Offshore Wind Power Limited

West of Orkney Windfarm Post Award Support

Option Agreement Area EPS Risk Assessment and Protected Sites and Species Assessment for Geophysical Surveys

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CONTENTS

ACRONYMS

ACRONYM LIST	
2D	Two Dimensional
2DUHR	2D Ultra High Resolution
3D	Three-Dimensional
AA	Appropriate Assessment
dB	Decibel
dBht	Decibel Hearing Threshold
EEC	European Economic Community
EPS	European Protected Species
EU	European Union
FCS	Favourable Conservation Status
HF	High Frequency
Hr	Hour
HRA	Habitats Regulations Appraisal
HWDT	Hebridean Whale and Dolphin Trust
Hz	Hertz
IAMMWG	Inter-Agency Marine Mammal Working Group
IROPI	Imperative Reason Overriding Public Interest
JNCC	Joint Nature Conservation Committee
kHz	Kilohertz
km	Kilometre
km^2	Kilometre Squared
LF	Low frequency
LSE	Likely Significant Effect
m	Metre
m^3	Cubic metre
m/s	Metres per second
MBES	Multi Beam Echosounder
MF	Mid Frequency
MHWS	Mean High Water Spring
MMMU	Marine Mammal Management Unit

ACRONYM LIST	
MMO	Marine Mammal Observer
MMPP	Marine Mammal Protection Plan
MS-LOT	Marine Scotland Licensing Operations Team
N/E	Non Expected
NCMPA	Nature Conservation Marine Protected Area
NM	Nautical Miles
NMFS	National Marine Fisheries Service
NMPi	National Marine Plan interactive
NOAA	National Oceanic and Atmospheric Administration
NSA	National Scenic Area
OAA	Option Agreement Area
OSPAR	Oslo and Paris Convention
OW	Otarids in Water
OWPL	Offshore Wind Power Limited
PAM	Passive Acoustic Monitoring
PMF	Priority Marine Feature
PO	Plan Option
PTS	Permanent Threshold Shift (of hearing)
PW	Pinnipeds in Water
RMS	Root Mean Square
s	Second
SAC	Special Area of Conservation
SCANS	Small Cetaceans in Atlantic Waters of the North Sea
SNCB	Statutory Nature Conservation Body
SCOS	Special Committee on Seals
SEL	Sound Exposure Level
SEL_{cum}	SEL cumulative
SI	Sirenians
SNH	Scottish Natural Heritage
SPA	Special Protection Area
SPL	Sound Pressure Level
SPLrms	Sound Pressure Level (root mean square)

ACRONYM LIST	
SSSI	Site of Special Scientific Interest
SVP	Sound Velocity Profiler
TTS	Temporary Threshold Shift (of hearing)
UK	United Kingdom
UKCS	United Kingdom Continental Shelf
USBL	Ultra-Short Baseline
UXO	Unexploded Ordnance
VHF	Very High Frequency
WCA	Wildlife and Countryside Act 1981
WDC	Whale Dolphin Conservation
µPA	Micro Pascal

1 INTRODUCTION

Offshore Wind Power Limited (OWPL) are planning to undertake a survey campaign in 2023 over the West of Orkney Windfarm Option Agreement Area (OAA) associated with the ScotWind N1 Plan Option (PO). The purposes of this reconnaissance survey is to further investigate and expand understanding of the OAA prior to beginning engineering focussed surveys.

The proposed activities will involve the following:

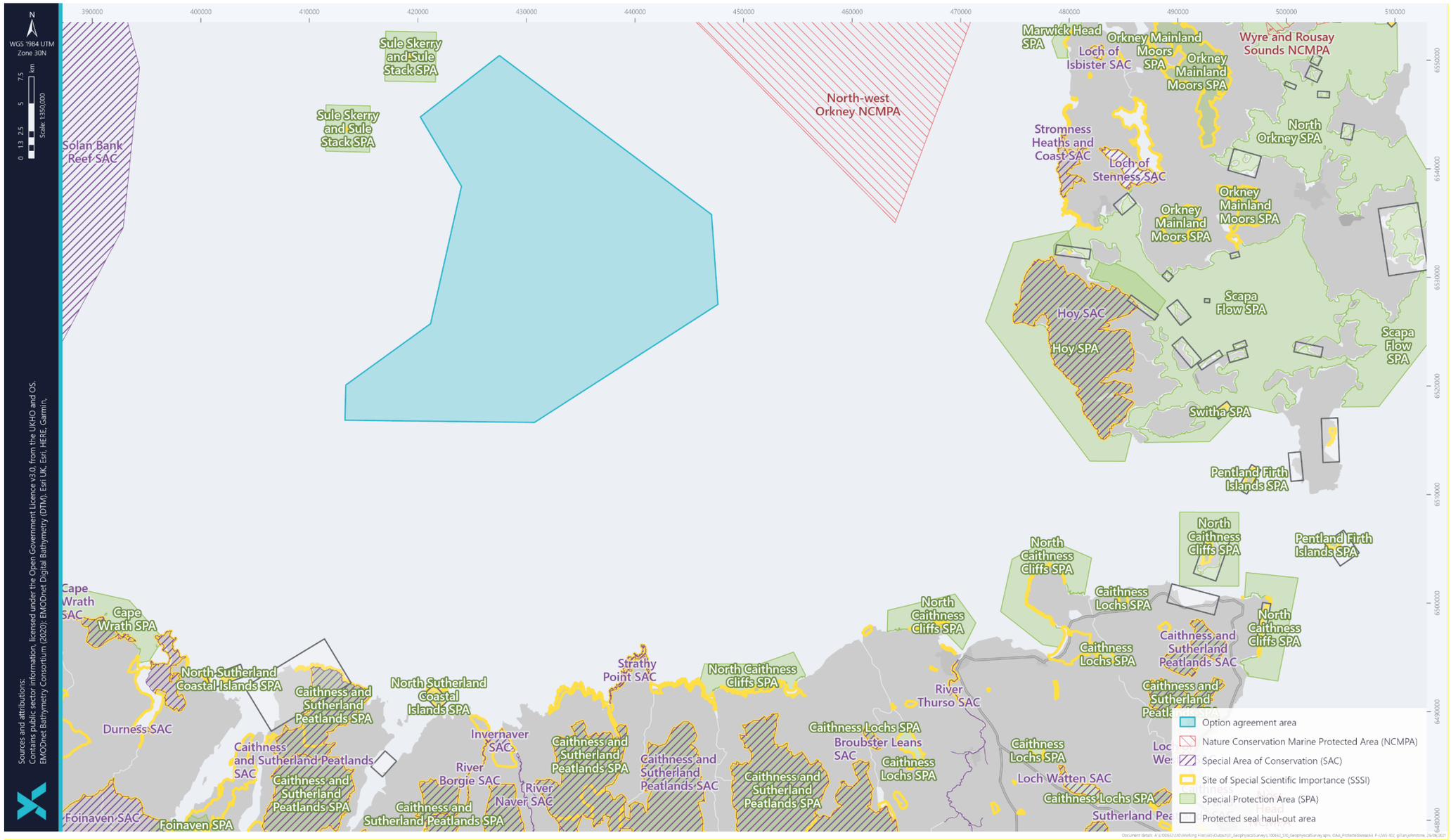
- Measuring the water depth, variations and slope changes within the sections of the OAA surveyed;
- Evaluating any shallow geohazards potentially affecting the sections of the OAA surveyed (e.g. slope failures, faults, hardgrounds, etc.) within the top 100 metres below seabed by two dimensional ultra-high resolution (2DUHR) survey; and
- Using the information to refine the existing ground model and planning of the detailed geotechnical campaign areas.

1.1 Project Overview

OWPL are planning to undertake a geophysical survey of the West of Orkney Windfarm within the N1 PO (Figure 1-1). In order to ascertain the seabed characteristics and the potential for protected features within the area, a geophysical survey will be conducted.

The OAA survey area encompasses Scottish Territorial Waters (within 12 Nautical Miles (NM) of Mean High Water Spring (MHWS) and United Kingdom (UK) Offshore Waters (between 12 and 200 NM from MHWS). The OAA survey area will cover approximately 657 km^2. The anticipated start date is approximately the 12th June 2023 and is expected to take up to approximately 27 days to complete. Additional days (approximately 33) have been applied for as contingency in the event of weather-related delays. The estimated end date of operations is therefore the 12th August 2023. Further details on the survey activity schedule can be found in Section 2.5.

Figure 1-1 Location of Proposed Survey



1.2 Report Purpose

Ahead of any survey activities, all relevant consents and licences need to be in place. This document provides the necessary information to support the following:

1. An assessment of potential impacts on cetaceans, and determination of the need for a European Protected Species (EPS) Licence under the Conservation (Natural Habitats, &c) Regulations 1994 (as amended in Scotland) (the Habitats Regulations) and the Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) (The Offshore Habitats Regulations). Where an EPS licence is required, this document also provides the EPS risk assessment to support the application.

2. An assessment of potential impacts on basking sharks, and determination of whether a derogation licence will be required under the Wildlife and Countryside Act 1981 (as amended).

3. An assessment of the potential for Likely Significant Effects (LSE) on designated sites as required by the Habitats Regulations, the Marine (Scotland) Act 2010. This will be in line with the Habitats Regulations Appraisal (HRA) process, which is conducted by the Competent Authority (as prescribed by the Habitats Regulations), to assess the potential of likely significant effects on the UK Site Network; and

4. An assessment of the potential to harass (intentionally or recklessly) any seals at designated seal haul-outs, as defined by section 117 of the Marine (Scotland) Act 2010, as amended by the Protection of Seals (Designation of Haul-Out Sites) (Scotland) Amendment Order 2017.

It should be noted that there is ongoing consultation for requirements within the relevant Harbour Authorities area (i.e. Orkney and Scrabster).

1.3 Protected Species Overview

1.3.1 European Protected Species (EPS)

Cetaceans

All cetacean species within UK waters are deemed 'species of community interest' under Annex IV of the Habitats Directive and thus require strict protection as EPS. The strict protection to all cetaceans as EPS is enshrined in domestic legislation through the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended), while bottlenose dolphin *Tursiops truncatus* and harbour porpoise *Phocoena phocoena* have further protection under Annex II of the Habitats Directive, which regulates the designation of special areas of conservation (SACs) for those species.

In Scotland, the Habitats Directive is transposed into law by The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) within Scottish Territorial waters (12 NM limit), and the Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) in UK Offshore Waters. An EPS licence is required where an activity may result in an offence under the Habitats Regulations, which in the context of marine surveys, pertains to cetaceans.

Part III of both these Regulations defines what is considered an offence, in terms of human interactions with EPS. However, the definition of an offence under The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) differs slightly from that prescribed in The Conservation of Habitats and Species Regulations 2017 (as amended), as summarised in Table 1-1 below. The key difference is regulation 39(2) within The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (highlighted in bold in Table 1-1), which makes disturbance of any cetacean an offence in Scottish Territorial Waters. There is no equivalent regulation in the offshore legislation.

An EPS Licence will therefore be required for:

1. any activity that might result in injury to any cetacean or other EPS;
2. disturbance to any individual cetacean within Scottish inshore waters; and/or
3. any population of individuals in Scottish offshore waters, as stated in the relevant in Table 1-1.

Table 1-1 - Definitions of Disturbance Offenses Against EPS in Scottish Territorial and UK Offshore Waters

AREA	SCOTTISH TERRITORIAL WATERS	UK OFFSHORE WATERS
Applicability	Within 12 NM Limit	Out-with 12 NM Limit
Relevant Legislation	The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)	Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended)
Definition of Relevant Offences	Regulation 39: (1) It is an offence– (a) deliberately or recklessly to capture, injure or kill a wild animal of a European protected species; (b) deliberately or recklessly– (i) to harass a wild animal or group of wild animals of a European protected species; (ii) to disturb such an animal while it is occupying a structure or place which it uses for shelter or protection; (iii) to disturb such an animal while it is rearing or otherwise caring for its young; (iv) to obstruct access to a breeding site or resting place of such an animal, or otherwise to deny the animal use of the breeding site or resting place; (v) to disturb such an animal in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species to which it belongs; or (vi) to disturb such an animal in a manner that is, or in circumstances which are, likely to impair its ability to survive, breed or reproduce, or rear or otherwise care for its young; (c) deliberately or recklessly to take or destroy the eggs of such an animal; or (d) to damage or destroy a breeding site or resting place of such an animal. (2) Subject to the provisions of this Part, it is an offence to deliberately or recklessly disturb any dolphin, porpoise or whale (cetacean).	Regulation 45: (1) Subject to regulations 46 and 55, a person who— (a) deliberately captures, injures, or kills any wild animal of a European protected species, (b) deliberately disturbs wild animals of any such species, (c) deliberately takes or destroys the eggs of such an animal, or (d) damages or destroys, or does anything to cause the deterioration of, a breeding site or resting place of such an animal, is guilty of an offence. (2) For the purposes of paragraph (1)(b), disturbance of animals includes, in particular, any disturbance which is likely— (a) to impair their ability— (i) to survive, to breed or reproduce, or to rear or nurture their young; or (ii) in the case of animals of a hibernating or migratory species, to hibernate or migrate; or (b) to affect significantly the local distribution or abundance of the species to which they belong.

[Redacted]

[Redacted]

1.3.2 Basking Sharks

Basking sharks *Cetorhinus maximus* are protected under Schedule 5 of the WCA which prohibits the killing, injuring or taking by any method of those wild animals listed on Schedule 5 of the Act. The Nature Conservation (Scotland) Act 2004, Part 3 and Schedule 6 make amendments to the WCA, strengthening the legal protection for threatened species to include 'reckless' acts, and specifically makes it an offence to intentionally or recklessly disturb or harass basking sharks. A derogation licence under the WCA will therefore be required for any activity which may result in disturbance or injury to basking sharks.

Basking sharks are only very rarely present within the North Sea area (Paxton *et al.*, 2014). Moreover, recent ecological niche modelling found that relative habitat suitability for basking sharks is low in the vicinity of the OAA, compared to the rest of the UK seascape (Austin *et al.* 2019). Considering information on their known distribution, it

is considered extremely unlikely that interactions with basking sharks will occur, hence the potential for the proposed survey activities to result in intentional or reckless disturbance or harassment of this species is equally limited.

1.3.3 Seabirds

The primary legislation for the protection of birds in the UK is the WCA in combination with the Nature Conservation (Scotland) Act 2004. Under these acts, it is an offence to harm wild bird species, their eggs and nests. Additional protection is provided for certain bird species listed on Schedule 1 of the WCA, and it is an offence to disturb those species at their nest while it is in use.

The proposed survey activities are unlikely to result in the intentional or reckless killing of wild birds or the destruction of their nests, but if carried out during the breeding season, such works could result in an offence by disturbing nesting Schedule 1 bird species.

1.4 Protected Sites

1.4.1 European Sites

The term 'European site' is being used to refer to what were previously known as 'Natura' sites. This recognises that Special Protection Areas (SPAs) and SACs protect species and habitats shared across Europe and were originally designated under European legislation.

European sites (SACs and SPAs) form a unique network of protected areas that stretches across the European Union (EU). Prior to leaving the EU, Scotland's sites contributed to the Natura network. Now they form part of the Emerald Network, spanning Europe and into Africa.

Natura sites were originally designated under The European Habitats Directive (92/43/EEC) and Birds Directive (79/409/EEC). European Sites continue to be designated under Scottish domestic law and are now referred to as the UK Site Network:

- In the terrestrial environment and within Scottish Territorial Waters (12 NM limit) by:
  The Conservation (Natural Habitats, &c.) Regulations 1994 (Current Scottish legislation); and
  Habitats Directive and Birds Directive (EU legislation).
- Out-with Scottish Territorial waters by:
  The Offshore Habitats Regulations.

SACs were designated under the Habitats Directive for habitats and non-bird species. The Habitats Directive sets out how such European sites should be protected and has a number of wider implications such as those relating to European protected species. The Birds Directive protects all wild birds and their nests, eggs and habitats within the European Union. SPAs are classified under the Birds Directive to protect birds that are rare or vulnerable in Europe as well as all migratory birds that are regular visitors.

The guidance within, and associated with, the Habitats and Birds Directive continues to inform how our European sites are managed. The Habitats Regulations have been amended as a result of leaving the EU so that European

sites are both protected, and continue to operate, as they have done since their original designation. The changes to the Regulations also mean that the requirements of the Directives continue to be relevant to the management of European sites.

The aim of protection for European sites is to promote the maintenance of biodiversity, by requiring maintenance or restoration of representative natural habitats and wild species at FCS, through the introduction of robust protection for those habitats and species of European importance.

As part of these protection measures, there is a requirement to determine whether a plan or project is likely to have an adverse effect on the integrity of a European site. This is implemented through the HRA process. The HRA process requires that any proposal which has the potential to result in a negative LSE to a UK Site Network or its designated features, is subject to an HRA and an Appropriate Assessment (AA) by the Competent Authority. The HRA and AA processes ensure that no activity can be consented if it may cause adverse effects on the integrity of the UK Site Network, unless there are no alternatives, and there is an Imperative Reason of Overriding Public Interest (IROPI) for the activity to proceed.

1.4.2 Nature Conservation Marine Protected Areas

Under section 82 of the Marine (Scotland) Act 2010, Marine Scotland Licensing Operations Team (MS-LOT) is required to consider whether a licensable activity is capable of affecting (other than insignificantly) a protected feature in a Nature Conservation Marine Protected Area (NCMPA), or any ecological or geomorphological process on which the conservation of any protected feature in an NCMPA is dependent. If MS-LOT determine there is, or may be, a significant risk of a project hindering the achievement of the conservation objectives, then they must notify the relevant conservation bodies; NatureScot in this case (previously known as Scottish Natural Heritage (SNH)).

It is an offence to intentionally or recklessly kill, remove, damage, or destroy any protected feature of an NCMPA. MS-LOT must be sure that consenting/licensing decisions do not cause a significant risk to the conservation objectives of any NCMPA.

Sufficient detail is provided below in Section 4 to support MS-LOT to ascertain potential effects on NCMPAs.

1.4.3 Designated Seal Haul-Outs

Seal haul-outs are coastal locations that seals use to breed, moult and rest. Nearly 200 seal haul-out sites have been designated through The Protection of Seals (Designation of Haul-Out Sites) (Scotland) Order 2014, which was amended with additional sites in 2017. These haul-out sites are protected under Section 117 of the Marine (Scotland) Act 2010. The Act is designed to strengthen the protection of seals when they are at their most vulnerable and, as such, provides additional protection from intentional or reckless harassment whilst seals occupy these important coastal sites.

1.4.4 Selection Criteria for Protected Sites

Over and above potential impacts on protected species, the potential for the proposed survey activities to impact protected sites needs to be considered. The following criteria has been used to select those designated sites where potential impacts need to be assessed:

- SACs and NCMPAs (including proposed and candidate sites) with cetaceans as qualifying features within 50 km of the proposed survey area;
- SACs (including proposed and candidate sites) with harbour seal features within 50 km of the proposed survey area and breeding grey seal within 20 km of the proposed survey area;
- Designated seal haul-outs or seal breeding and/or otter sites that overlap with or located within 500 m of the proposed survey area;
- SPAs and NCMPAs (including proposed and candidate sites) with birds as qualifying features that overlap with or are located within 2 km of the proposed survey area;
- SACs and NCMPAs (including proposed and candidate sites) with otter features that overlap with or located within 500 m of the proposed survey area; and
- SACs and NCMPAs (including proposed and candidate sites) with vegetation or ground features that overlap or located within proposed survey areas.

There is not considered to be the potential for impact on benthic qualifying features as a result of geophysical survey activities. As such, protected sites with benthic features have not been considered within this assessment.

Seals are not an EPS but are listed on Annex II of the Habitats Directive, meaning they can be a designating feature for SACs. Moreover, they are also protected from disturbance at haul-outs as discussed in Section 1.4.3. The nearest SAC with seals as a designating feature (Sanday SAC) is located approximately 80 km away. Furthermore, there are no designated haul-outs within 500 m of the OAA. The closest designated haul-out site is located approximately 20 km south of the survey area. Carter *et al.* (2022) also predicts low densities of both species of seal in the OAA. Therefore, no impacts to sites with seals as a qualifying interest will occur and the likelihood of seals being encountered in the OAA are low, with the likelihood of disturbance or injury to these individuals also very low. On this basis, seals will not be considered further in this EPS Risk Assessment.

2 DESCRIPTION OF PROJECT ACTIVITIES

2.1 Overview

OWPL are planning to carry out a survey within the OAA. The results of the survey works will be used to ascertain seabed characteristics within the survey areas, in order to identify potential geohazards, refine the existing ground model and inform the planning of the detailed geotechnical campaign. A geotechnical soil investigation survey, will also be undertaken. A separate notice of intention to carry out an exempted activity will be submitted to MS-LOT to cover the geotechnical soil investigation survey.

2.2 Testing and Calibration of Survey Equipment

Prior to survey activities commencing, the survey equipment and sensors will need to be tested and calibrated. Testing and calibration may be required for all survey equipment that will be utilised during the survey activity, as detailed in Table 2-1. It is anticipated that the testing and calibration will take approximately three days to complete and will be tested at the survey location.

Since the vessel, equipment, and activities required for testing and calibration will be the same as those used during geophysical survey works, the potential impacts on protected species and sites resulting from testing and calibration will be analogous to those resulting from the main survey phase. As such, testing and calibration is not specifically considered by this assessment.

2.3 Survey Activities

Survey equipment selection and deployment will be informed both prior to survey operations, by several factors including environmental considerations, weather and sea state, survey requirements and water depth. The survey vessel (name TBC) will undertake the proposed activities. Table 2-1 presents the types of activity that are associated with the geophysical surveys.

Table 2-1 - Summary of the Activities Associated with the Different Survey Types

ACTIVITIES	
Vessels	Survey Vessel
Survey Equipment	Multi Beam Echosounder (MBES)
	2D Ultra High-Resolution (2DUHR) seismic source and digital streamer
	Sound Velocity Profiler (SVP)

2.4 Survey Equipment

A range of different equipment may be employed during the survey activities, with their use summarised in Table 2-2. Each type of equipment has been assessed for its potential to introduce sound into the marine environment and/or interact with protected species. The most significant sound related aspects potentially generated by this project are detailed within Table 3-1, along with a determination as to whether each requires further assessment.

Table 2-2 - Details of the Equipment to be Employed for the Survey Activities

SYSTEM/SURVEY EQUIPMENT	DESCRIPTION
2DUHR	A 2DUHR system optimised to achieve a sub-bed penetration depth focusing on the depth range of 1 –100 m below seafloor. This technology requires a controlled seismic source of energy connected by high voltage cable to a sound source (sparker) that transfers the energy through the water to penetrate the seabed. The energy reflected back from the different sediment layers below the seabed is received by hydrophones on the sea surface, recorded and processed by

SYSTEM/SURVEY EQUIPMENT	DESCRIPTION
	a data acquisition system aboard a vessel, so that visual profile of the seabed can be created. There are numerous seismic sources which may be deployed during survey operations, including sparkers. A seismic sparker works by discharging an electrical pulse between electrodes and a grounding point in seawater. This discharge creates an acoustic pulse, and the reflected signal is received by a hydrophone deployed at a set distance from the source. The equipment used will be as follows: • Applied Acoustics Dura Spark 400 + 400 (2 x 400 tips) or similar
MBES	MBES are used to obtain detailed Three Dimensional (3D) maps of the seafloor which show water depths. They measure water depth by recording the two-way travel time of a high frequency pulse emitted by a transducer. The beams produce a fanned arc composed of individual beams (also known as a swathe). MBES can, typically, carry out 200 or more simultaneous measurements. Frequency levels below 200 kHz will not be used during survey activities and have therefore been scoped out of further assessment on the basis that they are out-with the generalised hearing range for EPS and other protected species likely to be affected by underwater sound. The Kongsberg EM2040D MBES will be used for this survey and operates at frequency between 200 - 400 kHz or similar.
SVP	The SVP continuously emits high frequency pulses as it is lowered towards the seafloor in order to measure the speed of sound within the water column. This technology also makes use of sonar to determine how quickly sound attenuates in the marine environment, which can aid in calibrating geophysical survey equipment. The Valeport Midas SVX2 will be used for this survey and operates at a frequency between 1,000 – 4,000 kHz or similar.

2.5 Activity Schedule

The proposed geophysical survey activities are scheduled to be undertaken from a date no earlier than the 12th June 2023, with the total survey activities expecting to take up to approximately 61 days collectively. This duration includes 33 contingency days to account for unforeseen operational and/or weather delays.

3 EUROPEAN PROTECTED SPECIES RISK ASSESSMENT

3.1 Overview

The primary purpose of this EPS Risk Assessment is to determine whether an EPS licence is required for the proposed survey works, by identifying the potential for injury and disturbance to EPS. This section of the risk assessment addresses potential impacts to EPS, regardless of their inclusion as qualifying features of protected sites. An assessment of potential impacts to protected sites and their qualifying features is provided in Section 4. Although not classified as EPS, an assessment of underwater sound impacts to pinnipeds, including sound modelling, has been included in this section to support the Protected Sites Impact Assessment undertaken in Section 4.

Furthermore, although not specifically an EPS, an assessment of the potential impacts to basking sharks from the survey activities is also provided below within Section 3.1.1 in order to determine whether a Basking Shark licence is required for the proposed survey activities.

A number of different survey activities will be employed as part of the survey works, each with varying risk to protected species. They include:

- Vessel activity;
- Survey equipment calibration testing; and
- Geophysical surveys of the seabed.

Underwater sound emissions from geophysical survey equipment are the primary source of potential injury and disturbance to EPS. An overview of survey activities and their potential sound-related impacts to EPS and pinnipeds is provided in Table 3-1.

While some survey techniques may introduce sound to the marine environment, the majority of survey equipment types do not operate in relevant frequency ranges or generate sufficient levels of sound to be considered as potential sources of sound-related injury or disturbance to EPS and basking sharks have been screened out of the detailed assessment, as indicated in Table 3-1.

It is acknowledged that the physical presence of vessels during the proposed survey operations may also generate disturbance to EPS and pinnipeds; these potential impacts are discussed further in the relevant EPS and Other Protected Species sections below.

Table 3-1 – Overview of Potential Impacts of Marine Survey Equipment on EPS and Other Protected Species within the Vicinity of the Proposed Survey Areas

ACTIVITY/EQUIPMENT	EXAMPLE EQUIPMENT	POTENTIAL IMPACTS	FREQUENCY RANGES (KHZ)	INDICATIVE SPL_{RMS} (DB RE 1 1µPA)	FURTHER INFORMATION REQUIRED AS PART OF THE EPS AND PROTECTED SITES RISK ASSESSMENT
Survey Vessel	Vessel TBC	Propellers, engines, and propulsion activities form the primary sound sources of survey vessels. Vessel sound is generally continuous and comes in both narrowband and broadband emissions. Potential impacts on EPS and other protected species depend on the duration of the survey activities, location of the survey routes and species of cetacean potentially present in the area. Increased vessel activity additionally has the potential to cause injury from collisions. The risk of collision with an animal is influenced by the dimensions of the vessel and its speed. It should be noted that travel speed of most typical survey vessels is between 3-4 knots. This is slower than the majority of marine mammals which could be impacted via collisions.	Acoustic energy from vessels is strongest at frequencies <1 kHz	Approximately 160 – 175	No – The source levels associated with vessels are likely to be too low to result in injury, and the presence of three survey vessels in the Firth of Forth region does not constitute a change from baseline conditions. It is acknowledged that vessels pose a collision risk to EPS and other protected species. While this does not constitute a change from baseline, all vessels will adhere those mitigation measures, as outlined in Section 5.

ACTIVITY/EQUIPMENT	EXAMPLE EQUIPMENT	POTENTIAL IMPACTS	FREQUENCY RANGES (KHZ)	INDICATIVE SPL_{RMS} (DB RE 1 1µPA)	FURTHER INFORMATION REQUIRED AS PART OF THE EPS AND PROTECTED SITES RISK ASSESSMENT
2DUHR	Geosource Sparker (3 x 400 tips)[1]	A 2DUHR system is optimised to achieve a sub-bed penetration depth focusing on the depth range of 10–250 m below seafloor. This technology requires a controlled seismic source of energy connected by high voltage cable to a sound source (sparker) that transfers the energy through the water to penetrate the seabed. The energy reflected back from the solid seabed layers is received by hydrophones on the sea surface, recorded and processed by a data acquisition system aboard a vessel, so that visual profile of the seabed can be created.	0.75-100	205 / 218	Yes – The frequency of the sound emissions is within marine mammal hearing ranges and the source pressure level may pose a risk of injury and disturbance to EPS.

[1] *It is anticipated that a 2 x 400 tips Geosource Sparker will be used for the survey, which has a higher frequency and lower SPL and SEL. However, a 3 x 400 tips sparker has been used to assess the impact of the 2DUHR survey work to the marine environment as a worst case scenario.*

ACTIVITY/EQUIPMENT	EXAMPLE EQUIPMENT	POTENTIAL IMPACTS	FREQUENCY RANGES (KHZ)	INDICATIVE SPL_{RMS} (DB RE 1 1µPA)	FURTHER INFORMATION REQUIRED AS PART OF THE EPS AND PROTECTED SITES RISK ASSESSMENT
MBES	Kongsberg EM2040D	High frequency sound pulses created by MBES equipment generate sound waves which produce impulsive underwater sound. Depending on the frequency of the pulses, location and duration of the operations, and the species present, there could be potential impacts on cetaceans.	200 – 400	218	No – The MBES used for the proposed survey operations will operate at frequencies above 200 kHz. This is above the hearing threshold of all marine mammals and protected species which may be present in the area (as detailed in Table 3-2). Hence no potential for injury or disturbance exists (NOAA, 2018).
SVP	Valeport Midas SVX2	SVPs rely on high frequency pulsed sounds to gather data on the marine environment and are used to measure the speed of sound within the water column to calibrate geophysical survey equipment.	1,000 – 4,000	150 – 200	No – the sound source frequencies fall out-with the hearing range of marine mammals. There is no potential for injury or disturbance to any marine mammal species from sound emitted by this equipment.

3.2 European Protected Species

3.2.1 Cetaceans

All cetacean species within UK waters are deemed 'species of community interest' under Annex IV of the Habitats Directive and thus require strict protection as EPS. The strict protection to all cetaceans as EPS is enshrined in domestic legislation through the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended), while bottlenose dolphin and harbour porpoise have further protection under Annex II of the Habitats Directive, which regulates the designation of SACs for those species.

Thirteen species of cetacean are known to be present within the North Coast and Orkney Waters (Hague *et al.*, 2020; Evans *et al.*, 2011). Of these, the following 11 cetacean species are known to frequent or seasonally visit the waters of the north coast of Scotland: harbour porpoise; bottlenose dolphin; short-beaked common dolphin *Delphinus delphis*; white-beaked dolphin *Lagenorhynchus albirostris*; Atlantic white-sided dolphin *Lagenorhynchus acutus*; Risso's dolphin *Grampus griseus*; long-finned pilot whale *Globicephala melas*; killer whale *Orcinus orca*; minke whale *Balaenoptera acutorostrata*; beaked whale species *Ziphiidae spp*. and humpback whale *Megaptera novaeangliae* (Evans *et al.*, 2011; Hammond *et al.*, 2021; Hague *et al.*, 2020).

Of these species, it is expected that harbour porpoise, white-beaked dolphin, bottlenose dolphin and minke whale occur with the most frequency in the survey area and its surrounding waters based on survey data and available published abundance and distribution data (Evans *et al.*, 2011; Hague *et al.*, 2020). These surveys will take place over the entire OAA. The following summarises those species regularly sighted in the vicinity of the proposed survey area:

- Harbour porpoise – The most abundant cetacean species in UK waters and are generally observed in small groups of one to three individuals (Reid *et al.*, 2003). The density of harbour porpoise within Block S of the Small Cetaceans in Atlantic Waters of the North Sea (SCANS) III survey, within which the project resides, was approximately 0.113 animals/km^2, which is average in the context of the wider United Kingdom Continental Shelf (UKCS) region (Hammond *et al.*, 2021). According to density modelling data (combining SCANS-III density data with environmental predictive factors), it is predicted that harbour porpoise densities within the project area will be low, with higher densities occurring in deeper offshore waters to the north and west of the project (Hague *et al.*, 2020; Hammond *et al.*, 2021). Nevertheless, this species has also been sighted within bays along the North Caithness coast (Evans *et al.*, 2011). Peak densities for the species are recorded across the UK in the summer months (Evans *et al.*, 2011). In addition, the peak calving period for harbour porpoises in Scottish waters is between April and June, indicating a possible increased sensitivity to any potential disturbance during this time. However, the annual distribution and relative abundance of harbour porpoise is highest in the East side of Hoy compared to the North Caithness coast and the West side of Hoy (NMPi, 2023).
- White-beaked dolphin – Common in Northern European continental shelf seas from Iceland and Norway south to Ireland and Southwest England, including the northern and central North Sea. White-beaked dolphin have an estimated density within Block S of the SCANS III survey of 0.007 animals/km^2, which is considered moderate compared to the rest of the UKCS (Hammond *et al.*, 2021). However, it is expected that densities within the project area may be higher than this, given the high predicted densities for this species immediately North and west of the project area (Hague *et al.*, 2020; Waggit *et al.*, 2020). It is expected that white-beaked dolphin will be present within the region year-round with peak densities occurring between June and October. The north of Scotland is used both for feeding and breeding by

white-beaked dolphin, primarily between May and August, when this species may be most sensitive to disturbance (Evans *et al.*, 2011). The annual distribution and relative abundance of white-beaked dolphin is highest off the west coast of Hoy compared to the North Caithness coast and the south coast of Hoy (NMPi, 2023).

- Bottlenose dolphin – More common in Scottish inshore waters than offshore waters. Small resident or semi-resident populations occupy a few scattered coastal localities throughout Scotland (Cheney *et al.*, 2013; Hague *et al.*, 2020). Densities of bottlenose dolphin along the North coast of Scotland are expected to be lower than the West and East coast and densities within Block S of the SCANS-III survey were approximately 0.0019 animals/km^2, which is low to average for the region (Hammond *et al.*, 2021; Hague *et al.*, 2020). Bottlenose dolphins have been shown to prefer coastal habitats (20 – 50 m depths), with densities highest around bays, estuaries or sandbanks (Evans *et al.*, 2011). Concentrations of sightings of this species have occurred in Thurso bay (Evans *et al.*, 2011). This species is present in UK waters year-round, although peak densities are expected to occur between May and September, with a breeding season between May and October when individuals may be particularly sensitive (Evans *et al.*, 2011). The annual distribution and relative abundance of bottlenose dolphin is low throughout the entire survey area with some individuals sighted to the East of John o' Groats (NMPi, 2023).
- Minke whale – The smallest, most prevalent baleen whales to occur in Scottish waters. They feed mainly in shallower waters over the continental shelf and regularly appear around shelf banks and mounds, or near fronts where zooplankton and fish are concentrated at the surface (Reid *et al.*, 2003). They are also commonly seen in the strong currents around headlands and small islands, where they can come close to land, even entering estuaries, bays and inlets. Minke whale density within Block S of the SCANS -III survey is considered to be moderate in comparison to the rest of the UKCS, with an estimate 0.0095 animals/km^2 (Hammond *et al.*, 2021). However, density modelling data suggests densities along the north coast of Scotland are higher than this, particularly along the North coastline of Caithness where the project resides (Hammond *et al.*, 2021; Hague *et al.*, 2020). This species shows a large seasonal variation with much lower densities in the winter months, likely driven by variations in sea surface temperature and chlorophyll concentrations (Hague *et al.*, 2020). Breeding locations of this species are currently unknown. The annual distribution and relative abundance of minke whale is low throughout the area west of Hoy with the exception of the North Caithness coast and East of John o' Groats (NMPi, 2023).
- Other cetacean species –such as Rissos's dolphin, killer whale, short-beaked common dolphin, Atlantic white-sided dolphin, long-finned pilot whale, humpback whales and beaked whale species (*Ziphiidae spp.*), are encountered intermittently throughout the year along the north coast of Scotland. The Shorewatch campaign managed by Whale Dolphin Conservation (WDC) conducted 52,000 watches throughout the UK between 2005-2018 which generated 11,000 sightings of at least 18 cetacean species (Gutiérrez-Muñoz *et al.*, 2021). As previous reports show, there are no obvious spatial or temporal patterns in abundance or distribution for a number of cetacean species (Reid *et al.*, 2003; Evans *et al.*, 2011; Hague *et al.*, 2020) or not within the proposed survey area (Hammond *et al.*, 2021). The occurrences of such sightings and densities of each species are very low (exhibiting densities of <0.01 individual/km^2) (Reid *et al.*, 2003; Robinson *et al.*, 2007; Robinson *et al.*, 2017; Hague *et al.*, 2020; Hammond *et al.*, 2021).

Due to the lack of density data and / or management unit data, the following species have not been included within the EPS Risk Assessment: Rissos's dolphin, killer whale, short-beaked common dolphin, Atlantic white-sided dolphin, long-finned pilot whale, humpback whales and beaked whale species.

Potential Impacts

Sound emissions from the proposed activities constitute the greatest potential risk of injury or disturbance to cetaceans in the vicinity of the survey area. Injury and disturbance from underwater sound may impact cetaceans in the following ways:

- Injury – physiological damage to auditory or other internal organs; and
- Disturbance (temporary or continuous) – disruptions to behavioural patterns, including, but not limited to migration, breathing, nursing, breeding, foraging, socialising and / or sheltering.

To determine the potential for sound impacts to cetaceans predicted emission levels are compared to available empirically estimated thresholds for injury and disturbance. Several threshold criteria and methods for determining how sound levels are perceived by marine mammals are available (e.g., the decibel hearing threshold (dBht) method and other hearing weighted and linear measures) and each has its own advantages and disadvantages. Scottish Government (2020) guidance recommends using the injury and disturbance criteria proposed by Southall *et al.* (2007), which is based on a combination of linear (un-weighted) peak sound pressure levels (SPL) and weighted sound exposure levels (SEL). Since the publication of this paper (Southall *et al.*, 2007), there has been mounting evidence of marine mammal auditory abilities in novel species and well-researched species alike (e.g., harbour porpoise) which has led to amendments to the auditory thresholds for injury (NOAA, 2018; Southall *et al.*, 2019). In accordance with recent regulator feedback, these amended hearing groups and thresholds for acoustic injury have been adopted herein; they are detailed in Table 3-2.

If a sound emission is composed of frequencies which lie out-with the estimated auditory bandwidth for a given species, then disturbance or injury is extremely unlikely. To understand the potential for sound-related impacts, the likely hearing sensitivities of different cetacean hearing groups has been summarised in Table 3-2 which is the basis for screening out MBES and SVP from further assessment as detailed in Table 3-1.

Table 3-2 – Auditory Bandwidths Estimated for Cetaceans (Southall et al., 2019; NOAA, 2018)

HEARING GROUP	ESTIMATED AUDITORY BANDWIDTH
Low-frequency cetaceans (LF): (e.g. baleen whales, such as humpback whales, minke whales, fin whales, etc.)	7 Hz to 35 kHz
High-frequency cetaceans (HF): (e.g. dolphins, toothed whales, beaked whales and bottlenose whales)	150 Hz to 160 kHz
Very high-frequency cetaceans (VHF): (e.g. harbour porpoises and other 'true' porpoises)	275 Hz to 160 kHz

3.1 Other Species

3.1.1 Basking Sharks

Basking sharks are one of the only three species of shark which filter feed and are the second largest fish in the world (Sims, 2008). This species can be found throughout the offshore waters in the UK continental shelf (Sims, 2008) and are considered frequent visitors to the north and west coasts of Scotland (HWDT, 2018; Witt, *et al.*, 2012). They are

widely distributed in cold and temperate waters and feed predominantly on plankton and zooplankton e.g. barnacles, copepods, fish eggs and deep-water oceanic shrimps by filtering large volumes of water through their wide-open mouth. They typically move very slowly (around 6.5 km per hour). In the winter, they dive to great depths to get plankton while in the summer they are mostly near the surface, where the water is warmer.

Basking sharks were hunted in Scotland up to 1994 (Scottish Wildlife Trust, 2023). However, they are now protected in the UK waters principally under Schedule 5 of the Wildlife and Countryside Act 1981 and under the Nature Conservation (Scotland) Act 2004 and are classed as Scottish PMF as well as a species on the Oslo and Paris Convention (OSPAR) list. Due to their size, slow swimming speeds and preference for swimming in coastal waters during the summer months, basking sharks are considered to be at potential risk of collision with vessels associated with the survey activities. Given that basking sharks are slow to mature and have a long gestation period, the species can be slow to recover if populations are rapidly depleted.

Basking sharks seasonally visit Scottish coastlines in the spring and leave in autumn. In the summer, basking sharks spend the majority of time near the surface, where they appear to be basking whilst feeding on plankton. Summer also functions as a potential breeding season for the species, with aggregations of individuals peaking in July and August. They are mainly found around the western isles of Scotland, but at certain times can be found in the Northern Isles or along the east coast as an occasional visitor (Evans *et al.*, 2011; Witt *et al.*, 2012). Basking shark sightings recorded by NatureScot (then SNH), show basking shark sightings along the North Caithness coast and in Orkney waters between 1980 and 2010 (SNH, 2011). Some of which coincide with the proposed survey areas. The NMPi (2023) reports basking sharks to be present in the project area off at a predicted density of 0.00-0.10 animals/km^2.

Potential Impacts

The basking shark is an elasmobranch (sharks and rays) which is a group with generally low sensitivity to sound vibrations due to the fact they do not have a swim bladder. The hearing range of basking sharks is not known; however, five other elasmobranchs have been found to have a hearing range between 20 Hz to 1 kHz. However, this may or may not be transferable to basking sharks (Macleod *et al.*, 2011). As 20 Hz – 1 kHz only encompass a small proportion of the sound emitted during the proposed geophysical surveys, and the activities are of short duration, sound disturbance is not expected to impact basking sharks. On this basis, the potential for sound emissions to impact upon basking sharks is screened out of further assessment.

Vessel collision also poses a threat to this slow-moving species. Collision risk increases with increasing vessel speed. However, as the survey vessels will be slow-moving and will follow a pre-determined survey transect, the potential for collision risk is generally low.

The potential to impact basking sharks is therefore considered very low and will be reduced further on the basis of mitigation measures that OWPL introduce (Section 5). An application for a Basking Shark licence under the Wildlife and Countryside Act 1981 (as amended) will be submitted in support of this EPS Risk Assessment.

In conclusion, it is unlikely that large numbers of basking sharks will be encountered throughout the duration of the survey activities. Moreover, the survey period does not run into September, when basking shark sightings are more prominent in western and northern isles of Scotland (which includes Orkney waters) (Basking Shark Scotland, 2023). However, as basking sharks may be encountered, a basking shark licence is still required. Provided the mitigation proposed for cetaceans is in place (see Section 5.2), the surveys are unlikely to cause any significant adverse impacts to basking shark.

3.1.2 Birds

The primary legislation for the protection of birds is the WCA in combination with the Nature Conservation (Scotland) Act 2004. Under these acts, it is an offence to harm wild bird species, their eggs and nests. Additional protection is provided for certain bird species listed on Schedule 1 of the WCA, and it is an offence to disturb those species at their nest while it is in use.

The Scottish coastal and marine environment offers a number of vital nesting, breeding and foraging habitats for seabird species. The west coast of Scotland hosts some particularly important cliff and island habitats which support seabird populations throughout the year. Seabirds are most vulnerable to human disturbance at sea during the moulting period when many species become flightless and spend a greater portion of time on the sea surface (Pollock *et al.*, 2000). After the breeding season has ended, moulting birds disperse from their coastal colonies and head into offshore waters. This at-sea period increases the likelihood of human disturbance and interactions with surveys vessels, resulting in an increased potential for collision risk. Important life history periods for seabirds have been summarised in Table 3-3.

In addition, there are several species of seabird, shorebird and waterfowl (e.g. ducks) for which SPAs are designated under the requirements of the EU Birds Directive. These SPAs protect key areas for certain species at specific times of the year, e.g. breeding colonies or important foraging areas.

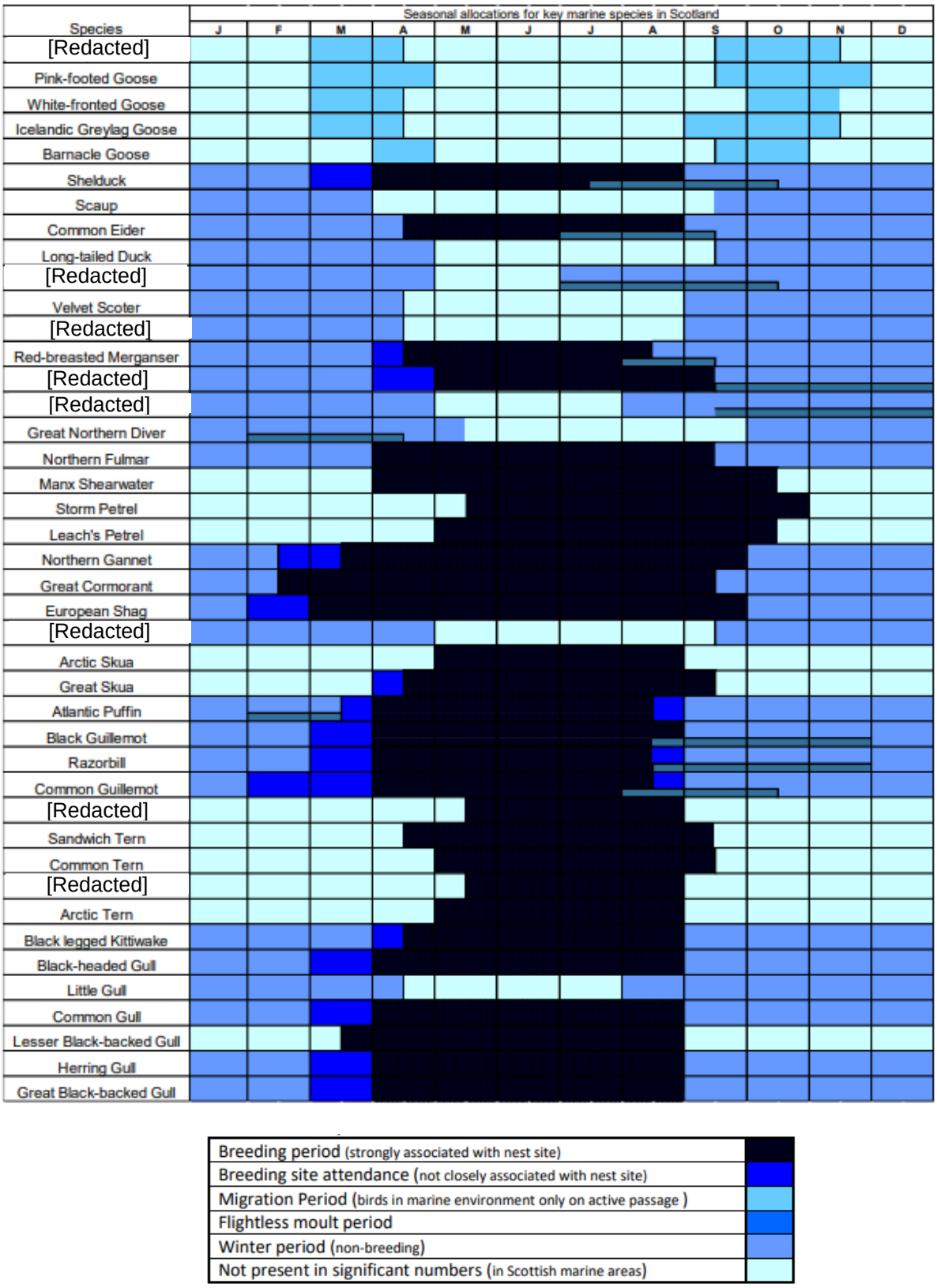
Potential Impacts

During the proposed activities, the physical presence of the survey vessel may cause disturbance to birds in the region. The presence of vessel lighting also has the potential to disorientate fledgling birds, leading to collisions with vessels which may be fatal (Rodriguez *et al.*, 2015). The proposed project activities have the potential to take place at any point between the 12th June 2023 to the 12th August 2023, and therefore have the potential to coincide with the sensitive breeding periods for birds (Table 3-3).

Despite the potential overlap between the proposed activities and sensitive periods for birds which utilise the marine environment, the short-term and temporary nature of the activities, and their limited spatial extent, restrict the potential for introducing significant impacts to birds in the region. Finally, vessels will be travelling slowly and in a predetermined pattern over the course of the survey. Considering that the seabirds are protected by legislation from harm to individuals, eggs, and nests, no further assessment is conducted herein since these impacts will not occur from the project activities.

Impacts on designated conservation sites with seabird features (e.g. SPAs) are considered below in Section 4, and mitigation to control impact on sites protected for seabirds is detailed in Section 5.

Table 3-3 Breeding Season and Nest Occupancy of Seabirds in Scottish Waters (NatureScot, 2020)



3.2 Sound Assessment Criteria

3.2.1 Injury

The Joint Nature Conservation Committee (JNCC) (2010) recommends using the injury criteria proposed by Southall *et al.* (2007), which are based on a combination of linear (i.e. un-weighted) peak pressure levels and mammal hearing weighted (M-weighted) SEL.

The Southall *et al.* (2007) study has been revaluated in light of subsequent scientific advances and as a result revised sound exposure criterion to predict the onset of auditory effects in marine mammals have been published (Southall *et al.*, 2019). The only significant difference between Southall *et al.* (2019) and the National Marine Fisheries Service (NMFS) (2018) is the re-categorisation of mid-frequency and high frequency groups to HF and VHF respectively i.e., very high frequency for greater clarity. This report retains the categorisation used in NMFS guidance, namely, MF and HF.

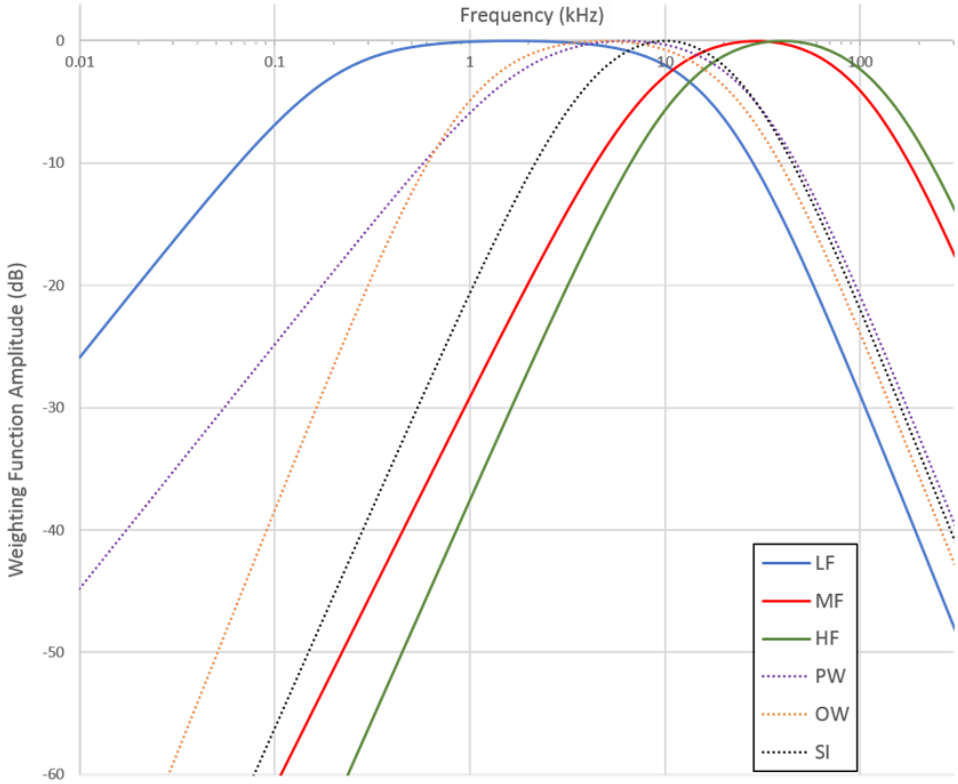
NMFS (2018) provides details of the acoustic thresholds at which individual marine mammals are predicted to experience changes in their hearing sensitivity for acute, incidental exposure to all underwater anthropogenic sound sources. These new thresholds reflect new/updated scientific formation that has demonstrated differences between the marine mammal hearing groups first categorised in Southall *et al.* (2007).

The hearing weighting functions used in NMFS are designed to represent the bandwidths of each group within which acoustic exposures may have auditory effects. This study uses the NMFS (2018) hearing group frequency categories:

- LF i.e. marine mammal species such as baleen whales with an estimated functional hearing range between 7 Hz and 35 kHz;
- Mid-frequency (MF) i.e. marine mammal species such as dolphins, toothed whales, beaked whales and bottlenose whales with an estimated functional hearing range between 150 Hz and 160 kHz
- HF i.e. marine mammal species such as true porpoises, river dolphins and *cephalorhynchus* with an estimated functional hearing range between 275 Hz and 160 kHz); and
- PW – i.e. a suborder of carnivorous aquatic mammals that includes seals, walruses and other similar animals having finlike flippers with an estimated functional hearing range between 50 Hz and 86 kHz.

These are illustrated in Figure 3-1.

Figure 3-1 Auditory Weighting Functions for Pinnipeds and Cetaceans (NMFS, 2018)[2]



3.2.2 Disturbance

There are two regulations which govern disturbance to EPS: Regulation 39(1) and Regulation 39(2). Regulation 39(1) from the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) defines disturbance for all EPS in UK waters and individuals which are vulnerable to disturbance due to biological or environmental circumstances. Regulation 39(2) (for which comparable offence is not found in offshore waters, or in English or Welsh inshore waters) goes beyond the disturbance guidelines provided in Regulation 39(1) by making it an offence to deliberately or recklessly disturb any cetacean in Scottish Territorial Waters (i.e., up to 12 NM) (Scottish Government, 2020). The definitions of disturbance are provided in Table 3-4 below.

Table 3-4 Disturbance Regulations in Scottish Territorial Waters

The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)
Regulation 39 (1) makes it an offence —
(a) deliberately or recklessly to capture, injure, or kill a wild animal of a European protected species;
(b) deliberately or recklessly –

[2] *Sirenians (SI) and Otarids in water (OW) are not relevant to the current study.*

(i) to harass a wild animal or group of wild animals of a European protected species;

(ii) to disturb such an animal while it is occupying a structure or place which it uses for shelter or protection;

(iii) to disturb such an animal while it is rearing or otherwise caring for its young;

(iv) to obstruct access to a breeding site or resting place of such an animal, or otherwise to deny the animal use of the breeding site or resting place;

(v) to disturb such an animal in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species to which it belongs;

(vi) to disturb such an animal in a manner that is, or in circumstances which are, likely to impair its ability to survive, breed or reproduce, or rear or otherwise care for its young; or

(vii) to disturb such an animal while it is migrating or hibernating.

Regulation 39(2) provides that it is an offence —

to deliberately or recklessly disturb any dolphin, porpoise or whale (cetacean).

To consider the possibility of a disturbance offence resulting from the proposed survey, it is necessary to consider the likelihood that survey activities would generate a non-trivial disturbance based on the sensitivity of the species present. Where there is a possibility of disturbing an individual animal, it is necessary to apply for a Marine EPS Licence to ensure that an offence is not committed. However, in issuing a Marine EPS Licence, MS-LOT must consider whether the FCS of any species will be affected. Consequently, the impacts of proposed activities on the FCS of all protected species must be considered to satisfy both Regulation 39(1) and 39(2). The assessment below addresses the impacts of survey activities on the existing conservation status of protected species within the area.

3.2.3 Criteria Summary

The Permanent Threshold Shift (PTS) threshold criteria adopted within the study was those presented in NMFS (2018). These have been reproduced in Table 3-5.

Table 3-5 Marine Mammal Criteria for Onset of PTS (NMFS, 2018)

MARINE MAMMAL GROUP	TYPE OF SOUND	PTS THRESHOLD CRITERIA	
		PEAK SPL, DB RE 1 MPA (UNWEIGHTED)	SEL, DB RE 1 MPA2S (WEIGHTED)
LF cetaceans	Single or multiple pulses – e.g. impulsive	219	183
	Non-impulsive e.g. continuous sound	-	199
MF cetaceans	Single or multiple pulses – e.g. impulsive	230	185
	Non-impulsive e.g. continuous sound	-	198
HF cetaceans	Single or multiple pulses – e.g. impulsive	202	155
	Non-impulsive e.g. continuous sound	-	173

The equipment and environment data were supplied by OWPL and the manufacturers technical specifications. The assessment considered one type of seismic source, namely:

- 2DUHR Triple Stacked (3 x 400 tips sparker).

The details of the sound source modelled is provided in Table 3-6. It should be noted that in some cases the source levels are close to, or less than, the marine mammal group thresholds provided in Table 3-5 and therefore are considered to represent little or no potential for causing marine mammal injury.

Table 3-6 3 x 400 Tip Sparker Sound Model Parameters

3 X 400 TIP SPARKER	
Equipment type	Towed Sparker
Ping length (m/s)	0.2
Peak energy frequency	0.75 kHz
RMS (SPLrms)	218
SPL	221 @ 1 m: dB re 1 µPa
SEL	181 @ 1m: dB re 1 µPa^{2}s
Maximum survey time per 24 hours	Full 24hr period
Water depth	10 m and 74 m
Source depth	0.3 m
Sediment type	Sand

3.3 Sound-Related Impacts to EPS

3.3.1 Summary of Results

The distances at which sound levels decrease to below threshold values associated with potential injury and behavioural change for the different modelled scenarios are summarised in Table 3-7 and

Table 3-8, based on a comparison of the calculated sound level against the criteria described in Section 3.2.3. Injury zones are presented relative to the leading edge of the survey operations. The emitted sound is assumed to be omni-directional, therefore the distances are presented as the radius of the predicted effected zone.

Table cells denoted as 'N/E' indicate that the received sound levels are not expected to exceed the PTS thresholds or distances are less than 1 m form the source.

The proposed survey area covers a range of water depth, with an average depth of 74 m in the deeper areas, to approximately 10 m in the areas closer to shore. The sound propagation model therefore has been undertaken for two different water depths, 10 m and 74 m.

Table 3-7 Radius of Predicted Effect for PTS from the 3 x 400 Tip Sparker (10 m water depth)

SITUATION	PREDICTED DISTANCE AT WHICH SOUND LEVELS DECREASE TO BELOW THRESHOLD VALUES, M			
	LOW-FREQUENCY CETACEAN	MID-FREQUENCY CETACEAN	HIGH-FREQUENCY CETACEAN	PINNIPEDS
Peak pressure SPL (PTS)	2	N/E	15	2
Peak pressure SPL (PTS) + soft start	N/E	N/E	4	N/E
SEL weighted (PTS) of vessel passing static mammal	6	N/E	2	2
SEL weighted (PTS) of vessel passing static mammal + soft start	2	N/E	N/E	N/E
SEL weighted (PTS) of mammal swimming away from moving vessel	2	N/E	N/E	N/E
SEL weighted (PTS) of mammal swimming away from moving vessel + soft start	N/E	N/E	N/E	N/E

Table 3-8 Radius of Predicted Effect for PTS from the 3 x 400 Tip Sparker (74 m water depth)

SITUATION	PREDICTED DISTANCE AT WHICH SOUND LEVELS DECREASE TO BELOW THRESHOLD VALUES, M			
	LOW-FREQUENCY CETACEAN	MID-FREQUENCY CETACEAN	HIGH-FREQUENCY CETACEAN	PINNIPEDS
Peak pressure SPL (PTS)	2	N/E	14	2
Peak pressure SPL (PTS) + soft start	N/E	N/E	4	N/E
SEL weighted (PTS) of vessel passing static mammal	19	N/E	2	3
SEL weighted (PTS) of vessel passing static mammal + soft start	2	N/E	N/E	N/E
SEL weighted (PTS) of mammal swimming away from moving vessel	2	N/E	N/E	N/E
SEL weighted (PTS) of mammal swimming away from moving vessel + soft start	N/E	N/E	N/E	N/E

The distances presented in the tables above reflect the start point of the mammal relative to the source when the source first emits sound. The source (the vessel with the 2DUHR equipment onboard) would then move away from the mammal receiver position, so the distance between the mammal and the source would increase over time whether the mammal was static or moving away from the source.

The potential ranges presented for injury and disturbance should not be interpreted as a hard and fast contour 'line' within which an impact will occur. The contour provides a conservative distance estimate at which sound levels will decrease to below threshold values for PTS, which in reality is a probabilistic combination of a range of variables; exposure dependency in PTS onset, individual variations in hearing, uncertainties regarding behavioural response and swim speed / direction.

3.3.2 Peak Pressure

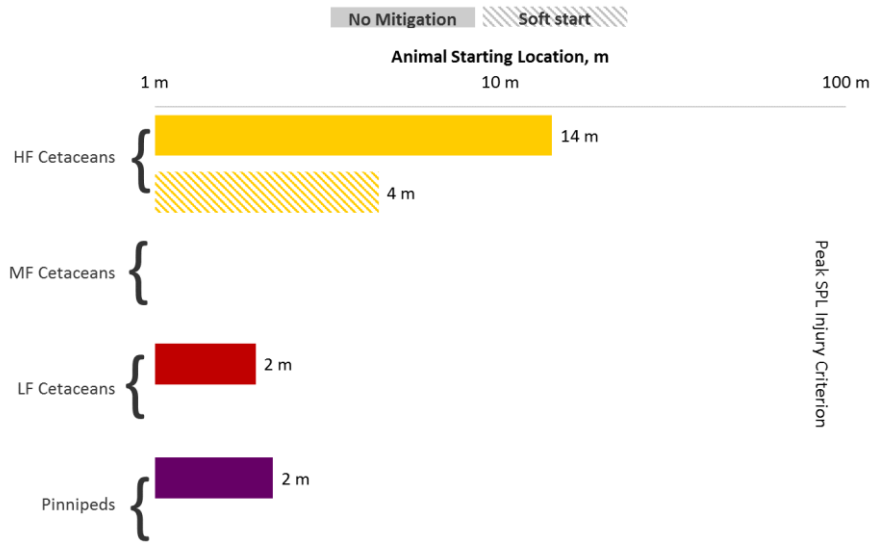
Table 3-7 and

Table 3-8 indicate that the predicted radius of effect for PTS is greatest for the survey conducted in the deeper water column (74 m), therefore only the results from these models will be discussed in the following sections.

The results of the 3 x 400 tip sparker system (Table 3-8), the maximum predicted radius for sound levels to decrease to below the SPL threshold values for PTS is 14 m from the source for HF cetaceans. This distance is predicted to reduce to approximately 4 m when a soft start procedure is implemented. For all other marine mammal groups, the distance at which the sound levels reduce to below the PTS threshold is 2 m and not exceeded following implementation of the soft start procedure.

The peak pressure levels for the baseline and soft start conditions for the 3 x 400 tip sparker sound source are represented graphically in Figure 3-2. Missing distance bars within the Figures indicates that the predicted distances were less than 1 m.

Figure 3-2 Start Distances Resulting in Exceedance of Guideline Peak Criteria for Onset of PTS in Marine Mammals (3 x 400 Tip Sparker)

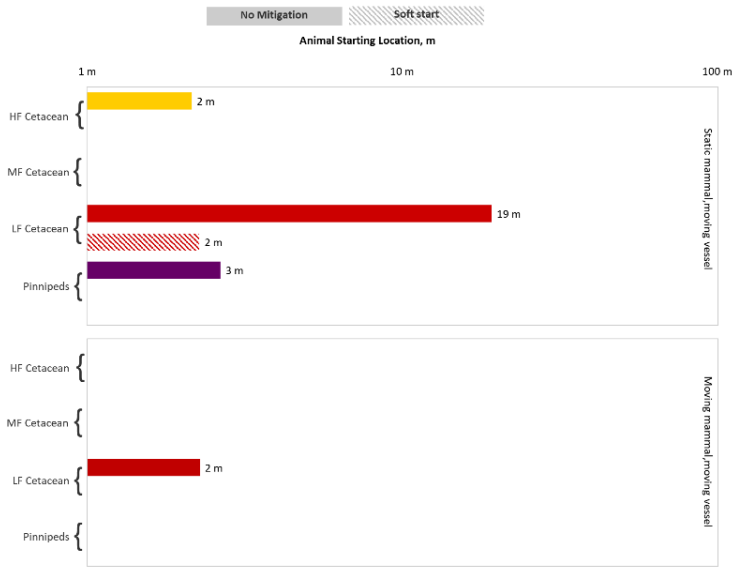


3.3.3 Cumulative Weighted SEL

The sound exposure level for; i) a marine mammal staying stationary relative to the passing source array and ii) a marine mammal moving away from a moving source array at a constant speed of 1.5 m/s are shown in Figure 3-3. Missing distance bars within the Figures indicates that the predicted distances were less than 1 m.

The assumption that the mammal would stay stationary during a period of survey activity is considered to be unrealistic. A more realistic assumption is that, upon hearing the onset of survey activity, the mammal would move away from the sound source, hence the first pulse would provide the highest 'dose' of sound, with each subsequent pulse contributing less to their exposure as they move away from the source. Swim speeds of the species most likely to be observed in the area have been shown to be up to 5 m/s e.g. a cruising minke whale swims at a speed of 3.25 m/s (Cooper *et al.*, 2008) and harbour porpoise up to 4.3 m/s (Otani *et al.*, 2000). Further, Nature Scot (then SNH) (2016) has provided standard parameter values for various mammals which include mean swimming speeds. For example, for harbour porpoises the mean speed is 1.4 m/s (Westgate *et al.*, 1995); harbour seal / grey seals 1.8 m/s (Thompson, 2015); minke whale 2.1 m/s (Williams, 2009). Therefore, to take a representative approach, the predicted exposures of marine mammals moving away from the sound source have been calculated using a mean swim speed of 1.5 m/s.

Figure 3-3 Start Distances Resulting in Exceedance of Guideline SEL Criteria for Onset of PTS in Marine Mammals (3 x 400 Tip Sparker)



The benefit of the soft start operations will be greater at shorter ranges from the source than if the mammal starts further away from the source array. This is because at short distances the sound level is higher and falls away at a faster rate, so an animal swimming at a constant speed will see a larger relative reduction in sound if it starts closer to the source. Care should also be taken in interpreting the results close to the source due to near-field effects for the larger source arrays. However, this is considered to be less of a problem for single source 2DUHR devices, such as those being considered in this assessment.

The mitigation measures outlined in the JNCC guidelines (JNCC, 2017) aim to protect marine mammals from the injury due to survey activities by encouraging vessels to be aware of animals that might be in the area and by increasing sound emissions gradually to give animals the opportunity to move away. With a soft start procedure implemented, the overall radius of potential injury in terms of PTS has been reduced significantly as illustrated in the figure above. The maximum impact distances from the 3 x 400 Tip Sparker system (Figure 3-3) are predicted to be less than 19 m for the LF cetaceans for the static mammal scenario, reducing to 2 m following the soft start procedure. For all other marine mammal hearing groups, the distances at which the sound levels are predicted to decrease to below the threshold values for PTS are less than 3 m for both the static mammal and moving mammal scenarios.

3.3.4 Behavioural Effects

The sound assessment considered the general 160 dB threshold proposed by NMFS (2013) as an indicator of potential behavioural impact zones. As a worst-case the results presented corresponds to a static marine mammal and without any soft start duration. The predicted impact distances for the 3 x 400 Tip Sparker system is summarised in Table 3-9.

Table 3-9 Radius of Potential Behavioural Distances from the 3 x 400 Tip Sparker system Based on Disturbance Threshold from NMFS (2013)

	3 X 400 TIP SPARKER
Behavioural change 160 dB threshold	62 m

For a single source pulse, the model results indicate a predicted worst-case impact radius of 62 m based on 3x 400Tip Sparker system. Behavioural changes such as moving away from an area for short periods, reduced surfacing time, masking of communication signals or echolocation clicks, vocalisation changes and separation of mothers from offspring for short periods, do not necessarily imply that detrimental effects will result for the animals involved. In addition, the pulses will be intermittent rather than a continuous sound, which will reduce the period over which sound is experienced and allow animals to echolocate and communicate between pulses. Some whales are known to continue calling in the presence of pulses since the vocalisations can be heard between pulses (e.g. Greene and McLennan, 2000, Madsen *et al.*, 2002). It is therefore considered that the zone of behavioural change will not be a zone from which animals are necessarily excluded, but rather one in which normal behaviour might be affected across a range of potential responses, from a simple noticing of the sound to a startl response and return to normal behaviour, through to exclusion from an area. The fact that an animal is within this area does not necessarily mean that disturbance will occur. Mitigation of the potential impacts of anthropogenic sound on cetaceans focuses on reducing near field injuries, and risk assessments are based on the assumption that the animals move away from loud sources of sound. While this is supported by various studies, observations also show a decline in response to airgun sound during the seismic survey. The findings of Thompson *et al.* (2013) suggest that broader-scale exclusion from preferred habitats is unlikely. Instead, individual's fitness and demographic consequences are likely to be subtle and indirect, highlighting the need to develop frameworks to assess the population consequences of sub-lethal changes in foraging energetics of animals occurring within affected sites.

To determine the likelihood of impact in terms of actual number of animals, it is possible to calculate the number of animals likely to experience some sort of behavioural impact using local density and population estimates. Density estimates from the area covering the North Sea are not well understood for many cetacean species but estimates from SCANS-III (detailed in Hammond *et al.*, 2021) provide regional density estimates for some of the species most regularly found in vicinity of the survey.

To understand how the number of animals that might be affected might constitute a non-trivial disturbance offence, it is important to understand what proportion of the population this number represents. Temporarily affecting a small proportion of a population would be highly unlikely to result in population level effects, thus not considered as being qualifying as non-trivial disturbance. In contrast, affecting a large proportion of a population may be considered non-trivial disturbance. Determining this proportion is not a simple task since it is not clear how northeast Atlantic marine mammal populations act at a local level. For example, minke whales are likely to make use of the entire northeast Atlantic, so the population can be viewed as one, whilst other species, such as bottlenose dolphins, may display more local fidelity and be viewed as a series of sub-populations.

The Statutory Nature Conservation Bodies (SNCBs) (Hammond *et al.*, 2021; IAMMWG, 2021, JNCC, 2010;) note that marine mammals of almost all species found in UK waters are part of larger biological populations whose range extends into the waters of other States and/or the High Seas. To obtain the best conservation outcomes for many

species, it is necessary to consider the division of populations into smaller management units. This requires an understanding of the geographical range of populations and sub-populations, to provide advice on impacts at the most appropriate spatial scale. The output of the SNCB exercise investigating how marine mammal populations may act is the determination of Marine Mammal Management Units (MMMU) for species including harbour porpoise, bottlenose dolphin, Risso's dolphin and minke whale. These MMMUs and associated population estimates can be interpreted in the context of the potential disturbance zones to consider the potential for a significant impact to occur.

Harbour porpoise, bottlenose dolphin, minke whale and white-beaked dolphins have been recorded within the project area. The number of individual cetaceans potentially affected by the proposed operations are detailed in Table 3-10.

Due to the lack of density data and / or management unit data, the following species have not been included within the EPS Risk Assessment: Rissos's dolphin, killer whale, short-beaked common dolphin, Atlantic white-sided dolphin, long-finned pilot whale, humpback whales and beaked whale species.

The number of individual animals that are likely to exhibit some form of change in behaviour for the period in which they encounter sound from the proposed operations is relatively small. Therefore, the proposed operations would be largely undetectable against natural variation and would have no significant effect at the population level.

The information provided indicates that there is a very low likelihood of injury or non-trivial disturbance as a result of the proposed survey (Table 3-10). The sound emitted from the source will dissipate relatively very quickly and there will be no accumulation of the sound levels. Therefore, whilst animals may move away from the sound source, they are likely to be able to return to the area following the passing of the survey vessel. Hence, it was considered that the single pulse approach represented a realistic case.

Table 3-10 Estimated Number of Cetaceans Experiencing Behavioural Changes Based on a Single Pulse of the 3 x 400 Tip Sparker (62 m) (Hammond et al., 2021; IAMMWG, 2021, NMPi, 2023; SCOS, 2020)

SPECIES	SCANS-III DENSITY (ANIMAL) ESTIMATES PER KM^2	MAXIMUM NUMBER OF ANIMALS PREDICTED TO BE IN THE BEHAVIOURAL CHANGE IMPACT ZONE AT ANY ONE TIME (DENSITY X BEHAVIOURAL CHANGE AREA)	MANAGEMENT UNIT (MU) / BIOGEOGRAPHICAL POPULATION ESTIMATE (IAMMWG, 2021 & SCOS, 2020)	PERCENTAGE OF REFERENCE POPULATION POTENTIALLY AFFECTED (%)
Harbour porpoise	0.152	0.00182	346,601	0.0000005
Bottlenose dolphin	0.0037	0.00004	2022[3]	0.0000022
Minke whale	0.0095	0.00011	20,118	0.0000006
White-beaked dolphin	0.021	0.00025	43,951	0.0000006

3.3.5 Basking Sharks

As discussed in Section 3.1.1, basking sharks are not expected to be heavily influenced by sound due to being an elasmobranch and not having a swim bladder. However, given the uncertainty surrounding the hearing range of basking sharks and the small possibility of the species being present in the study area, a sound assessment has been included on a precautionary basis to support the application for a basking shark license. There are no available impact criteria based on 2DUHR equipment. The most relevant criteria for basking sharks are considered to be those contained in the Sound Exposure Guidelines for Fishes and Sea Turtles (Popper *et al.*, 2014). The guidelines set out criteria for injury and other impacts for elasmobranch fish from seismic airguns but not specifically for sources like sparkers or chirpers. The criteria for the different types of sources include a range of indices; SEL, rms and peak sound pressure levels. Where insufficient data exist to determine a quantitative guideline value, the risk is categorised in relative terms as "high", "moderate" or "low" at three distances from the source: "near" (i.e. in the tens of metres), "intermediate" (i.e. in the hundreds of metres) or "far" (i.e. in the thousands of metres). It should be noted that these qualitative criteria cannot differentiate between exposures to different levels of sound and therefore all sources of sound, independent of source level, would theoretically elicit the same assessment result.

The Popper *et al.* (2014) criteria presented for seismic surveys using airguns are reproduced in Table 3-11 for elasmobranch fish (i.e no swim bladders). These have been adopted in the assessment due to the lack of threshold criteria for 2DUHR sources and are likely to overestimate the potential impact areas due to a variation in sound generation; electric signals from 2DUHR sources compared to pulses from airguns which are created by the release of high-pressure air. However, it is still considered to provide a useful metric to inform the assessment of potential impacts.

[3] There is no abundance estimate for bottlenose dolphin in the Coastal East Scotland Management Unit, in which the survey area is located. Abundance estimates for the nearby Greater North Sea Management Unit were used instead as they represent a worst-case for the percentage of population impacted (%).

Table 3-11 Threshold criteria for Potential Impacts to Elasmobranch Fish due to Seismic Activities (Popper et al., 2014)

TYPE OF ANIMAL	PARAMETER	MORTALITY AND POTENTIAL MORTAL INJURY	IMPAIRMENT		BEHAVIOURAL RESPONSE
			RECOVERABLE INJURY	TTS	
Elasmobranch fish: no swim bladder (particle motion detection)	Peak, dB re 1 µPa	>213	>213	-	(*Near*) High (*Intermediate*) Mod. (*Far*) Low
	SEL_{cum} dB re 1 $\mu Pa^2 \cdot s$.	>219	>216	>>186	

While detailed modelling for basking sharks has not been carried out, the distances at which sound level decreases to below the various threshold values for elasmobranch fish due to the proposed survey operations are presented in Table 3-12.

The distance at which the sound level exceeds the threshold values during the proposed survey operations using the Popper *et al.* (2014) criteria is small. The results indicate that for the 3 x 400 Tip Sparker system, sound levels will decrease to below threshold values for potential mortality beyond 4 m distance from the source for basking sharks. For Temporary Threshold Shifts, the distance is reduced to 1 m. Basking sharks not in the immediate vicinity of the sound generating activity are generally able to move away and avoid the likelihood of physical injury.

In terms of disturbance (or behavioural response) the impacts from geophysical survey operations are presented in qualitative terms rather than quantitatively. Based on these qualitative criteria, there is a high level of risk of disturbance up to 'tens of metres' from the moving device, moderate at distances of 100s of metres and low beyond this (i.e. 'far').

Wardle *et al.* (2001), Mosbech *et al.* (2000) and Wardle *et al.* (1998) state that the potential disturbance zone for fish from intermittent sources like seismic survey sound sources may extend to hundreds of metres or a few kilometres, although these references relate to airgun sources. Whilst these studies are not specific to basking sharks, they provide an insight into how they may react to seismic survey sound. The movement of basking sharks tens or hundreds of metres away from the potential injury or disturbance impact zones would not constitute a large-scale movement by individuals of a species and is unlikely to result in population level impacts. Similarly, the potential impact of basking sharks outside the impact area finding the sound levels too high to enter would be unlikely to result in population level impacts.

In summary, using the approach adopted by Popper *et al.* (2014), the area of behavioural change will extend beyond 10 m from the source, but the risk of disturbance will be moderate and is unlikely to be significant beyond 1 km. Given the fact that the operations will be constantly moving and the relatively short period of activity no habituation to the sound is likely.

Table 3-12 Impact Assessment on Elasmobranch Fish from the 3 x 400 Tip Sparker system

TYPE OF ANIMAL	PARAMETER	MORTALITY AND POTENTIAL MORTAL INJURY	IMPAIRMENT		BEHAVIOURAL RESPONSE
			RECOVERABLE INJURY	TTS	
Elasmobranch fish: no swim bladder (particle motion detection)	Peak, dB re 1 µPa	4 m	4 m	-	(*Near*) High (*Intermediate*) Mod. (*Far*) Low
	SEL_{cum} dB re 1 µPa ^{2}·s.	N/E	N/E	1 m	

Summary of basking shark impact assessment

The impact assessment results for basking sharks have been based on threshold criteria for seismic airgun sources, as there is no impact criteria data available for 2DUHR sources. Therefore, the information presented in this report is considered conservative.

Using Popper *et al.* (2014), a qualitative assessment has been undertaken for the 3 x 400 Tip Sparker. The distance at which the sound level decreases to below the threshold values is very small for all equipment assessed:

For the 3 x 400 Tip Sparker, the distance is approximately 4 m; and for temporary threshold shifts the distance is 1 m.

As noted, these distances are considered to be very small and therefore realistically, the potential impact associated with 2DUHR sources on basking sharks is negligible.

3.3.6 Mitigation

The underwater sound assessment and calculations have predicted that the use of soft start procedures will reduce the overall impact of the survey on marine mammals. It should also be considered that the survey equipment is designed to produce a downward focused sound source; with sound levels reducing with horizontal distance. Thus, relative to a fixed point in the survey area, the sound levels will gradually increase as the survey vessel approaches, reaching a peak when the vessel is directly above, and reducing to background levels moves away. Therefore, marine mammals or basking sharks within the wider survey area would be subject to varying sound levels over time as the survey vessel and source moves around the survey area, rather than being subject immediately to the levels considered in the assessment and will have the opportunity to vacate the area. The gradual increasing sound levels with the approaching vessel could also be considered akin to a soft-start procedure.

The JNCC guidelines for minimising the risk of disturbance and injury to marine mammals from geophysical surveys (JNCC, 2017) are summarised below. Compliance with these guidelines is considered to constitute best practice and will in most cases, reduce the risk of deliberate injury to marine mammals to negligible levels. Whilst guidelines do not deal with disturbance directly it is considered that the mitigation measures as recommended will also assist in

reducing the potential for disturbance. In addition, modelling indicated that disturbance would occur within up to 62 m of the sound source as a worst-case (see Table 3-9), which will be within the pre-source start search and mitigation zone discussed below, therefore reducing the potential for impact further.

Marine Mammal Observer (MMO) and Passive Acoustic Monitoring (PAM)

MMOs on board the survey vessel will monitor for the presence of marine mammals, during the pre-source start search, soft-start and survey, and will recommend delays in the commencement of source activity should any marine mammals be detected within the 500 m mitigation zone. Dedicated PAM operators may also be required to cover the hours of darkness and during periods when day-time conditions are not conducive for visual surveys (e.g. fog or increased sea states). The survey contractor will be providing a team to cover 24-hour observations / PAM during the survey.

Pre-Source Start Search and Mitigation Zone

All observations (MMO or PAM) will be undertaken during a pre-shooting search of 30 minutes i.e. prior to the commencement of any use of the seismic sources / high resolution surveys (e.g. 2DUHR) in waters < 200 m. This will involve a visual (during daylight hours) and/or acoustic assessment (during hours of darkness / reduced visibility) to determine if any marine mammals are present within the 500 m mitigation zone from the centre of the device deployed. If marine mammals are detected in the mitigation zone during the pre-shooting search then operations must be delayed until their passage, or the transit of the vessel, results in the marine mammals being outside of the mitigation zone. Either way there should be a minimum of a 20-minute delay from the time of the last sighting within the mitigation zone and the commencement of the soft-start and / or start of operations, to allow animals unavailable for detection to leave the area.

Soft-Start

There should be a soft start conducted every time prior to survey operations.

Regardless of duration, where possible power should be built up gradually, in uniform stages from a low energy start-up. Surveys should be planned to avoid unnecessary firing at operational power before commencement of an acquisition line and to time operations to commence data collection as soon as possible once full operational power is achieved.

Survey operations should be planned to avoid unnecessary time at operational power before the commencement of an acquisition line and to time operations to commence data collection as soon as possible once full operational power has been achieved.

Line Changes

In line with the JNCC guidelines, where line turns are expected to take longer than 40 minutes:

Sound source is to be terminated at the end of the survey line;
A pre-source start search will be undertaken during the line change;
The soft start procedure is to be delayed if marine mammals are sighted within the 500 m mitigation zone during pre-shooting; and
A full 20-minute soft-start will be undertaken before the start of the next data acquisition line.

Reporting

All recordings of marine mammals will be made using JNCC Standard Forms. At the end of the survey, a monitoring report detailing the marine mammals recorded, methods used to detect them, and details of any problems encountered will be submitted to the JNCC. The report will also include feedback on how successful the mitigation measures were. This requirement will be communicated to the MMO at project start up meetings and at crew change. If the MMO has any queries on the application of the guidelines during the survey, they will contact the JNCC for advice.

3.3.7 Conclusions

There will be no injurious impacts to cetaceans as a result of project activities and no requirement to apply for an EPS licence in that respect, once the proposed mitigation measures are applied (Section 5). However, there is potential for disturbance to cetaceans, and OWPL will therefore apply for an EPS licence in respect to this disturbance. The disturbance is expected to be limited to one or a few individuals of the local population and will therefore not result in any adverse impact to the FCS of any cetacean species. Overall, the proposed survey operations constitute work of overriding public interest while presenting minimal and temporary disturbance to a few individual animals in very limited areas.

4 PROTECTED SITES RISK ASSESSMENT

4.1 Relevant Protected Sites

In addition to assessing potential impacts on protected species, potential impacts to protected sites from the proposed survey works need to be considered to inform the HRA process, if required.

The designated sites located in the vicinity of the proposed survey area which have the potential to be impacted by the survey activities are outlined in Table 4-1 and shown in Figure 1-1. These have been selected based on the criteria outlined in Section 1.4.4. It should be noted here that sites designated for benthic features have not been included within this assessment, as geophysical surveys do not result in any interaction with the seabed and therefore are not considered to pose any risk of likely significant effects to these sites.

For each designated site that has the potential to be impacted by the survey, mitigation measures have been identified relevant to site-specific qualifying features and these are also included within Table 4-1. Further details of the mitigation measures are provided in Section 5. Some of the mitigation measures included in Section 5 may not be listed in Table 4-1. If they are not related to protecting designated features of those sites. However, all mitigation measures in Section 5 will be applied to all activities, regardless of proximity to protected sites.

Table 4-1 Protected Sites in the Vicinity of the Survey Areas

SURVEY AREA NAME	DESIGNATED SITE POTENTIALLY AFFECTED*	CRITERIA FOR POTENTIAL CONNECTIVITY TO THE SITE	DISTANCE FROM NEAREST PART OF SURVEY	RELEVANT QUALIFYING FEATURES OF DESIGNATED SITE	PROPOSED MITIGATION MEASURES	POTENTIAL FOR LIKELY SIGNIFICANT EFFECT
OAA survey area	Sule Skerry and Sule Stack SPA	The designated site is within 2 km of the survey area.	<2	European storm petrel *Hydrobates pelagicus*, Leach's storm petrel *Oceanodroma leucorhoa*, Northern gannet *Morus bassanus*, Atlantic puffin, common guillemot, European shag *Phalacrocorax aristotelis*.	M8 – M10	No

*** It should be noted that it is deemed Sites of Special Scientific Interest (SSSI) and National Scenic Areas (NSA) etc. are wholly or partially encompassed by associated SACs and/or SPAs, and hence do not require specific assessment within this EPS Risk Assessment – such an example is the Sule Skerry and Sule Stack SSSI.*

4.2 Assessment of Impacts on Protected Sites

4.2.1 Protected Sites with Cetaceans or Basking Sharks as a Qualifying Feature

Although cetaceans are present in the area, the proposed survey area is not within 50 km of a SAC with cetacean and/or basking shark as a designated feature. A full assessment of the potential impact on cetaceans from the survey activity is provided in Section 3. It can be concluded that there is unlikely to be impacts to basking sharks as they do not frequent the area with any regularity. As discussed in Section 3.3.5, there are not expected to be any sound related impacts to basking sharks as a result of the proposed operations.

4.2.2 SACs with Otters as a Qualifying Feature

[Redacted]

4.2.3 Protected Sites with Seals as a Qualifying Feature and Seal Haul-Out Sites

The proposed survey is not within 500 m of any seal haul-out sites. There are no SACs with harbour seals as designating features within 50 km of the survey area. Similarly, there are no SACs with grey seals as a designating feature within 20 km of the proposed survey area.

4.2.4 Protected Sites with Seabed and/or Benthic Protected Features

There are no sites with vegetation or ground features that overlap or are located within proposed survey area.

4.2.5 SPAs and NCMPAs with Birds as Qualifying Features

Sule Skerry and Sule Stack SPA

Sule Skerry and Sule Stack are isolated islets off the west coast of Orkney. Sule Skerry is larger, lower and has more vegetation than Sule Stack which is a higher bare rock with very little vegetation (JNCC, 2022).

The Sule Skerry and Sule Stack SPA qualifies under Article 4.1 of the Habitats Directive (79/409/EEC) by regularly supporting populations of European importance of the Annex I species: European storm petrel (500 – 5,000 pairs, representing 1 – 6% of the British population); and Leach's storm petrel (5 pairs, < 0.1% of the British population).

Sule Skerry and Sule Stack SPA qualifies under Article 4.2 of the Habitats Directive (79/409/EEC) by regularly supporting population of European importance of the migratory species: Northern gannet (5,900 pairs, 2.2% of world biogeographic population); and Atlantic puffin (46,900 pairs, 5% of the biogeographic population).

Sule Skerry and Sule Stack SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. The site regularly supports 100,000 seabirds including nationally important populations of the following species: common guillemot (6,298 pairs, 0.9% of British population); European shag (874 pairs, 2.3% of the British population); Atlantic puffin (46,900 pairs, 10.4% of the British population); Northern gannet (5,900 pairs, 4% of the British population); European storm petrel (5,000 pairs); and Leach's storm petrel (5 pairs).

The conservation objectives of the SPA are:

- To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and
- To ensure for the qualifying species that the following are maintained in the long term:
    - Population of the species as a viable component of the site;
    - Distribution of the species within site;
    - Distribution and extent of habitats supporting the species;
    - Structure, function and supporting processes of habitats supporting the species; and
    - No significant disturbance of the species.

The proposed OAA survey area is approximately 1.7 km from the SPA. The proposed activities will start no earlier than the 12th June 2023 with activities expected to finish by the 12th August 2023.

Seabird species which are qualifying features of Sule Skerry and Sule Stack SPA have the potential to be disturbed by the physical presence of the vessel during the survey activities. Additionally, survey activities will overlap with the breeding season. Despite the potential overlap between the survey vessel and breeding birds utilising the marine environment, vessel presence will not result in killing of individuals or the disturbance of eggs and nests as survey operations will be wholly within the marine environment.

Additionally, the survey vessel will be moving slowly (4-8 knots), limiting any potential collision risks to birds and disturbance to foraging potential. This slow speed will also allow any rafting birds time to disperse before the vessel arrives. When not involved in active survey the vessel will avoid bird rafts where operationally possible. Within the survey area, lighting on-board the survey vessel(s) will be kept to the minimum level required to ensure safe operations and lights will be directed or shielded to prevent upward illumination and minimise disturbance.

Taking into account the limited temporal and spatial impact and the proposed mitigation, the survey activities are highly unlikely to cause significant effects on the qualifying bird features of the SPA and the conservation objectives of the protected site will not be compromised.

LSE on Protected Sites with Birds as Qualifying Features

Several seabird species have the potential to be disturbed by the physical presence of vessels during the geophysical survey activities. Moreover, as shown in Table 3-3, the breeding season for the majority of seabirds in Scottish waters takes place between April and August. The proposed survey overlaps with this timeframe and therefore has the potential to disrupt breeding activity. However, despite the potential overlap between survey vessels and breeding birds utilising the marine environment, the short duration of the survey activities, both spatially and temporally, will

not result in killing of individuals or disturbance of eggs and nests as survey operations will be wholly within the marine environment. Furthermore, the survey vessel will be moving slowly, limiting any potential collision risks to birds and disturbance to foraging potential.

Therefore, with the implementation of the mitigation measures set out in Section 5, the survey activities are highly unlikely to cause significant effects on the FCS of the qualifying bird features of the SPAs or proposed (p)SPAs and the conservation objectives of the protected sites will not be compromised.

4.2.6 Other Areas of Importance

As detailed in Table 4-1, it is deemed SSSI and NSA sites are wholly or partially encompassed by associated SACs and/or SPAs, and hence do not require specific assessment within this EPS Risk Assessment – such an example is the Sule Skerry and Sule Stack SSSI. Details of the SSSI are already covered in the description of the SPA above.

4.2.7 Cumulative Effects

There are several assets in the region of the proposed surveys and wider area, which could potentially result in cumulative effects to the qualifying features of the designated sites identified above. However, any disturbance to the qualifying features of the designated sites listed in Table 4-1 is anticipated to be extremely spatially and temporally limited. It is not expected that these survey activities could result in a significant increase in the potential for LSE to occur at the designated sites. It should be noted that a proposed geotechnical survey is also planned to take place in the OAA during approximately the same timeframe. The planned geotechnical survey includes the use of Ultra-Short Baseline (USBL) and therefore may result in cumulative noise impacts. However, as the geotechnical USBL will be targeted at the seabed, impacts to background noise levels in the water column (where the majority of noise sensitive organisms inhabit) are likely to be minimal. Therefore, any cumulative noise impacts from the two proposed surveys is expected to be limited.

4.2.8 Conclusions

The survey areas do not lie within the distance for assessment (Section 1.4.4) of protected sites with cetaceans, [Redacted] seals, basking sharks or vegetation / benthic features as qualifying features.

Following the implementation of the mitigation outlined in Section 5, there will be no risk of injury to cetacean species, and the potential disturbance resulting from underwater sound emissions will be extremely localised and temporary. As such, no LSE are expected for cetaceans in the area.

The survey area is in close proximity to a single protected site which has bird species as a designating feature (Sule Skerry and Sule Stack SPA). Given the proximity, there is the potential for disturbance of birds whilst foraging at-sea. However, any disturbance to birds will be localised and temporary, and these impacts are not expected to have any long-term significant effects on the bird species for which these sites are designated, and therefore no LSE are anticipated.

Due to the temporary and localised nature of the proposed survey activities and the mitigation measures outlined in Section 5, no significant impact is anticipated on the conservation objectives of any protected site, with no potential for cumulative effects identified. The proposed survey operations are required to facilitate the progression of developments of a proposed wind farm and associated cable routes, which will allow an increase in renewable energy generation capacity, and the national reliance on fossil fuels. Hence, the survey activities constitute work of an overriding public need whilst presenting a minimal and temporary disturbance in a limited area.

5 PROTECTED SITES AND SPECIES PROTECTION MEASURES

5.1 Overview

This section summarises the proposed mitigation measures to be implemented for avoiding and reducing potential impacts on species that may be present in the vicinity of the survey works.

Species and task specific mitigation is provided below; however, the following measures will be implemented during all survey works:

- The survey vessel will adhere to the provisions of the Scottish Marine Wildlife Watching Code (SNH, 2017); and the Basking Shark Code of Conduct; and
- Survey teams will be made aware of all protected species within the marine environment, and their responsibility to implement the mitigation in this document.

5.2 Marine Mammals

A Marine Mammal Protection Plan (MMPP) has been prepared in order to reduce risk of injury and disturbance to marine mammals resulting from 2DUHR survey operations, this is aligned to JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys (JNCC, 2017). The key components of the MMPP for 2DUHR sources include:

- Deployment of a MMO to monitor for the presence of cetaceans and seals, prior to the commencement of 2DUHR operations;
- Soft start of survey equipment;
- Survey operations will be run 24/7, however it is noted that up to a maximum of 12 hours a day occurring only during hours of daylight is the best practise;
- During times of poor visibility when the MMO cannot monitor for the visibility of seals, the equipment will not be started within 100 m of any designated seal haul-out site. The 2DUHR will be started out with this distance, and the vessel then moved into position once the 2DUHR is sounding;
- During times of poor visibility, PAM will be used to enhance detection of vocalising marine mammals prior to the commencement of 2DUHR operations;
- 500 m mitigation zone for cetaceans;
- 500 m mitigation zone for seals, reducing to 100 m in the event of a need to avoid critical delay to the project; and
- Reporting of survey activities and marine mammal sightings.

5.2.1 M1 – Marine Mammal Monitoring

There will be MMO coverage for the commencement of 2DUHR activities. They will have experience of working at sea and be equipped with binoculars offering at least 8x magnification. The MMO(s) will be located at a suitable vantage point, providing good all-round visibility.

5.2.2 M2 – Marine Mammal Observer

The MMO(s) will carry out visual observations to monitor for the presence of cetaceans and seals before the 2DUHR equipment are activated and will recommend delays in the commencement of the operation should any cetaceans be detected within the 500 m mitigation zone. This 500 m distance will also be applied for seals, except in the event of a need to avoid critical delay to the project in which case the mitigation zone for both species' groups will be 100 m. The criteria as to what constitutes a critical delay leading to reduction in mitigation zone distance from 500 m to 100 m would be agreed on a case-by-case basis in consultation with MS-LOT.

5.2.3 M3 - Passive Acoustic Monitoring (PAM)

When visibility is poor (i.e., due to fog or during hours of darkness) and/or during periods when the sea state is greater than Beaufort 3, UHRS operations shall not be commenced unless a PAM system is deployed to facilitate detection of cetaceans. Where utilised, PAM system will be operated by a single MMO/PAM operator, and shall comprise of at least 3 hydrophone elements, allowing for directional localisation of detections, together with software allowing real time automated detection of marine mammal vocalisations (e.g., PAMGuard or equivalent).

5.2.4 M4 – Pre-Start Search

Visual observations (MMO) will be conducted for a pre-start search of 30 minutes (i.e., prior to the commencement of 2DUHR operations). This will involve a visual (during daylight hours) to determine if any cetaceans or seals are within 500 m of the activities (or 100 m for seals in the event of the critical delay described in mitigation measure M2).

5.2.5 M5 – Cetacean, Seal and Basking Shark Mitigation Zone

The mitigation zone is defined as the area within 500 m of the survey equipment. Should any cetaceans, seals or basking sharks be detected within the mitigation zone prior to the commencement of the 2DUHR source and survey operations (or after breaks in 2DUHR survey activity of more than 10 minutes), operations will be delayed until cetaceans, seals or basking sharks are no longer present within the mitigation zone. There will be a 20-minute delay from the time of the last sighting within the mitigation zone to the commencement/recommencement of the 2DUHR source and survey operations.

The mitigation zone for seals and basking sharks may be reduced from 500 m to 100 m in the event of a need to avoid critical delay to the project, subject to agreement with the regulator.

5.2.6 M6 – Designated seal haul-outs

During hours of darkness and in poor visibility when the MMO cannot monitor for the visibility of seals, the equipment must not be started within 100 m of any SAC designated for seals or designated seal haul-out site. The 2DUHR source must be started out-with this distance, and the vessel then moved into position once the 2DUHR source is sounding.

OWPL will ensure that survey works within 200 m of land will be scheduled to take place out-with the grey seal breeding or moulting seasons.

If the MMO confirms that no seals are hauled out onshore inside the SAC such that they would be within 200 m of the vessel; the above seasonal restrictions shall not apply to vessel based nearshore survey operations, and the vessel will be permitted to continue working within 200 m of land.

5.2.7 M7 – Reporting

All recordings of cetaceans and seals will be made using JNCC Standard Forms. At the end of the operations, a monitoring report detailing the cetaceans recorded, methods used to detect them, and details of any problems encountered will be submitted to Marine Scotland. The report will also include feedback on how successful the mitigation measures were. This requirement will be communicated to the MMOs at project start up meetings.

5.3 Seabirds

5.3.1 M8 – Rafting seabirds

The survey vessels will be moving at a maximum speed of 4-8 knots during survey operations, to allow any rafting seabirds time to disperse before the vessel arrives. When not on survey effort, vessels will avoid bird rafts where operationally possible, and it is safe to do so.

5.3.2 M9 – Light disturbance

When within the survey area, and where there is potential for 24-hour working, the following measures will be implemented to minimise the potential impacts to birds:

- Lighting on-board the survey vessel(s) will be kept to the minimum level required to ensure safe operations; and
- Lights will be directed or shielded to prevent upward illumination and minimise disturbance; and
- Blackout blinds and/or curtains will be used where possible when working in marine SPAs.

5.3.3 M10 – Breeding Birds

When in proximity to an SPA which has been designated for breeding birds that may nest or feed in close proximity to the survey area, further consultation will be undertaken with NatureScot on the requirement for any seasonal restriction to be implemented for equipment calibration and testing, as well as geophysical survey activities in order to avoid disturbance to qualifying species during the most sensitive time of the year.

6 CONCLUSION

This risk assessment has assessed the risk posed by the survey activities associated with the geophysical survey to cetaceans, seals, basking sharks, birds, otters and protected sites. This has included assessing the risk caused by sound emitted from the geophysical survey equipment, collision impact and disturbance to the following receptors

- Cetaceans;
- Basking Sharks;
- SACs with cetacean, seal and otter qualifying features;
- NCMPAs with cetacean, bird and otter qualifying features; a
- Designated seal haul-outs and seal breeding sites; and
- SPAs.

This assessment has concluded that the nature of the survey works, and considering the proposed mitigation, means that no adverse impact through injury to EPS or other protected species is anticipated, and an EPS licence is not required in this regard. However, the use of the 2DUHR survey equipment may cause disturbance to cetaceans and basking shark and as such an application for EPS Licence and Basking Shark Licence for disturbance will be sought by OWPL.

As outlined in the criteria summary (Section 1.4.4) the Sule Skerry and Sule Stack SPA is located within <2 km from the survey area and has therefore also been assessed. No other relevant protected sites were identified for assessment according to the selection criteria outlined in Section 1.4.4. Due to the temporary and localised nature of the survey activities, there is expected to be no long-term impacts to the qualifying interests of protected sites. A number of mitigation strategies will also be followed to further reduce any potential impacts. It is therefore concluded that, the proposed works will not affect the conservation objectives of the above sites.

Overall, the proposed survey operations constitute work of an overriding public need while presenting minimal and temporary disturbance in a limited area.

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APPENDIX A CO-ORDINATES ENCOMPASSING THE ENTIRE SURVEY AREA

Coordinate no.	Co-ordinates for the survey work (WGS 84)	
	Latitude DMS	Longitude DMS
1	59° 05' 13.351" N	4° 15' 54.257" W
2	58° 57' 30.527" N	3° 55' 14.042" W
3	58° 53' 03.263" N	3° 54' 29.971" W
4	58° 47' 03.269" N	4° 11' 52.979" W
5	58° 46' 58.416" N	4° 29' 59.983" W
6	58° 48' 43.252" N	4° 29' 59.979" W
7	58° 51' 51.135" N	4° 22' 00.680" W
8	58° 58' 42.212" N	4° 19' 18.340" W
9	59° 02' 05.863" N	4° 23' 24.547" W