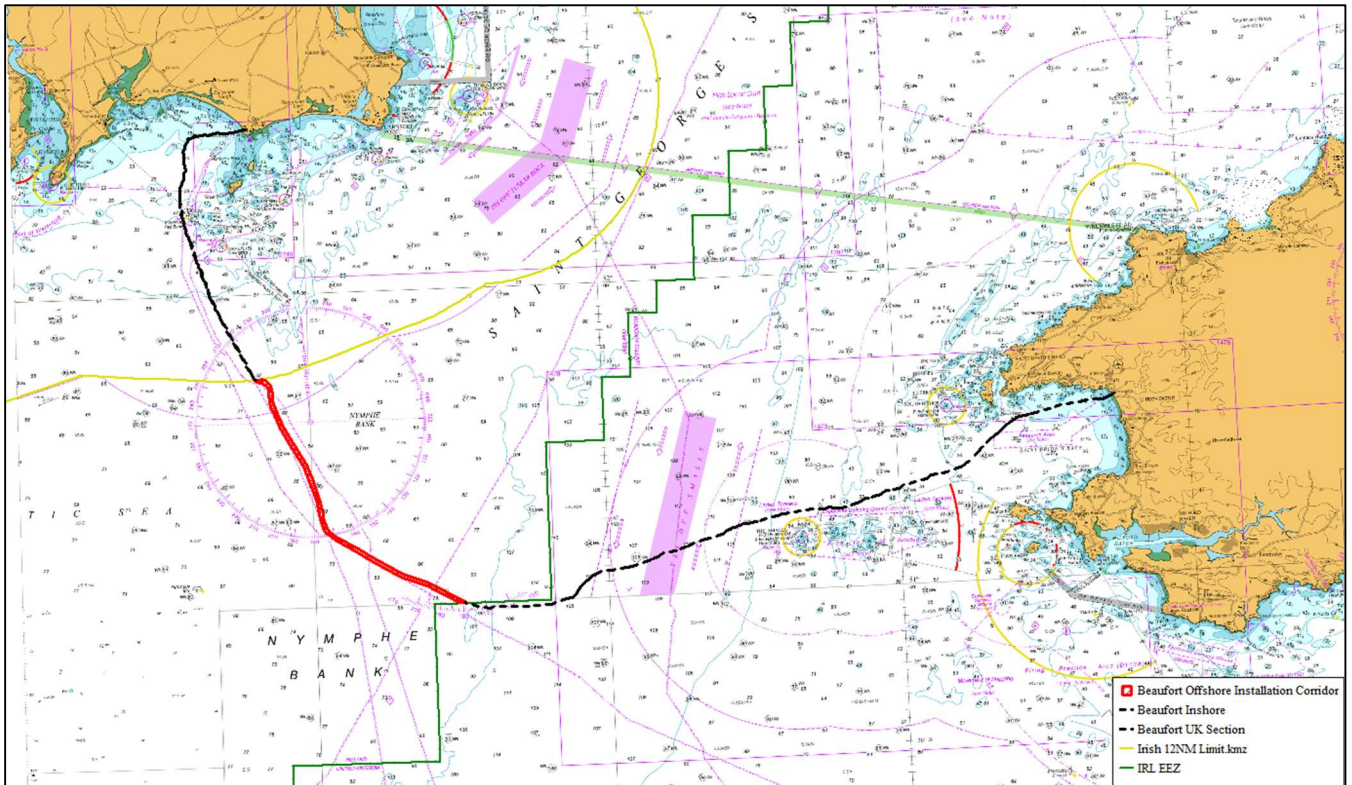


Risk Assessment for Annex IV Species for the Beaufort Subsea Fibre Optic Cable: Cable Installation Works from IRL 12nm Limit to IRL EEZ Boundary.



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On behalf of: Amazon MCS Ireland Limited.

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1. Introduction

This Annex IV Risk Assessment has been prepared on behalf of McMahon Design and Management Ltd. to assess whether the proposed installation of the Beaufort Subsea Fibre Optic Cable (specifically in relation to cable installation works from IRL 12nm Limit to IRL EEZ Boundary) will remove the system of strict protection established for Annex IV species. This risk assessment will aid in the application to obtain a Maritime Area Consent (MAC) for the proposed installation of this undersea fibre optic cable. This report will detail the species protected under Annex IV of the Habitats Directive that may be present within the MAC application area. Under Article 12 and 13 of the Habitats Directive, Member States must establish systems of strict protection for animal and plant species which are particularly threatened, and which are listed on Annex IV of the Habitats Directive. Article 16 provides for derogations from these provisions under limited circumstances. Article 12, 13 and 16 of the Habitats Directive are transposed into Irish law by Regulations 51, 52 and 54 of the European Communities (Birds and Natural Habitats) Regulations 2011, as amended. Annex IV species are afforded strict protection throughout their range, both inside and outside of designated protected areas. It is an offence to deliberately kill, injure or disturb a specimen in the wild, or damage or destroy a breeding site or resting place of an Annex IV animal species. This report may also contain species which are protected under Annex II, which are protected within Special Areas of Conservation (SACs). Grey seals (*Halichoerus grypus*) have been recorded in the area, however as this species is protected under Annex II and V, it will not be considered any further in this risk assessment.

1.1 Altemar Ltd.

Since its inception in 2001, Altemar has been delivering ecological and environmental services to a broad range of clients. Operational areas include: residential; infrastructural; renewable; oil & gas; private industry; Local Authorities; EC projects; and, State/semi-State Departments. Bryan Deegan, the managing director of Altemar, is an Environmental Scientist and Marine Biologist with over 30 years' experience working in Irish terrestrial and aquatic environments, providing services to the State, Semi-State and industry. He is currently contracted to Inland Fisheries Ireland as the sole "External Expert" to environmentally assess internal and external projects. Bryan Deegan (MCIEEM) holds a MSc in Environmental Science, BSc (Hons.) in Applied Marine Biology, NCEA National Diploma in Applied Aquatic Science and a NCEA National Certificate in Science (Aquaculture). Bryan Deegan carried out all elements of this SISAA. Bryan has been involved in twelve international sub marine fibre optic cable projects, many of which involved Horizontal Directional Drills within designated sites and all works required ecological supervision.

2. Annex IV Species

All species listed under Annex IV with the potential to be impacted by the proposed works should be included, even if they have been separately assessed in the SISAA, NIS, or EclA process.

Of the animal and plant species on Annex IV known to occur in Ireland, the following species (Table 1) were identified as relevant to the proposed development:

Table 1. Annex IV protected species in Ireland

| Classification | Species | Conservation Status | Potential for Effect |
|----------------|--|---------------------|--|
| Cetacea | Humpback Whale (<i>Megaptera novaeangliae</i>) | Favourable | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| Cetacea | Bottlenose Dolphin (<i>Tursiops truncatus</i>) | Favourable | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| Cetacea | Short-Beaked Common Dolphin (<i>Delphinus delphis</i>) | Favourable | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| Cetacea | Harbour Porpoise (<i>Phocoena phocoena</i>) | Inadequate | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| Cetacea | Killer Whale (<i>Orcinus orca</i>) | Unknown | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| Cetacea | Long-Finned Pilot Whale (<i>Globicephala melas</i>) | Favourable | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| Cetacea | Risso's Dolphin (<i>Grampus griseus</i>) | Favourable | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| Cetacea | Atlantic White-Sided Dolphin (<i>Lagenorhynchus acutus</i>) | Favourable | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| Cetacea | White-Beaked Dolphin (<i>Lagenorhynchus albirostris</i>) | Favourable | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| Cetacea | Striped Dolphin (<i>Stenella coeruleoalba</i>) | Favourable | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| Cetacea | Cuvier's Beaked Whale (<i>Ziphius cavirostris</i>) | Favourable | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| Cetacea | Sowerby's Beaked Whale (<i>Mesoplodon bidens</i>) | Favourable | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| Cetacea | Minke Whale (<i>Balaenoptera acutorostrata</i>) | Favourable | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| Cetacea | Fin Whale (<i>Balaenoptera physalus</i>) | Favourable | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| Cetacea | Blue Whale (<i>Balaenoptera musculus</i>) | Unknown | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |

| Classification | Species | Conservation Status | Potential for Effect |
|--------------------------|---|---------------------|---|
| <i>Cetacea</i> | Sperm Whale (<i>Physeter macrocephalus</i>) | Favourable | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| <i>Cetacea</i> | Northern Bottlenose Whale (<i>Hyperoodon ampullatus</i>) | Unknown | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| <i>Cetacea</i> | Sei Whale (<i>Balaenoptera borealis</i>) | Unknown | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| <i>Cetacea (Vagrant)</i> | Northern Right Whale (<i>Eubalaena glacialis</i>) | Unknown | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| <i>Cetacea (Vagrant)</i> | False Killer Whale (<i>Pseudorca crassidens</i>) | Unknown | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| <i>Cetacea (Vagrant)</i> | True's Beaked Whale (<i>Mesoplodon mirus</i>) | Unknown | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| <i>Cetacea (Vagrant)</i> | Pygmy Sperm Whale (<i>Kogia breviceps</i>) | Unknown | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| <i>Cetacea (Vagrant)</i> | Beluga/White Whale (<i>Delphinapterus leucas</i>) | Unknown | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| <i>Cetacea (Vagrant)</i> | Gervais' Beaked Whale (<i>Mesoplodon europaeus</i>) | Unknown | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| | | | |
| <i>Mustelidae</i> | Otter (<i>Lutra lutra</i>) | Favourable | The proposed works relating to this application are exclusively located within Irish offshore waters (between 12nm-EEZ Boundary) at a minimum of 29km to the Irish mainland. There is no potential for this species to be effected by the proposed works. Further Assessment Not Required |
| | | | |
| <i>Testudines</i> | Leatherback Turtle (<i>Dermochelys coriacea</i>) | Unknown | There is potential for this species to be located within the works area and therefore be effected. Further Assessment Required |
| | | | |
| <i>Chiroptera</i> | Lesser Horseshoe Bat (<i>Rhinolophus hipposideros</i>) | Favourable | The proposed works relating to this application are exclusively located within Irish offshore waters (between 12nm-EEZ Boundary) at a minimum of 29km to the Irish mainland. There is no potential for this species to be effected by the proposed works. Further Assessment Not Required |
| <i>Chiroptera</i> | Common Pipistrelle (<i>Pipistrellus pipistrellus</i>) | Favourable | The proposed works relating to this application are exclusively located within Irish offshore waters (between 12nm-EEZ Boundary) at a minimum of 29km to the Irish mainland. There is no potential for this species to be effected by the proposed works. Further Assessment Not Required |
| <i>Chiroptera</i> | Soprano Pipistrelle (<i>Pipistrellus pygmaeus</i>) | Favourable | The proposed works relating to this application are exclusively located within Irish offshore waters |

| Classification | Species | Conservation Status | Potential for Effect |
|-------------------|--|---------------------|---|
| | | | (between 12nm-EEZ Boundary) at a minimum of 29km to the Irish mainland. There is no potential for this species to be effected by the proposed works. Further Assessment Not Required |
| <i>Chiroptera</i> | Nathusius' Pipistrelle (<i>Pipistrellus nathusii</i>) | Favourable | The proposed works relating to this application are exclusively located within Irish offshore waters (between 12nm-EEZ Boundary) at a minimum of 29km to the Irish mainland. There is no potential for this species to be effected by the proposed works. Further Assessment Not Required |
| <i>Chiroptera</i> | Natterer's Bat (<i>Myotis nattereri</i>) | Favourable | The proposed works relating to this application are exclusively located within Irish offshore waters (between 12nm-EEZ Boundary) at a minimum of 29km to the Irish mainland. There is no potential for this species to be effected by the proposed works. Further Assessment Not Required |
| <i>Chiroptera</i> | Daubenton's Bat (<i>Myotis daubentonii</i>) | Favourable | The proposed works relating to this application are exclusively located within Irish offshore waters (between 12nm-EEZ Boundary) at a minimum of 29km to the Irish mainland. There is no potential for this species to be effected by the proposed works. Further Assessment Not Required |
| <i>Chiroptera</i> | Whiskered Bat (<i>Myotis mystacinus</i>) | Favourable | The proposed works relating to this application are exclusively located within Irish offshore waters (between 12nm-EEZ Boundary) at a minimum of 29km to the Irish mainland. There is no potential for this species to be effected by the proposed works. Further Assessment Not Required |
| <i>Chiroptera</i> | Brown Long-Eared Bat (<i>Plecotus auritus</i>) | Favourable | The proposed works relating to this application are exclusively located within Irish offshore waters (between 12nm-EEZ Boundary) at a minimum of 29km to the Irish mainland. There is no potential for this species to be effected by the proposed works. Further Assessment Not Required |
| <i>Chiroptera</i> | Leisler's Bat (<i>Nyctalus leisleri</i>) | Favourable | The proposed works relating to this application are exclusively located within Irish offshore waters (between 12nm-EEZ Boundary) at a minimum of 29km to the Irish mainland. There is no potential for this species to be effected by the proposed works. Further Assessment Not Required |
| <i>Chiroptera</i> | Other bat species not listed above if present | | The proposed works relating to this application are exclusively located within Irish offshore waters (between 12nm-EEZ Boundary) at a minimum of 29km to the Irish mainland. There is no potential for this species to be effected by the proposed works. Further Assessment Not Required |

| Classification | Species | Conservation Status | Potential for Effect |
|-------------------------|--|---------------------|---|
| <i>Mollusca</i> | Kerry Slug (<i>Geomalacus maculosus</i>) | Favourable | The proposed works relating to this application are exclusively located within Irish offshore waters (between 12nm-EEZ Boundary) at a minimum of 29km to the Irish mainland. There is no potential for this species to be effected by the proposed works. Further Assessment Not Required |
| <i>Anura</i> | Natterjack Toad (<i>Epidalea calamita</i>) | Bad | The proposed works relating to this application are exclusively located within Irish offshore waters (between 12nm-EEZ Boundary) at a minimum of 29km to the Irish mainland. There is no potential for this species to be effected by the proposed works. Further Assessment Not Required |
| <i>Hymenophyllaceae</i> | Killarney Fern (<i>Vandenboschia speciosa</i>) | Favourable | The proposed works relating to this application are exclusively located within Irish offshore waters (between 12nm-EEZ Boundary) at a minimum of 29km to the Irish mainland. There is no potential for this species to be effected by the proposed works. Further Assessment Not Required |
| <i>Najadaceae</i> | Slender Naiad (<i>Najas flexilis</i>) | Bad | The proposed works relating to this application are exclusively located within Irish offshore waters (between 12nm-EEZ Boundary) at a minimum of 29km to the Irish mainland. There is no potential for this species to be effected by the proposed works. Further Assessment Not Required |
| <i>Saxifragaceae</i> | Marsh Saxifrage (<i>Saxifraga hirculus</i>) | Favourable | The proposed works relating to this application are exclusively located within Irish offshore waters (between 12nm-EEZ Boundary) at a minimum of 29km to the Irish mainland. There is no potential for this species to be effected by the proposed works. Further Assessment Not Required |

3. Risk Assessment for Relevant Annex IV Species

Cetaceans

A number of the 24 aforementioned cetacean species have been identified proximate to the application area; the common minke whale, common dolphin, fin whale, and bottlenose dolphin (IWDG, 2017). These species of cetacean may be present year-round in the region (Wall et al., 2013), whereas larger species such as fin whale are seasonal visitors during the late summer months (Wall et al., 2013). From the (IWDG, 2017) data, many of the cetacean species' sightings in the region, were recorded during the summer months.

Turtles

The leatherback turtle (*Dermochelys coriacea*) is the only turtle species that is protected under Annex IV of the Habitats Directive in Ireland. This species has been recorded proximate to the proposed works area (NBDC, 2026). A seasonal visitor, leatherback turtles migrate north during the summer months to more temperate waters. Some visit the northeast Atlantic and Irish waters where they feed on jellyfish before turning south again in Autumn (NPWS, 2019). These sightings mostly range from the late 1970s to the early 2000s. There is, therefore, a possibility that the leatherback turtle may be present at the time of works.

4. Potential Impacts on Annex IV Species

Cetaceans

Construction

The proposed works are temporary in nature, with offshore works predicted to take 2 weeks in total over a 2 month period. However, due to the number of cetacean records within the proposed works area and surrounding region, it cannot be assumed that there is no risk to marine mammals from the proposed works. The activity which poses the greatest threat to cetacean species is the underwater noise levels produced by the USBL equipment, however, these levels have been kept within an acceptable range as described by (Southall et al., 2019) (see Section 4.1 below for further details). Works vessels will generate some subsea noise in the marine environment from engine noise and dynamic positioning thrusters. Shipping noise is typically within the 50-300 Hz frequency band and is the dominant noise source in deeper water (DECC, 2011). Propellers on vessels all have the potential to produce cavitation noise. This sound is caused by vacuum bubbles that were generated by the collapse of bubbles created by the spinning of the propellers. There are a large number of cetacean species that have been previously recorded within the proposed works area, therefore, the potential for a collision between the vessel or equipment and marine mammals must also be factored in as a potential risk. All of this considered, the speed of the vessel will be at a low speed (0.5kn) at which cetacean species will be able to move away from the area with no pressure from the vessel. Mitigation measures will be put in place to ensure no harm on any cetacean species from the proposed works.

Operation

The cable will be laid in the deep offshore subtidal within the Irish EEZ, buried in marine sediment. The cable will be inert, “un-repeated” (i.e. not powered), and will not generate acoustic noise. Operational works will be isolated to specific areas along the cable route. Out of an abundance of caution, there is the potential for minor disturbance impacts to cetaceans (acoustics from repair / decommissioning vessel) which may be present along the route during maintenance / decommissioning works. Mitigation measures will be put in place to ensure no harm on any cetacean species from the proposed works.

Turtles

Although there have been recordings of leatherback turtle proximate to the proposed works area, the potential for impact on this species is incredibly low. This is assumed due to the date of the majority of sightings, of which most occurred over 50 years ago and also the relatively limited scale and duration of the proposed works. The only potential for impact to this Annex IV species is by collision with the vessel or equipment over the duration of the proposed works, which as previously stated are temporal and spatially restricted. The proposed works are located exclusively within the offshore subtidal (between 12nm limit – Irish EEZ boundary) and will therefore not impact on any leatherback turtle resting or breeding grounds. The proposed works do not offend the system of strict protection of turtles under Article 12 of the Habitats Directive.

4.1 Potential Noise Impacts on Cetaceans

All cetaceans are listed under Annex IV of the Habitats Directive, which means that they are protected wherever they occur. Bottle-nosed Dolphin and Harbour Porpoise are also listed under Annex II of the Directive. Annex II species require that core areas of their habitat are designated as sites of Community importance.

The proposed works would be expected to impact on cetaceans primarily through the emission of noise due to the vessel and acoustics from the USBL (Ultra Short Baseline) equipment. It should be noted that, given the slow speed (0.5 knots) of the vessel, no collision impacts with the proposed works vessel and equipment are foreseen as a result of the proposed works. USBL is a method of underwater

acoustic positioning. It is used to track subsea targets such as ROVs/jetting trencher. USBL positioning is used from shallow to deep waters (down to 10,000m and more) and its accuracy is proportional to the distance, typical from 1-2% of the slant distance for basic equipment and up to 0.06% for the ultimate USBL systems.

USBL positioning is suitable for a wide range of applications, including subsea asset tracking, subsea structure placement, LBL array calibration, UXO survey, IMR (Inspection, Maintenance and Repair). For metrology and sub-decimeter deep water applications LBL solutions will be more suitable. As outlined by O’Brien (2005), “sound travels 4.5 times faster in water than in air and low frequency sounds travel farther underwater than high frequency sounds.”

Southall *et al.* (2019) outlined in their publication “*Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects*” revised the marine mammal hearing groups, which are seen in Table 2.

Table 2. Marine Mammal Functional Hearing Groups and Estimated Functional Hearing groups Proposed by Southall *et al.* (2019)

| Marine mammal hearing group | Auditory weighting function | Genera (or species) included |
|-------------------------------|-----------------------------|---|
| Low-frequency cetaceans | LF | <i>Balaenidae</i> (<i>Balaena</i> , <i>Eubalaenidae</i> spp.); <i>Balaenopteridae</i> (<i>Balaenoptera physalus</i> , <i>B. musculus</i>) |
| | | <i>Balaenopteridae</i> (<i>Balaenoptera acutorostrata</i> , <i>B. bonaerensis</i> , <i>B. borealis</i> , <i>B. edeni</i> , <i>B. omurai</i> ; <i>Megaptera novaeangliae</i>); <i>Neobalenidae</i> (<i>Caperea</i>); <i>Eschrichtiidae</i> (<i>Eschrichtius</i>) |
| High-frequency cetaceans | HF | <i>Physeteridae</i> (<i>Physeter</i>); <i>Ziphiidae</i> (<i>Berardius</i> spp., <i>Hyperoodon</i> spp., <i>Indopacetus</i> , <i>Mesoplodon</i> spp., <i>Tasmacetus</i> , <i>Ziphius</i>); <i>Delphinidae</i> (<i>Orcinus</i>) |
| | | <i>Delphinidae</i> (<i>Delphinus</i> , <i>Feresa</i> , <i>Globicephala</i> spp., <i>Grampus</i> , <i>Lagenodelphis</i> , <i>Lagenorhynchus acutus</i> , <i>L. albirostris</i> , <i>L. obliquidens</i> , <i>L. obscurus</i> , <i>Lissodelphis</i> spp., <i>Orcaella</i> spp., <i>Peponocephala</i> , <i>Pseudorca</i> , <i>Sotalia</i> spp., <i>Sousa</i> spp., <i>Stenella</i> spp., <i>Steno</i> , <i>Tursiops</i> spp.); <i>Montodontidae</i> (<i>Delphinapterus</i> , <i>Monodon</i>); <i>Plantanistidae</i> (<i>Plantanista</i>) |
| Very high frequency cetaceans | VHF | <i>Delphinidae</i> (<i>Cephalorhynchus</i> spp.; <i>Lagenorhynchus cruciger</i> , <i>L. australis</i>); <i>Phocoenidae</i> (<i>Neophocaena</i> spp., <i>Phocoena</i> spp., <i>Phocoenoides</i>); <i>Iniidae</i> (<i>Inia</i>); <i>Kogiidae</i> (<i>Kogia</i>); <i>Lipotidae</i> (<i>Lipotes</i>); <i>Pontoporiidae</i> (<i>Pontoporia</i>) |
| Phocid carnivores in water | PCW | <i>Phocidae</i> (<i>Cystophora</i> , <i>Erignathus</i> , <i>Halichoerus</i> , <i>Histiophoca</i> , <i>Hydrurga</i> , <i>Leptonychotes</i> , <i>Lobodon</i> , <i>Mirounga</i> spp., <i>Monachus</i> , <i>Neomonachus</i> , <i>Ommatophoca</i> , <i>Pagophilus</i> , <i>Phoca</i> spp., <i>Pusa</i> spp.) |

The Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (NOAA, 2018) outlined the hearing groups of marine mammals including the generalised hearing range of these cetacean groups (Table 3). They also noted that “Exposures exceeding the specified respective criteria level for any exposure metric are interpreted as resulting in predicted temporary threshold shift (TTS) or permanent threshold shift (PTS) onset.” The onset of PTS on marine mammals was also outlined in NOAA 2018 (Table 4). The updated figures for PTS and TTS for are outlined in Table 5.

Table 3. Hearing Groups of Marine Mammals (NOAA, 2018)

| Hearing Group | Generalized Hearing Range* |
|--|----------------------------|
| Low-frequency (LF) cetaceans (baleen whales) | 7 Hz to 35 kHz |
| Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales) | 150 Hz to 160 kHz |
| High-frequency (HF) cetaceans (true porpoises, Kogia, river dolphins, cephalorhynchid, Lagenorhynchus cruciger & L. australis) | 275 Hz to 160 kHz |
| Phocid pinnipeds (PW) (underwater) (true seals) | 50 Hz to 86 kHz |
| Otariid pinnipeds (OW) (underwater) (sea lions and fur seals) | 60 Hz to 39 kHz |

* Represents the generalized hearing range for the entire group as a composite (i.e., all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall et al. 2007) and PW pinniped (approximation).

Table 4. Onset of PTS in Marine mammals

| Hearing Group | PTS Onset Thresholds (Received Level) | |
|-------------------------------------|---|-----------------------------------|
| | Impulsive ¹ | Non-impulsive ² |
| Low-Frequency (LF) Cetaceans | Cell 1 <i>Lpk,flat</i> : 219 dB <i>LE,LF,24h</i> : 183 dB | Cell 2 <i>LE,LF,24h</i> : 199 dB |
| Mid-Frequency (MF) Cetaceans | Cell 3 <i>Lpk,flat</i> : 230 dB <i>LE,MF,24h</i> : 185 dB | Cell 4 <i>LE,MF,24h</i> : 198 dB |
| High-Frequency (HF) Cetaceans | Cell 5 <i>Lpk,flat</i> : 202 dB <i>LE,HF,24h</i> : 155 dB | Cell 6 <i>LE,HF,24h</i> : 173 dB |
| Phocid Pinnipeds (PW) (Underwater) | Cell 7 <i>Lpk,flat</i> : 218 dB <i>LE,PW,24h</i> : 185 dB | Cell 8 <i>LE,PW,24h</i> : 201 dB |
| Otariid Pinnipeds (OW) (Underwater) | Cell 9 <i>Lpk,flat</i> : 232 dB <i>LE,OW,24h</i> : 203 dB | Cell 10 <i>LE,OW,24h</i> : 219 dB |

¹Impulsive: produce sounds that are typically transient, brief (less than 1 second), broadband, and consist of high peak sound pressure with rapid rise time and rapid decay (ANSI 1986; NIOSH 1998; ANSI 2005).

²Non-impulsive: produce sounds that can be broadband, narrowband or tonal, brief or prolonged, continuous or intermittent) and typically do not have a high peak sound pressure with rapid rise/decay time that impulsive sounds do (ANSI 1995; NIOSH 1998).

Table 5. Southall *et al.* (2019) TTS- and PTS-onset thresholds for marine mammals exposed to impulsive noise: SEL thresholds in dB re 1 $\mu\text{Pa}^2\text{s}$ under water and dB re (20 μPa)²s; and peak SPL thresholds in dB re 1 μPa under water.

| Hearing Group | Impulsive Noise | | Non-impulsive Noise |
|-------------------------------------|--|---|---|
| | Unweighted SPL _{peak} (dB re 1 μPa) | Weighted SEL _{cum} (dB re 1 $\mu\text{Pa}^2\text{s}$) | Weighted SEL _{cum} (dB re 1 $\mu\text{Pa}^2\text{s}$) |
| PTS Criteria | | | |
| Low-frequency (LF) cetaceans | 219 | 183 | 199 |
| High-frequency (HF) cetaceans | 230 | 185 | 198 |
| Very-High frequency cetaceans (VHF) | 202 | 155 | 173 |
| Phocid carnivores in water (PCW) | 218 | 185 | 201 |
| TTS Criteria | | | |
| Low-frequency cetaceans | 213 | 168 | 179 |
| High-frequency cetaceans | 224 | 170 | 178 |
| Very high-frequency cetaceans | 196 | 140 | 153 |
| Phocid carnivores in water | 212 | 170 | 181 |

The hearing ranges and sensitivity of marine mammals differ from one species to another depending on their audiogram. “For example, harbour porpoises are sensitive from 3 kHz to 130 kHz, with peak sensitivity at 125-130 kHz, and bottlenose dolphins from 5-110 kHz, with peak sensitivity at 40 and 60-116 kHz” (Southall *et al.*, 2007). Humans are sensitive only to frequencies from 20 Hz to 16-18 kHz but with peak sensitivity from 2-4 kHz. Most small cetaceans, excluding harbour porpoise, have an auditory bandwidth of 150 Hz to – 160 kHz, while harbour porpoise have an auditory bandwidth within 200 Hz to 180 kHz.”

The proposed USBL equipment and the noise frequency emissions are seen in Table 6.

Table 6. Details of the potential sources of acoustic noise

| Equipment Type | Typical Source Pressure Level (dB re 1 μ Pa @ 1 m) | Potential for auditory injury? | Typical Frequency Range (kHz) |
|----------------------|--|--------------------------------|-------------------------------|
| USBL System | 194 - 207 | Potential risk | 20-50 |
| Large Vessel (>100m) | Approx. 180 | Potential risk | 50-300 (DECC, 2011) |

The low frequencies emitted from the USBL equipment (20-50 kHz) are below the auditory range of high and very high frequency cetaceans, but are within the hearing range of low frequency cetaceans that would be seen on the cable route. Conversely, frequencies emitted by the cable-laying vessel are outside the auditory range of low frequency cetaceans, but within the auditory range of high and very high frequency cetaceans. It should be noted that, due to the slow speed of the vessel during cable burial (0.5 knots), acoustic noise emitted from the main lay vessel is expected to be low.

The noise emitted from a USBL is below the TTS- and PTS-onset threshold injury levels indicated by Southall *et al.* (2019), negative impacts may be foreseen if Low Frequency Cetaceans are close enough to the equipment to receive sound levels above this indicative threshold.

The operations would comply with the NPWS (2014) “*Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters*”. These guidelines would be deemed adequate to mitigate the negative impacts of the proposed works. Marine mammals in the vicinity of the vessel during start up procedures would be given ample time to leave the site with the due to the slow launch/recovery procedures of the subsea trencher outlined in the guidelines. In addition, vessel speeds are extremely slow which would give marine mammals ample opportunity to move from the area.

The Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing

Southall (2019) outlined the main differences between their publication and previous publications including NOAA (2018) which was referenced as NMFS (2018) in Southall (2019). Southall (2019) states that “*The noise criteria here represent the next step in a sequential process of evolution of the criteria proposed by Southall et al. (2007), substantially modified with new analytical methods by Finneran (2016), and recently adopted as U.S. regulatory guidance by the NMFS (2016, 2018). While the quantitative process described herein and the resulting exposure criteria here are based on, and in many respects are identical to, those derived by Finneran (2016) and adopted by the NMFS (2016, 2018), there are a number of significant distinctions. The exposure criteria here appear in a peer-reviewed publication and include all marine mammal species for all noise exposures, both under water and in air for amphibious species. NMFS (2016, 2018) provides regulatory guidance only for the subset of marine mammals under their jurisdiction and do not include criteria for aerial noise exposures, an important consideration in many locations for which some earlier assessments were made (Finneran & Jenkins, 2012). The exposure criteria here, while based on the Finneran (2016) quantitative method and consistent with the NMFS (2016, 2018) guidance where they overlap, are thus more broadly relevant, peer-reviewed, and less subject to potential changes in national regulatory policy.*”

Southall (2019) also stated that “*It should be noted that this results in some proposed differences in the terminology of hearing groups relative to those used in Finneran (2016) and NMFS (2016, 2018). These proposed differences in nomenclature may be confusing, but we believe they are justified (see the “Marine Mammal Hearing Groups and Estimated Group Audiograms” section and Appendices 1-6) and will support future criteria as new information emerges.*”

The difference in nomenclature between NOAA 2018 and Southall (2019) is that NOAA (2018)¹ classified cetaceans as Low-frequency (LF) cetaceans (baleen whales), Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales) and High-frequency (HF) cetaceans (true porpoises, Kogia, river dolphins, cephalorhynchid, Lagenorhynchus cruciger & L. australis) while Southall reclassified these groups to Low-frequency cetaceans, High-frequency cetaceans, Very high-frequency cetaceans. As outlined in Southall (2019) *“The distinction between HF and VHF cetacean groups (as opposed to mid- and high-frequency) reflects the regions of best hearing sensitivities within these groups, often including frequencies approaching or exceeding 100 kHz; these frequencies would be more appropriately described within marine bioacoustics as high to very high. Further, as discussed in more detail below, a number of anatomical and sound production properties suggest a potential distinction of very low-(VLF) and LF cetaceans among mysticetes. Some evidence also suggests a potential segregation of mid-frequency (MF) and HF cetaceans in addition to the distinction of HF and VHF cetaceans.”* This is in effect a relabelling of Mid-Frequency (MF) Cetaceans and High-Frequency (HF) Cetaceans to High-frequency cetaceans and Very high-frequency cetaceans respectively. It should be clearly noted that the PTS values within the updated groups were identical between NOAA, 2018 and Southall 2019 and it was in effect a renaming of the groups.

Lurton (2016) modelled the sound field radiated by multibeam echosounders for acoustical impact assessment. Lurton (2016) stated that *“considering the injury criteria, the results illustrate that injury hazards are possible only at very short distances from the source: e.g. about 5 m for maximum Sound Pressure Level and 12 m for cumulative Sound Exposure Level in the case of a 240-dB source level, considering cetaceans. For behavioural response criteria, the corresponding values are 9 m and 70 m.”*

Based on these data, it is concluded that an underwater source noise level of 207dB (which the proposed main lay will not exceed) does not result in injury hazards once a minimum separation distance of 12 metres is maintained between the source of the noise and a cetacean. Equally there is no behavioural response once a minimum separation distance of 70 metres is maintained between the source of the noise and a cetacean. The proposed survey guidelines (DAHG, 2014) require a 1000m distance between the vessel and cetaceans prior to the commencement of vessel operations.

The operations would comply with the NPWS (2014) *“Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters”* http://www.npws.ie/sites/default/files/general/Underwater_sound_guidance_Jan_2014.pdf. These guidelines would be deemed adequate to mitigate the negative impacts of the proposed works. Cetaceans in the vicinity of the vessel during start up procedures would be given ample time to leave the site with the soft start procedures outlined in the guidelines. It should be noted that the vessel will be operating at a very slow speed on a 24 hour basis with a MMO on board. It is considered that due to the fact that the ship will be operating on this basis, a MMO will be onboard operating to MMO guidance procedures, it will be providing significant time for cetaceans to leave the area. In addition, vessel speeds are extremely slow which would give marine mammals ample opportunity to move from the area.

¹ NOAA 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. NOAA Technical Memorandum NMFS-OPR-59 April 2018.

Note: in relation to consistency between Southall (2019) and NOAA (2018)

The Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (NOAA, 2018) (or National Marine Fisheries Service, 2018 (as quoted in Southall 2019)), outlines the hearing groups of marine mammals including the generalised hearing range of these cetacean groups (Annex II). NOAA (2018) also noted that *“Exposures exceeding the specified respective criteria level for any exposure metric are interpreted as resulting in predicted temporary threshold shift (TTS) or permanent threshold shift (PTS) onset.”* The thresholds for the onset of PTS on marine mammals were also outlined in NOAA 2018. The updated Southall (2019) figures for PTS and TTS for are outlined in Annex IV.

Southall (2019) outlined the main differences between their publication and previous publications including NOAA (2018) which was referenced as NMFS (2018) in Southall (2019). Southall (2019) states that *“The noise criteria here represent the next step in a sequential process of evolution of the criteria proposed by Southall et al. (2007), substantially modified with new analytical methods by Finneran (2016), and recently adopted as U.S. regulatory guidance by the NMFS (2016, 2018). While the quantitative process described herein and the resulting exposure criteria here are based on, and in many respects are identical to, those derived by Finneran (2016) and adopted by the NMFS (2016, 2018), there are a number of significant distinctions. The exposure criteria here appear in a peer-reviewed publication and include all marine mammal species for all noise exposures, both under water and in air for amphibious species. NMFS (2016, 2018) provides regulatory guidance only for the subset of marine mammals under their jurisdiction and do not include criteria for aerial noise exposures, an important consideration in many locations for which some earlier assessments were made (Finneran & Jenkins, 2012). The exposure criteria here, while based on the Finneran (2016) quantitative method and consistent with the NMFS (2016, 2018) guidance where they overlap, are thus more broadly relevant, peer-reviewed, and less subject to potential changes in national regulatory policy.”*

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5. Mitigation Measures

Cetaceans

The following mitigation measures will be implemented:

- 1 During all cable operations within Irish waters, the cable lay vessel will be operating at idle /minimal wake speeds which reduces potential collision risk with marine mammals. ROV trenching operations will typically not exceed 0.5kn.
- 2 A certified Marine Mammal Observer (MMO) will be onboard the vessel at all times in Irish waters to implement standard NPWS marine mammal mitigation measures. “Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters” (NPWS, 2014) will be applied to ensure noise introduced into the marine environment have minimum effect. ROV trencher launch, seabed trenching and trencher recoveries will be conducted in consultation with the MMO.
- 3 In line with “Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters” (NPWS, 2014) “Sound-producing activities shall only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Where effective visual monitoring, as determined by the MMO, is not possible the sound-producing activities shall be postponed until effective visual monitoring is possible” and “in waters up to 200m deep, the MMO shall conduct pre-start-up constant effort monitoring at least 30 minutes before the sound-producing activity is due to commence. Sound-producing activity shall not commence until at least 30 minutes have elapsed with no marine mammals detected within the Monitored Zone by the MMO”.
- 4 A project ecologist (separate to the MMO) with sufficient ornithological expertise in the identification of diving seabirds will be onboard. Where the ecologist observes a significant cluster of actively diving birds in the works corridor, within 500 m of the vessel works will be mitigated based on the instruction of the ecologist. This could include slowing vessel cable laying or pausing works if there is potential for significant effect on birds.
- 5 Sufficient resources will be made immediately available on the vessel to deal with accidental oil spills, including hydraulic hoses bursting etc. and reported to the on board ecologist.
- 6 Ballast water discharges from project vessels will be managed under the International Convention for the Control and Management of Ships’ Ballast Water and Sediments standard (International Maritime Law: Ballast Water Management Convention).

The levels of noise produced from the proposed works will be kept within an acceptable range as described by (Southall et al., 2019) and the vessel will travel at a slow speed (0.5 knots) which cetacean species will be able to deviate course and move away with ease and under no pressure from the works vessel. If calves are sighted, all works must stop immediately for a minimum of 45 minutes from the last sighting to ensure the calves’ safety. The application of these proposed mitigation measures will ensure no significant impacts on cetacean species from the proposed works in or in proximity to the proposed works area.

Once decommissioned, the Beaufort Offshore Cable will be addressed in line with guidance and permissions at that time. It may remain buried in-situ within the subtidal seabed or be removed in line with guidance and consultation. Any works required to decommission this cable will be minor and isolated in nature. All mitigation measures relevant to cable-laying works (including an onboard MMO) will be implemented at a minimum, during any required decommissioning works.

Turtles

The potential risk of impact on a leatherback turtle from the proposed works is extremely low, however, the possible impacts must be mitigated against out of an abundance of caution. An experienced ecologist (MMO) will be present on board for the duration of the works.

6. Conclusion

This Risk Assessment of Annex IV has taken all species under this annex of the Habitats Directive into consideration. All species have been assessed on whether there is a potential of impact. Any species in which this was possible were further assessed. This narrowed the list down to all cetacean species (including vagrant species) and leatherback turtles. The presence of these species within the region was discussed using historical data (NBDC 2026), the use of this data in combination with the proposed works, potential impacts were assessed and finally mitigation measures were specifically designed to protect the species protected under Annex IV of the Habitats Directive (EC, 2023).

There is potential for impact on all of the discussed species from the proposed works, however, out of an abundance of caution and with the strict implementation of the specific mitigation measures provided, the risk of potential impact of these species or their interests has been significantly lowered.

There is no significant risk for potential impact on Cetacean or Turtle from the proposed works.

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