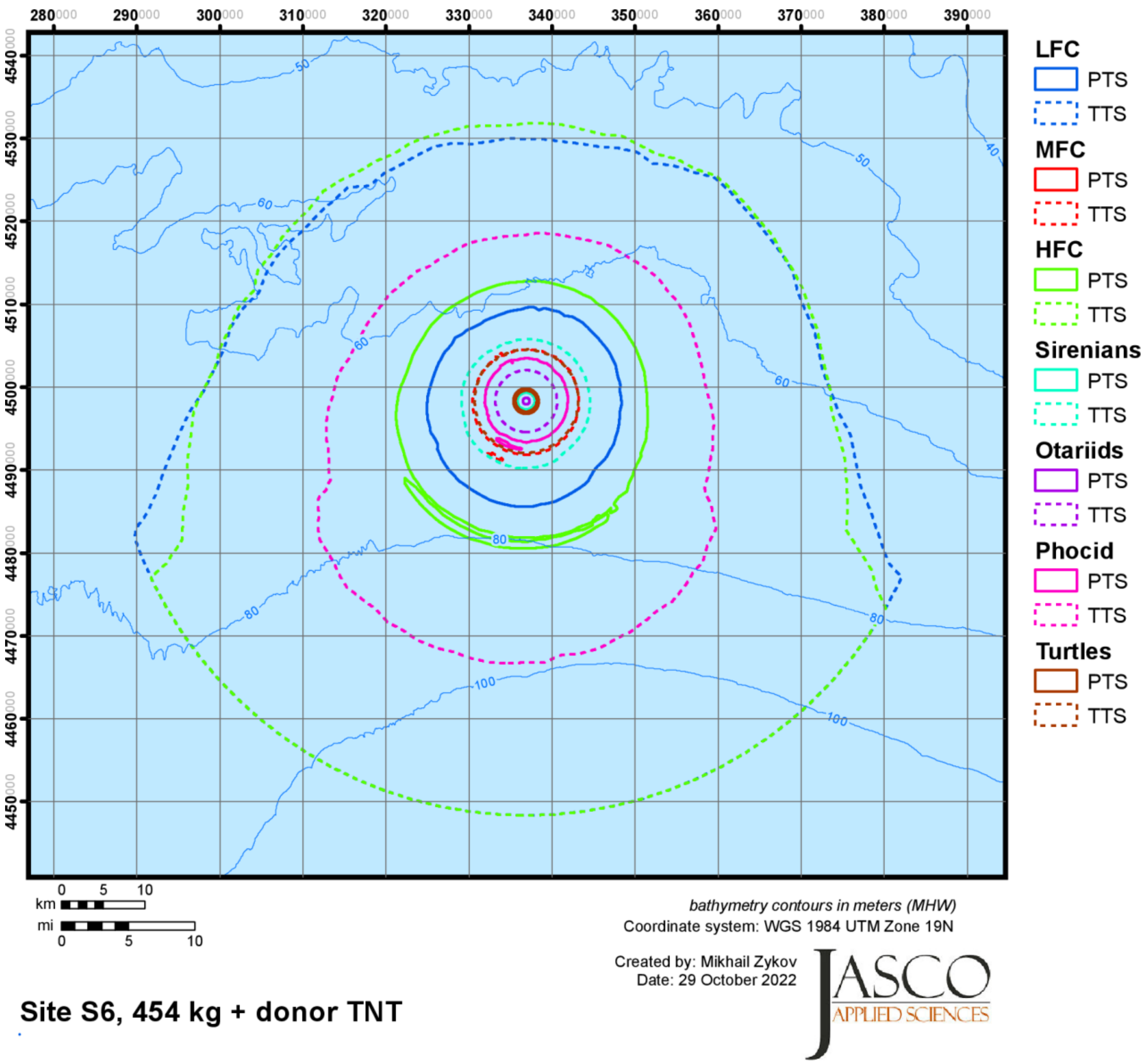


Figure SJ-12. Map of frequency-weighted SEL PTS and TTS exceedance zone for each species group for the 454 kg charge at Site S6.