



Chapter 16: Marine Mammals



Co-financed by the European Union
Connecting Europe Facility

NorthConnect KS
Serviceboks 603, Lundsiden
N-4606 Kristiansand
Norway

Phone +47 38 60 70 00
Mail: post@northconnect.no
Web: www.northconnect.no

Contents

16	Marine Mammals	16-1
16.1	Introduction	16-1
16.2	Sources of Information	16-1
16.2.1	European and International Regulations	16-1
16.2.2	National Legislation.....	16-1
16.2.3	Planning Framework	16-2
16.2.4	Other Guidance	16-2
16.3	Assessment Methodology.....	16-2
16.3.1	Desk Study.....	16-2
16.3.2	Impact Assessment Methodology.....	16-3
16.4	Baseline Information.....	16-6
16.4.1	Statutory Designated Sites.....	16-6
16.4.2	General Information	16-8
16.4.3	Cetaceans.....	16-9
16.4.4	Pinnipeds.....	16-11
16.4.5	Valuation of Key Receptors.....	16-11
16.5	Impact Assessment	16-13
16.5.1	Installation	16-13
16.5.2	Operation Phase Impacts.....	16-20
16.6	Mitigation Measures.....	16-21
16.6.1	Scottish Marine Wildlife Watching Code	16-21
16.6.2	Sub Bottom Profiler Marine Mammal Mitigation.....	16-22
16.7	Residual Effects.....	16-23
16.7.1	Sub Bottom Profiler Operations.....	16-23
16.8	Cumulative Impacts	16-23
16.9	Summary	16-25
16.10	References	16-43

16 Marine Mammals

16.1 Introduction

This chapter presents the marine mammal Ecological Impact Assessment (EclA) of the proposed marine HVDC cable installation. Marine mammal receptors are considered in this chapter and are evaluated in the context of nature conservation legislation and relevant planning policy (see Chapter 5: Planning Policy). Impacts on receptors are identified and subject to detailed impact assessment. Mitigation is proposed, cumulative impacts are considered, and finally the residual impacts and their significance are assessed.

This chapter is supported by Chapter 23: Noise and Vibration (Underwater).

16.2 Sources of Information

International and national legislation assists in identifying sensitive marine mammal species whose presence on a site should be given greater consideration during assessment. This legislation also allows for designation of sites for marine mammal interests. Further guidance for sensitive species was sought from the latest Biodiversity Action Plans (BAPs).

16.2.1 European and International Regulations

Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, known as the ‘Habitats Directive’ was adopted in 1992 (European Commission, 1992). The Directive is the means by which the European Union meets its obligations under the Bern Convention. All species of cetacean occurring in UK waters are listed in Annex IV of the Habitats Directive as European Protected Species (EPS) where the deliberate killing, disturbance or the destruction of these species or their habitat is banned.

In addition, species listed in Annex II of the Habitats Directive, which are native to the UK should be conserved through the designation of Special Areas of Conservation (SACs). Two species of cetacean present in UK waters are listed in Annex II; the bottlenose dolphin *Tursiops truncatus* and the harbour porpoise *Phocoena phocoena*. Since 1994 all SACs, in combination with Special Protection Areas (SPAs) comprise the UK contribution to the Natura 2000 ecological network of protected sites.

Although not afforded the strict protection of EPS through the Habitats Directive, pinniped species occurring in UK waters are listed in Annex V of the Habitats Directive, and as such that are defined as species of community interest; therefore, taking in the wild may be subject to management measures. Two species, the grey *Halichoerus grypus*, and common *Phoca vitulina* seals, are also listed in Annex II of the Habitat Directive, as species whose conservation requires the designation of SACs.

As such, species listed on Annexes II, IV, and V of the Habitats Directive are considered sensitive species for the purposes of this assessment.

16.2.2 National Legislation

The primary legislative instrument transposing the Habitats Directive into UK law is The Conservation (Natural Habitats, &c.) Regulations 1994 (the Habitats Regulations). All cetaceans are listed under Schedule 2 of the Habitats Regulations meaning it is an offence to:

- Deliberately to capture or kill a wild animal of a European protected species;
- Deliberately to disturb any such animal;
- Deliberately to take or destroy the eggs of such an animal; or
- To damage or destroy a breeding site or resting place of such an animal.

The Habitats regulations also provide protection to SACs, since they require that any proposal which has the potential to result in a negative likely significant effect (LSE) to an SAC or its designated features, to be subject to a Habitats Regulations Appraisal (HRA), and if necessary an Appropriate Assessment (AA). The HRA and AA process ensures that no development can be consented if it may cause adverse effects on the integrity of a Natura Site, unless there no alternatives, and there is an Imperative Reason of Overriding Public Importance for the development to be constructed.

The Wildlife and Countryside Act 1981, and Nature Conservation (Scotland) Act 2004 provide further protection to marine mammals. Cetaceans are listed in Schedule 5 of the Wildlife and Countryside Act 1981, which prohibits their deliberate killing, injuring or disturbance. The Nature Conservation (Scotland) Act 2004 makes amendments to the Wildlife and Countryside Act in Scottish waters, including the addition of 'reckless' acts to offenses against species protection, which makes it an offence to intentionally or recklessly disturb a cetacean.

The Marine (Scotland) Act 2010 and Marine and Coastal Access Act (2009) make it an offence to disturb seals at any designated haul out location and to kill, injure or take seals anywhere.

16.2.3 Planning Framework

The Scottish National Marine Plan provides General Planning Principles (GEN), of which the following apply to the Marine Mammal assessment:

- **GEN 9 Natural heritage:** Development and use of the marine environment must:
 - Comply with legal requirements for protected areas and protected species;
 - Not result in significant impact on the national status of Priority Marine Features;
 - Protect and, where appropriate, enhance the health of the marine area;
- **GEN 13 Noise:** Development and use of the marine environment should avoid significant adverse effects of man-made noise and vibration, especially on species sensitive to such effects.

16.2.4 Other Guidance

The Marine (Scotland) Act 2010, and the Marine and Coastal Access Act 2009, sets out duties on the Scottish Minister to ensure Scotland's seas are managed sustainably. In order to help meet this requirement, the Joint Nature Conservation Committee (JNCC) and Scottish Natural Heritage (SNH) have produced a list of habitats and species occurring in Scottish Waters, which are noted for their conservation importance; these are referred to as Priority Marine Features (PMFs). Thirteen cetacean species, and both grey and common seals are included in the PMF list (Tyler-Walters et al., 2016). Inclusion in the PMF list does not provide any additional legal protection, due consideration must be provided in Impact Assessments, and as such all PMFs are considered sensitive for the purpose of this assessment.

Guidance is also provided by JNCC and SNH regarding possible mitigation measures to reduce impacts on marine mammal species. These include:

- JNCC, 2017. JNCC Guidelines for minimising the risk of injury to marine mammals from geophysical survey operations.
- SNH, Undated. The Scottish Marine Wildlife Watching Code.

16.3 Assessment Methodology

16.3.1 Desk Study

A desk study and literature search was undertaken to inform the characterisation of the existing marine mammal baseline conditions. The following data sources were consulted to aid in identifying

and assessing the marine mammals which may be utilising the proposed development area, and surrounding waters, including gaining information on population sizes, seasonal trends, foraging characteristics, and associated designated sites:

- SNH interactive map facility at SiteLink (SNH, 2018);
- North-East Scotland Biological Records Centre (NESBReC, 2018);
- The UK PMF list (Tyler-Walters et al, 2016)
- National Marine Plan Interactive (Marine Scotland, 2018);
- Management Units for cetaceans in UK waters (IAMMWG, 2015);
- Scientific Advice on Matters Related to the Management of Seal Populations: 2017 (SCOS, 2017);
- Hywind Scotland Pilot Park – Environmental Statement (Statoil, 2015); and
- Various scientific reports and journal articles regarding marine mammal distribution and movements in the North Sea region.

16.3.2 Impact Assessment Methodology

The same principles of impact assessment methodology as carried out in the other ecological chapters, are also employed here. The assessment of the significance of predicted impacts on ecological receptors is based on both the ‘value’ of a receptor and the nature and magnitude of the impact that the development will have on it. Effects on biodiversity may be direct (e.g. the loss of species or habitats), or indirect (e.g. effects due to noise or disturbance), on receptors located within or out with the respective survey area. This EclA has, in principle, followed the assessment methodology outlined in Chapter 3: Methodology with the specific ecological assessment methods and criteria detailed below.

16.3.2.1 Evaluation of Ecological Receptors

The evaluation methodology has been adapted from the Guidelines for ecological impact assessment in the UK and Ireland: terrestrial, freshwater and coastal (CIEEM, 2016). A key consideration in assessing the effects of any development on flora and fauna is to define the areas of habitat and the species that need to be considered. This required the identification of a potential zone of influence, which is defined as those areas and resources that may be affected by biophysical changes caused by project activities, however remote from the respective survey area.

The approach that has been undertaken throughout this EclA is to identify ‘valued ecological receptors’ i.e. species and habitats that are both valued in some way and could be affected by the proposed development and separately, to consider legally protected species. Both species populations and habitats have been valued using a broad geographical basis with full details in Table 16.1.

The approach taken in this assessment is that a species population or habitat area that is of Regional or greater importance in biodiversity conservation terms is considered to be a valued ecological receptor. Therefore, if a species population is considered to be of High Local value or less, the proposed development is not anticipated to have as great an effect on the species population as a whole. Exceptions are made if the species population or habitat area has been identified as having a high social or economic value, or if the species is legally protected, for example if they are a Schedule 1 or Schedule 5 species, or an EPS.

Table 16.1 Nature Conservation Receptor Evaluation Criteria

Value	Criteria
International	<ul style="list-style-type: none"> • An internationally important site (SAC) or a site proposed for, or considered worthy of designation; • A regularly occurring substantial population of internationally important species (E.G. EPS listed on Annex IV of the Habitats Directive).
National	<ul style="list-style-type: none"> • A nationally designated site (MPA), or a site proposed for, or considered worthy of such designation; • A viable area of habitat type listed in Annex I of the Habitats Directive or of smaller areas of such habitat which are essential to maintain the viability of a larger whole; or • A regularly occurring substantial population of a nationally important species, e.g. listed on Schedule 5 & 8 of the 1981 Wildlife and Countryside Act.
Regional	<ul style="list-style-type: none"> • Areas of internationally or nationally important habitats which are degraded but are considered readily restored; • Viable habitats or populations of a species identified as a PMF, or smaller areas/populations which are essential to maintain the viability of a larger area/population as a whole; • Regionally important population/assemblage of an EPS, Schedule 1 and/or 5 species. • Regionally important assemblages of other species or habitats.
High Local	<ul style="list-style-type: none"> • Locally important population/assemblage of an EPS, Schedule 1 and/or 5 species; or • Sites containing viable breeding populations of species known to be county rarities, or supplying critical elements of their habitat requirements.
Moderate Local	<ul style="list-style-type: none"> • Undesignated sites, features or species considered to appreciably enrich the habitat resource within the local context (within 2km radius from the site) and may benefit from mitigation as a good practice measure.
Low Local	<ul style="list-style-type: none"> • Undesignated sites, features or species considered to appreciably enrich the habitat resource within the immediate environs of the site and may benefit from mitigation as a good practice measure.
Negligible	<ul style="list-style-type: none"> • Common and widespread or modified habitats or species.
Negative	<ul style="list-style-type: none"> • Invasive, alien species often scheduled under Section 14, Schedule 9 of the Wildlife and Countryside Act 1981 (as amended).

The approach of this assessment is to consider the value of the Site for the species under consideration, rather than the nature conservation importance of the species itself, although this is a factor in the evaluation process with the level of use of the Site (number of individuals using the site and nature and level of use) taken into consideration. An assessment is then made of the value of the Site to that species, based upon a combination of data sources, professional judgment and knowledge of the Site and wider area.

16.3.2.2 Legal Protection of Species

There is a need to identify all legally protected species that could be affected by the proposed development to ensure that the development complies with all relevant nature conservation legislation. It is, therefore, appropriate to take into full consideration the legal protection of a species within the evaluation process.

16.3.2.3 Nature and Magnitude of Impact

Impacts can be: permanent or temporary; direct or indirect; adverse or beneficial; reversible or irreversible; and may also have a cumulative function with other activities outwith the assessed development. These factors are taken into consideration in the context of the sensitivity of the valued ecological receptor and the range of potential effects. To identify whether impacts are significant or not it is important to undertake the assessment in terms of the integrity (coherence of the ecological structure and function) and conservation status (ability of the receptor to maintain its distribution and/or extent/size) of the receptor.

Table 16.2 provides an overview of the range of impact magnitudes referred to within this assessment. In addition, impacts may also be positive in nature.

Table 16.2 Definition of Magnitude of Impact.

Magnitude	Description
Negligible / None	Very slight change from the baseline conditions. Changes barely detectable, approximating to the 'no change' situation. Any effects likely to be reversible within 12 months and not affect the conservation status or integrity of the receptor.
Low	Minor shift away from baseline conditions. Effects will be detectable but unlikely to be of a scale or duration to have a significant effect on the conservation status or integrity of the receptor in the short term (1-5 years). Overall baseline character of site will not alter substantially.
Medium	Clear effect on the conservation status or integrity of the receptor in the short to medium term (6-15 years), although this is likely to be reversible or replaceable in the long-term (15 years plus).
High	Total loss of, or major alteration to conservation status or integrity of a receptor with situation likely to be irreversible, even in the long term. Fundamental alteration to the character and composition of the Site.

16.3.2.4 Impact significance

The significance of an effect is a product of the value of the ecological receptor and the magnitude of the impact on it, moderated by professional judgment. Table 16.3 illustrates a matrix based on these two parameters which is used for guidance in the assessment of significance. In terms of the EIA Regulations, only effects which are 'moderate' or 'major' are considered significant, the others constituting a non-significant effect. The level of effect has been assessed as either major, moderate, minor or negligible, or beneficial in accordance with the definitions provided in Chapter 3: Methodology.

Table 16.3 Significance of Effects Matrix

Magnitude of Impact	Value				
	International	National	Regional	Moderate Local/ High Local	Low Local /Negligible
High	Major	Major	Moderate	Moderate	Minor
Medium	Major	Moderate	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Minor	Negligible
Negligible	Minor	Negligible	Negligible	Negligible	Negligible

Key

	Significant Effect
	Non-significant Effect

16.4 Baseline Information

16.4.1 Statutory Designated Sites

There are several designated sites relevant to the proposed development site. The sites taken forward for assessment which are relevant to marine mammals are shown in Table 16.4, along with their qualifying features. Figure 16.1 provides a map showing the locations of the designated sites relative to the proposed development.

Table 16.4. Designated Sites Relevant to the Marine Mammal Receptors

Site	Direction and Distance by Sea	Value	Relevant Qualifying Feature(s)
Southern Trench pMPA	Crossed by Cable Corridor	National	<ul style="list-style-type: none"> Minke whale (<i>Balaenoptera acutorostrata</i>)
Moray Firth SAC	105km North West	International	<ul style="list-style-type: none"> Designated for bottlenose dolphin (<i>Tursiops truncatus</i>)
Firth of Tay & Eden Estuary SAC	120km South West	International	<ul style="list-style-type: none"> Common seal (<i>Phoca vitulina</i>)
Dornoch Firth & Morrich More SAC	140km North West	International	<ul style="list-style-type: none"> Common seal (<i>Phoca vitulina</i>)

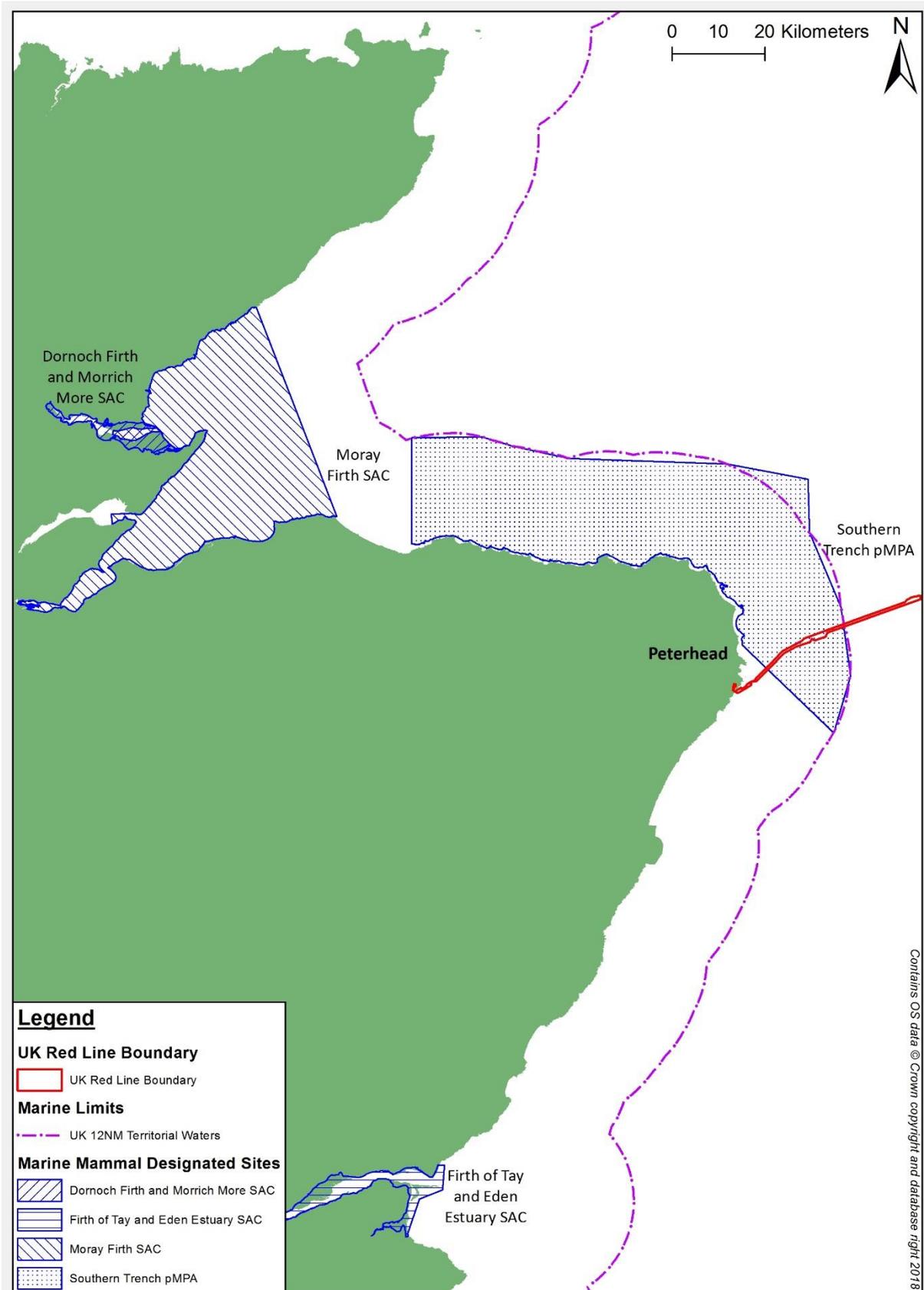


Figure 16.1. Designated sites relevant to the marine mammal receptors associated with the NorthConnect HVDC interconnector development.

16.4.1.1 Southern Trench pMPA

The Southern Trench proposed Marine Protected Area (pMPA) is designated in part due to the presence of ocean fronts, which accumulate nutrients, plankton and fish species. As a result, the area can be considered a biodiversity hotspot, which attracts higher trophic level foragers; minke whales (*Balaenoptera acutorostrata*) are noted as being sighted particularly frequently in the northern section of the pMPA (SNH, 2014). Paxton et al., (2014) state that the pMPA is persistently predicted to support above average densities of minke whales, compared to the wider Scottish territorial waters.

16.4.1.2 Moray Firth SAC

The Moray Firth SAC is designated for the conservation of bottlenose dolphins (*Tursiops truncatus*), under the European Habitats Directive. The area is of key importance to the UK east coast bottlenose dolphin population, and is regularly utilised by over 100 individuals annually, which equates >50% of the population (Cheney et al., 2018). It has been shown that the percentage of the population utilising the SAC has declined, however this is likely due to the fact that the population size is increasing, and hence the population is utilising a larger habitat area (Cheney et al., 2018).

16.4.1.3 Firth of Tay and Eden Estuary SAC

The Firth of Tay and Eden Estuary SAC is designated for supporting a nationally important breeding colony of common seals (*Phoca vitulina*), under the European Habitats Directive. It is estimated that approximately 600 seals use the area as a haul out, which comprises approximately 2% of the UK common seal population (JNCC, 2018). Given the relatively short distances of common seal foraging trips, (typically 50 km), it is considered unlikely that common seals from the Firth of Tay and Eden Estuary SAC will be in the vicinity of the proposed development. As such, this site will not be considered further.

16.4.1.4 Dornoch Firth and Morrich More SAC

The Dornoch Firth and Morrich More SAC is designated in part due to its importance to the Moray Firth common seal (*Phoca vitulina*) population, under the European Habitats Directive. The seals use the sand banks and shorelines as haul outs and breeding sites, and it is estimated that nearly 2% of the UK common seal population utilise the area (JNCC, 2018). Given the relatively short distances of common seal foraging trips, (typically 50 km), it is considered unlikely that common seals from the Dornoch Firth and Morrich More SAC will be in the vicinity of the proposed development. As such, this site will not be considered further.

16.4.2 General Information

The North Sea ecoregion is comparatively rich in cetaceans (whales, dolphins and porpoises); 9 species are regularly recorded in the region (Reid et al, 2003). Four species occur commonly, or are resident within the survey corridor including: harbour porpoise, bottlenose dolphin, minke whales, white beaked dolphin. A further five species are considered regular but less common, including: short-beaked common dolphin, Atlantic white-sided dolphin, long-finned pilot whale, killer whale, and Risso's dolphin.

The Moray Firth is of national importance for its bottlenose dolphin population and is designated as a Special Area of Conservation (SAC) for this species. The Southern Trench pMPA), as shown in Figure 1, is designated in part for minke whales.

Two species of pinniped are resident in this region of the North Sea; the grey and common seal. Both species use coastal sites for breeding/pupping and hauling out, and feed in inshore and offshore waters. Marine Scotland has designated 194 coastal sites around Scotland as seal haul-out sites, under the Marine (Scotland) Act 2010. No such sites occur within the vicinity (20km) of the survey area.

16.4.3 Cetaceans

16.4.3.1 Harbour Porpoise (*Phocoena phocoena*)

Harbour porpoises are the UK's most abundant cetacean, with the highest densities occurring along the North Sea coast, around the Northern Isles and the Outer Hebrides (Northridge et al., and Reid et al., 2003); as such are expected to be most frequently encountered during the HVDC cable installation operations. The harbour porpoises occurring within the vicinity of the Consenting Corridor are likely to be members of the North Sea population group, which is estimated to be composed of 227,298 individuals (IAMMWG, 2015).

Reid et al., (2003) reports that Harbour porpoises occur commonly on the Scottish East Coast, in waters shallower than 100m, making it very likely that they will be common within the marine Consenting Corridor. This is confirmed by the results of Ecological Line Transect Surveys conducted for the Hywind Pilot Park, which reported that harbour porpoises were the most frequently sighted marine mammals, with 229 animals being observed. This equates to 1.765 animals per hour and 0.091 animals per km (Statoil, 2015). During the year-round bird survey work at Longhaven Bay, 3 opportunistic harbour porpoises sightings were recorded, including 2 in February 2017, and a single observation in September 2017 (NRP, 2017), further information is provided in Appendix F.1.

Harbour porpoises are present year-round in the North Sea, and little is known of seasonal migration (Evans et al., 2003; Reid et al., 2003).

16.4.3.2 Bottlenose Dolphin (*Tursiops truncatus*)

Bottlenose dolphins are distributed throughout the UK shelf waters, primarily close to shore. Two larger aggregations are found in the Moray Firth, approximately 115km by sea to the north west of the survey corridor, as well as in Cardigan Bay (Wales) (Reid et al., 2003), both of which are designated as Special Areas of Conservation.

There are six management units for bottlenose dolphins in UK waters (IAMMWG, 2015). Bottlenose dolphins are most commonly recorded within the 20m depth contour, and as such individuals occurring within the Consenting Corridor are likely to belong to 'Coastal East Scotland' population, which estimated to hold 189 individuals, with a 95% highest posterior density interval of 155-216 (Cheney et al., 2018). The Consenting Corridor is not reported to be of particular importance to bottlenose dolphins, although it is likely to cross the migration route between the Moray Firth, and other key areas to the south, including the Firths of Forth and Tay. No bottlenose dolphins were recorded during the Hywind Pilot Park Surveys (Statoil, 2015).

The highest bottlenose dolphin numbers are reported in Scotland during July and October, with some areas including the Tay Estuary having an additional peak in March to April. Some nearshore animals have permanent dolphin presence, including the Moray Firth population (Reid et al., 2003).

16.4.3.3 Minke Whale (*Balaenoptera acutorostrata*)

The minke whale is the most common baleen species recorded in British shelf waters, including in the north western North Sea (Reid et al, 2003, and Evans 2008). They feed mainly in shallower water over the continental shelf, rather than out in the open ocean. They regularly appear around sandbanks or where upwellings bring nutrients and fish near the surface, or in the strong currents around headlands and small islands (Reid et al., 2003).

Minke whales throughout British and Irish waters are considered a single population of 23,528 individuals, although this is considered to be an underestimate (IAMMWG, 2015). Minke whales were the fourth most frequently observed marine mammal during the Hywind Pilot Park Surveys, with 16 animals recorded, equating to a sighting rate of 0.123 animals per hour and 0.006 animals per km (Statoil, 2015). It is considered likely that minke whales will be present within the Consenting Corridor.

Minke are most frequently observed in Scottish waters between July and September but are present from May to October (Reid et al., 2003).

16.4.3.4 White-Beaked Dolphin (*Lagenorhynchus albirostris*)

The UK is in the Southern extent of the range of white beaked dolphins, and as such the UK distribution is centred in the north; Scottish shelf waters are considered to be the main stronghold of this species in Europe particularly in the Minch, to the north of the Outer Hebrides, the outer Moray Firth, and off the coast of Aberdeenshire (Northridge et al, 1995, and Reid et al, 2003). The species typically inhabits waters of moderate depth, but less than 200m (Reid et al., 2003).

White-beaked dolphins from British and Irish waters are considered a single population of 15,895 individuals (IAMMWG, 2015). The high densities of this species reported off the Aberdeenshire coast make it likely that this species will be present within the Consenting Corridor. This is confirmed by the results of Hywind Pilot Park surveys, which found this species to be the second most commonly recorded, with a total of 39 animals, equating to a detection rate of 0.301 animals per hour and 0.016 animals per km during transect surveys (Statoil, 2015).

Sightings of white-beaked dolphin in the UK peak between June and October, although they are present year-round (Reid et al., 2003).

16.4.3.5 Other Cetaceans

In addition to the species detailed above, several other cetaceans are considered to be rare visitors to the waters in the vicinity of the Consenting Corridor, and are outlined below for completeness.

16.4.3.5.1 Short-Beaked Common Dolphin (*Delphinus delphis*)

Comparatively rare in the North Sea but when sighted are usually seen in summer (Reid et al., 2003). There have been few sightings in the vicinity of the Consenting Corridor (Reid et al, 2003; NMPI, 2014) and the majority of sightings in the North Sea are to the north or south east of the Consenting Corridor; east of Orkney and east of Dundee respectively (Marine Scotland, 2018).

16.4.3.5.2 Atlantic White-Sided Dolphin (*Lagenorhynchus acutus*)

This species is relatively rare in the North Sea, however there are some records off the north-east coast of Scotland and in close proximity to the Consenting Corridor. The species appears to enter the North Sea during summer (Reid et al., 2003).

16.4.3.5.3 Long-Finned Pilot Whale (*Globicephala melas*)

Although there are some sightings along the east coast of Scotland, particularly to the east of the Moray Firth, long-finned pilot whales are not considered common in the vicinity of the Consenting Corridor (Reid et al., 2003; Marine Scotland, 2018). When present, they are most commonly sighted between November and January.

16.4.3.5.4 Killer Whale (*Orcinus orca*)

Killer whales recorded year-round throughout the North Sea, although they are primarily recorded off northern Scotland and around the Norwegian coast in the summer (Evans et al., 2010). There have been sightings in the area of the Consenting Corridor, although only occasionally and more often close to land, (Reid et al., 2003 and Marine Scotland, 2018).

16.4.3.5.5 Risso's Dolphin (*Grampus griseus*)

Risso's dolphins in UK waters are primarily concentrated in The Minch in north west Scotland, in parts of the Irish Sea and off south west Ireland (Reid et al., 2003). Risso's dolphins in the North Sea, west of Scotland and Irish and Celtic seas are considered a single population, however no population estimate for the species is available as it is comparatively uncommon (IAMMWG, 2015).

16.4.4 Pinnipeds

16.4.4.1 Grey Seal (*Halichoerus grypus*)

Grey seals distributed throughout UK waters, although the population is concentrated in Scotland, with major concentrations in the Outer Hebrides, Orkney, and the Firth of Forth; in 2014, the total UK grey seal population was estimated to be 141,000 individuals (SCOS, 2017). Seals were frequently observed during the Hywind Pilot Park surveys, with 38 animals being sighted at a rate of 0.293 animals per hour and 0.019 animals per km (Statoil, 2015).

Designated breeding seal colony haul out sites are concentrated in the Northern Isles, Orkney and Shetland, and in the Outer Hebrides. Non-breeding haul out sites are also concentrated at these locations, in addition to various sites along the west coast of Scotland and along some of the east coast as far south as the Moray Firth. There are also some designated breeding sites in the Firth of Forth. There are no designated grey seal haul out sites within 140km of the Consenting Corridor (Marine Scotland, 2018).

Grey seals are present in Scottish waters all year round, however in northern Scotland the breeding season occurs between October and late November, and the grey seal moult takes place between December and April (Hammond et al., 2003). During these periods seals spend more time ashore, and as such it is anticipated that the at sea density of grey seals will be lower during the months of November – January (Hammond et al., 2003). Opportunistic marine mammal observations conducted during the 2017 year-round bird survey work at Longhaven Bay recorded a total of 73 grey seals, the largest number observed was 30 individuals that had hauled out along in January 2017. Grey seals were present in the area during every month of the year (NRP, 2017), further information is provided in Appendix F.1.

16.4.4.2 Common Seal (*Phoca vitulina vitulina*)

In UK waters, common seals are widespread around the west coast of Scotland, throughout the Hebrides and Northern Isles. On the east coast their distribution is more restricted with concentrations in the major estuaries of the Firth of Tay and the Moray Firth (SCOS, 2017). The UK common seal count population estimate for 2014 was 43,500 (SCOS, 2017). Common seals were only rarely encountered during the Hywind Pilot Park survey, with a total of 4 animals recorded, giving a sighting rate of 0.031 animals per hour and 0.002 animals per km during transect surveys.

There are no designated haul out sites, breeding or otherwise, within 100km of the Consenting Corridor, and the closest common seal haul out is in the Firth of Tay, within the Firth of Tay and Eden Estuary SAC (Marine Scotland, 2018).

Common seals are present year around in UK waters, the breeding period in Scotland is between June – July, and the moult occurs in August (Hammond et al, 2003). Only 2 common seals were observed opportunistically during the year-round bird surveys, one in May 2017, and a second in August 2017 (NRP, 2017), further information is provided in Appendix F.1.

16.4.5 Valuation of Key Receptors

Table 16.5 provides a summary of the evaluation of the marine mammal receptors identified from the desktop study.

Table 16.5 Evaluation of Marine Mammal Receptors.

Ecological Receptor	Evaluation Rationale	Site Ecological Receptor Value
Designated Sites		
Southern Trench pMPA	The Consenting Corridor passes through the southern extent of the Southern Trench pMPA. The site is designated in part due to its importance to minke whales. The proposed site is designated to meet the requirements of the Marine (Scotland) Act 2010.	National
Moray Firth SAC	The Consenting Corridor is located approximately 105km by sea SW of the Moray firth SAC, which is designated for bottlenose dolphins. This is a highly mobile species, and animals from the Moray Firth are known to travel as far south as the Firth of Forth, and as such may be present within the Consenting Corridor. The site is designated to fulfil the requirements of the European Habitats Directive.	International
Firth of Tay & Eden Estuary SAC	The Consenting Corridor is located approximately 120km by sea NE of this site which is designated for common seals. The site is designated to fulfil the requirements of the European Habitats Directive. Common seals have relatively short ranges, generally less than 50km, and hence seals from this site are unlikely to be present in the Consenting Corridor.	International: Scoped out of further assessment.
Dornoch Firth & Morrich More SAC	The Consenting Corridor is located approximately 140km by sea SE of this site; designated for common seals. The site is designated to fulfil the requirements of the European Habitats Directive. Common seals have relatively short ranges, generally less than 50km, and hence seals from this site are unlikely to be present in the Consenting Corridor.	International: Scoped out of further assessment.
Marine Mammal Species		
Harbour Porpoise	Harbour porpoises are likely to be present throughout the UK section of the Consenting Corridor. All cetaceans in UK water are designated as EPS and are included in Annex IV of the Habitats Directive.	International
Bottlenose Dolphin	Bottlenose dolphins may be present in the nearshore reaches of the UK Consenting Corridor. All cetaceans in UK water are designated as EPS and are included in Annex IV of the Habitats Directive.	International
Minke Whale	Minke whale may be present throughout UK Consenting Corridor. All cetaceans in UK water are designated as EPS and are included in Annex IV of the Habitats Directive.	International
White-Beaked Dolphin	White-beaked dolphins are likely to be present throughout UK Consenting Corridor. All cetaceans in UK water are designated as EPS and are included in Annex IV of the Habitats Directive.	International
Other Cetaceans	Other cetacean species not listed above may be occasional visitors to the UK Consenting Corridor, as detailed in Section 16.4.3.5. All cetaceans in UK water are designated as EPS and are included in Annex IV of the Habitats Directive.	International
Grey Seal	Grey seals may be present though the Consenting Corridor but are most likely to be encountered in the nearshore reaches. Grey seals are included in Annexes II and V of the Habitats Directive.	International
Common Seal	Common seals may be present in the nearshore reaches of the UK Consenting Corridor. Grey seals are included in Annexes II and V of the Habitats Directive.	International

16.5 Impact Assessment

16.5.1 Installation

Potential impacts on marine mammal receptors during the installation of the NorthConnect marine HVDC cables include:

- Deterioration in water quality;
- Underwater noise emissions;
- Risk of physical injury; and
- Indirect effects on prey species.

16.5.1.1 Water Quality

16.5.1.1.1 Resuspension of Sediments and Increased Water Column Sediment Loading

The cable burial, rock placement, and removal of out of service (OOS) cable operations detailed in Chapter 2: Project Description have the potential to increase sediment loading in the water column, through the resuspension of sediments and release of fines into the marine environment. Further information is provided in Chapter 11: Water Quality (Marine Environment). Increases in sediment loading in the water column, and the resultant increase in turbidity can reduce the foraging success of marine mammals, particularly visual predators such as seals. Increased turbidity may also cause marine mammals to avoid the affected area; potentially resulting in displacement of animals or interruption of transiting animals. As such, negative effects may result for species which utilise the waters in the vicinity of the Consenting Corridor for foraging, socialising, or migration (Priotta et al., 2013).

Any increases in water column sediment loading resulting from the NorthConnect marine HVDC cable installation activities will be very localised and short-term in duration (see Chapter 11: Water Quality (Marine Environment)). In addition, the effect will only occur in a few isolated locations (associated with the positions of cable burial and rock placement vessels) along the Consenting Corridor at any time, given the sequential nature of the cable installation operations, as detailed in Chapter 2: Project Description. Any sediment plumes resulting from the installation works will also be confined to the lower reaches of the water column, in the immediate vicinity of the cable burial tool, or rock placement fall pipe. The activities which could give rise to increased sediment loading will occur during five isolated periods over the 4-year marine installation period, including:

- A 6-month period of route clearance and pre-crossing rock placement; and
- Four individual 3-month long cable burial and protection campaigns.

As the increased sediment loading will be short-term and localised in nature along the Consenting Corridor, occurring sequentially with the location of the installation activity, and near the seabed; the likelihood of marine mammal species encountering an area of increased sediment loading is very low. Marine mammals are also highly mobile, and so should they encounter an area of increased sediment loading, are capable of navigating away and avoiding the area. The demersal environment in the Consenting Corridor, which is where the greatest impact will occur, is not identified as a particularly important marine mammal habitat. As such, the potential magnitude of impact on marine mammal species and their associated designated sites are assessed **negligible, short term, and reversible**, and the resulting effect is **minor: non-significant**.

16.5.1.1.2 Release of Hazardous Substances

A release of oils or other potential pollutants has the potential to result in both short and long-term impacts on both cetaceans and seals. Short term effects include reduction in the thermal properties of seals' fur, resulting in hypothermia and potentially death, as well as poisoning of both seals and cetaceans through inhalation or ingestion of the contaminant, resulting in sickness or death. Both seals and cetaceans may also avoid a contaminated area, which could impact foraging behaviour. In the longer term, both seals and cetaceans may accumulate toxic pollutants through the ingestion of contaminated food, or through a prolonged exposure to low levels of pollution. Such a toxic build-up may lead to reductions in reproductive success, illness, and increased mortality rates (Gubbay & Earll, 2000).

The Consenting Corridor is located within the Southern Trench pMPA, and as such there is the potential to cause direct effects on this site. A spill could result in indirect significant effects to the mobile designated features of other designated sites detailed in Section 16.4.1; if they are present within the contaminated area for long enough to ingest a toxic load of the contaminant, or for it to accumulate on their skin or fur.

For all marine mammal receptors, the magnitude of potential impacts arising from a release of contaminants would depend on the nature and quantity of material released into the environment. There is the potential for a spill of hazardous material to have long term major impacts, through changes to the health and behaviour of the receptors on a regional scale. However, as detailed in Chapter 11: Water Quality (Marine Environment), all vessels working on the project will be compliant with the conventions of the International Maritime Organisation (IMO), including the International Convention for the Prevention of Pollution from Ships (MARPOL). Compliance with the MARPOL convention provides rigorous pollution prevention and incident response procedures, which significantly reduces or removes the risk of a release of hazardous substances occurring. As such, it is considered extremely unlikely that release of hazardous material of a scale with the potential to negatively impact marine mammals or their designated sites will occur. Therefore, the potential impact magnitude is assessed as **negligible, short term, and reversible**, and the resulting effect is **minor: non-significant**.

16.5.1.1.3 Release of Drilling Fluids

As detailed in Chapter 2: Project Description, despite the primary mitigation of pumping out the drilling fluids prior to the Horizontal Directional Drilled (HDD) ducts breaking out into the sea, it is not possible to prevent any fluid escaping. The drilling fluid will contain a mixture of fresh water, bentonite, and pulverised rock fragments. It is estimated that the total HDD fluid losses to the sea from the three HDD holes, for the two HVDC cables and one fibre optic cable, will be 3,000m³. The total estimated solid losses to the sea will be 18m³. However, these losses will not be concurrent from all three HDD holes, but will be sequential as holes are drilled individually, and so only 1,0010m³ of fluid and 6m³ of solids will be discharged at any one time.

Bentonite is a naturally occurring clay-based material, which is non-toxic, however the release of the drilling fluids will result in increased sediment loading in the water column, resulting from the bentonite and pulverised rock entering the marine environment. As detailed in section 16.5.2.1.1, increased sediment loading can impact marine mammals through reducing foraging success, and causing displacement from the affected area.

The release of drilling fluids will occur at the HDD Exit point, which is located approximately 200m from the coast. Due to the volume of materials concerned, and the mechanism of release, and increase in water column sediment loading will be temporary and localised in the immediate area of the exit point. The only marine mammal species which was regularly observed in the vicinity of the HDD exit point location during the year-round seabird surveys were grey seals. Hence it is only grey seals that are likely be affected by the release of drilling fluids. Due to the highly localised and temporary nature of the increased sediment loading resulting from the release of drilling fluids, it is unlikely to result in effects at the individual level for grey seals, and has no potential for population level effects. As such the effects are assessed a **negligible, short term, and reversible**, and the resulting impact is **minor: non-significant**. The impacts on all other marine mammal species, and associated designated sites is assessed as **no change**.

16.5.1.2 Noise and Vibration (Underwater)

Underwater noise emissions will result from the activities associated with the installation of the proposed NorthConnect marine HVDC cables. Further detail on the proposed installation activities is provided in Chapter 2: Project Description. Marine mammals use acoustics for both communication and foraging, and as such are particularly sensitive to underwater noise. Underwater noise emissions can result in disruption of foraging behaviour, displacement, masking of communications, disturbance, and injury (Southall et al., 2007). A detailed underwater noise assessment has been undertaken for installation activities likely to be conducted during the installation of the marine HVDC cables; the results of which are presented in Chapter 23: Noise and Vibration (Underwater).

The noise assessment compared the predicted underwater noise emission levels and frequency ranges which are likely to result from the activities associated with the NorthConnect installation works, against the marine mammal hearing thresholds and precautionary auditory injury and disturbance criteria presented by Southall et al., (2007). This was in order to identify which activities have the potential to produce underwater noise at a frequency and intensity that could result in injury or disturbance to marine mammals. The activities assessed included:

- Vessel Noise;
- Subsea survey equipment including;
 - Multibeam Echo Sounder (MBES),
 - Side-Scan Sonar (SSS), and
 - Sub Bottom Profiler (SBP).
- Horizontal Directional Drilling (HDD);
- Cable Burial; and
- Rock placement.

As detailed in Chapter 23, none of these activities will produce underwater noise emissions at a frequency and source level that could result in auditory injury; either permanent or temporary threshold shift (PTS or TTS respectively). However, it was identified that the following activities did have the potential to cause disturbance to marine mammal species which may be present in the vicinity of the Consenting Corridor:

- Vessel noise;
- The use of SBP during subsea survey operations; and
- Cable burial works.

For these activities the range from the noise source to which marine mammal disturbance may occur was predicted, in order to inform the impact assessment. The predicted impact ranges were calculated by taking the published source noise levels for each activity and using a simple propagation loss model, in order to determine how the noise attenuates with distance from the source. A summary of the impact ranges is presented in Table 16.6.

The potential marine mammal impacts resulting from each of the three activities detailed above are considered in turn below.

Table 16.6 Maximum predicted marine mammal impact ranges resulting from underwater noise associated with the installation of the marine HVDC cables (after Southall et al., 2007).

Noise Sensitive Receptor	Effect Criteria	Exposure Limit (dB re 1 μ Pa)	Maximum Predicted Impact Ranges			
			DP Vessel Noise	Non-DP vessel Noise	Sub Bottom Profiler	Cable Burial
			Source Level 197dB re 1 μ Pa	Source Level 180dB re 1 μ Pa	Source Level 200dB re 1 μ Pa	Source Level 185dB re 1 μ Pa
Marine Mammals	PTS Onset - Cetaceans	230	<i>Effect Criteria Exposure Limit Not Reached</i>			
	PTS Onset - Seals	218	<i>Effect Criteria Exposure Limit Not Reached</i>			
	TTS Onset - Cetaceans	224	<i>Effect Criteria Exposure Limit Not Reached</i>			
	TTS Onset - Seals	212	<i>Effect Criteria Exposure Limit Not Reached</i>			
	Disturbance - All Groups	160	293m	22m	464m	46m

16.5.1.2.1 Vessel Noise

Installation of the marine HVDC cables will require multiple vessels including cable lay vessels, support vessels (cable burial/trenching, rock placement, route clearance vessels etc.), as well as guard vessels to protect exposed sections of cable. These vessels were broadly separated into two categories for the purpose of the assessment;

- DP Vessels: large vessels potentially exceeding 150m operating Dynamic Positioning (DP) propulsion systems.
 - These include the cable laying, support, and survey vessels.
- Non-DP Vessel: small vessels less than 50m in length operating conventional propulsion systems.
 - These include guard vessels, which are usually fishing vessel that are appointed to the project.

While the actual properties of the underwater vessel noise will depend on the vessels selected by the installation contractor; numerous studies have detailed the characteristics of various vessel types ranging from large DP vessels equivalent to the cable lay and support vessels, to smaller tugs and fishing vessels which are analogous to the Non-DP Vessels. These published figures were utilised for the assessment.

DP Vessels

Vessel noise from large DP vessels is described as being a low frequency broadband sound, with some tonal components ranging from 30Hz to 3kHz, making them detectable to all marine mammal species likely to be present in the vicinity of the Consenting Corridor. The sound pressure levels are reported as being between 180 to 197 dB re 1 μ Pa at 1m, resulting in a maximum potential marine mammal disturbance range of 293m (Table 16.6), meaning that a marine mammal would need to be within 300m of the vessel in order to be subjected to disturbance. Considering the vessels will be operating

in isolated areas of the Consenting Corridor and will be moving continuously as works progress, means that this disturbance can be seen as a highly localised, temporary, and transient effect.

Over the course of the 4-year marine HVDC cable installation works, DP Vessels will be utilised for the during several phases in UK waters, details of the DP vessel requirements and expected durations are provided in Table 16.7.

Table 16.7 Expected DP Vessel requirements and indicative duration for each marine cable installation activity.

Phase	DP Vessels Required	Total DP Vessel Requirement	Duration within UK waters
UXO Survey	Survey vessel (1)	1	3 months
Marine Route Surveys	Survey vessel (1)	1	3 months
Route Clearance	Clearance vessel (1)	1	1 month
Pre-lay Grapnel Run	Clearance vessel (1)	1	1 month
Cable Installation: Laying and Trenching	Cable lay vessel (1) Cable trenching vessel (1) Survey vessel (1)	3	4 months: (4 x 1-month campaigns over 4 years)
Further Cable Protection: Rock Placement	Rock-placement vessel (1) Survey vessel (1)	2	8 months: (4 x 2-month campaigns over 4 years)
As-built survey	Survey vessel (1)	1	1 month
Totals:		10	21 months

As detailed in Table 16.7, the NorthConnect marine HVDC cable installation works will result in an additional 10 DP Vessels operating for a total of 21-months over the 4-year installation campaign. The additional underwater noise resulting from NorthConnect’s DP vessel noise is set against a background of existing DP Vessel noise within the North Sea region. Chapter 19: Navigation and Shipping indicated that the area of the North Sea crossed by the Consenting Corridor is utilised by the oil and gas sector, and numerous large DP Vessels are used by the sector to support the industry’s offshore assets.

As such, the additional vessels that will be present in the area only constitute a negligible change from baseline. This together with the highly localised, temporary and transient nature of the resulting disturbance means that the impact of DP Vessel noise in marine mammals and their associated designated sites are assessed as **negligible, short term, and reversible**, and the resulting effect is **minor: non-significant**.

Non-DP Vessels

Non-DP vessels are reported as emitting broadband noise with tonal components, in a bandwidth concentrated between 50Hz and 2kHz, making them detectable to all marine mammal species likely to be present in the vicinity of the Consenting Corridor. The reported sound pressure levels are lower than for the larger DP vessels, and range between 170 to 180 dB re 1µPa at 1m. This results in a worst-case marine mammal disturbance range of 22m (Table 16.6), meaning that marine mammals would need to be within 22m of the vessel in order to be subjected to acoustic disturbance.

A disturbance range of 22m is unlikely to constitute a significant change from baseline conditions, especially considering Non-DP vessels will comprise largely of fishing vessels working as guard vessels on the project. As detailed in Chapter 20: Commercial Fisheries, fishing vessels are prevalent in the

vicinity of the Consenting Corridor, and as such the potential effects on marine mammals and their associated designated sites resulting from the use of Non-DP vessels is assessed as **no change**.

16.5.1.2.2 Cable Burial Operations

The noise emissions resulting from the cable burial operations area reported as being a mixture of broadband noise, tonal components, and transients associated with rock interactions, with a source level in the region of 185 dB re 1 μ Pa at 1m. As a broadband sound, cable burial noise will be detectable to all marine mammal species likely to be present in the vicinity of the Consenting Corridor. This results in a worst-case marine mammal disturbance range of 46m (Table 16.6).

The zone of marine mammal disturbance resulting from cable burial operations will therefore be highly localised around the burial tool. In addition, the effect will only occur in a single location (associated with the position of cable burial tool) along the Consenting Corridor at any one time, given the sequential nature of the cable installation operations. Since the burial tool will be located on the sea bed, the disturbance zone will also be confined to the lower reaches of the water column, in the immediate vicinity of the cable burial tool. The cable burial operations will be limited to four isolated 2-month periods over the 4-year marine installation phase.

As the disturbance resulting from cable burial noise will be short-term and localised in nature along the Consenting Corridor, and near the seabed; the likelihood of marine mammal species entering the disturbance zone for this activity is very low. If a marine mammal did enter the disturbance zone, it is only likely to be displaced from an area extending 46m from the burial tool, which will not lead to any significant displacement effects. The demersal environment in the Consenting Corridor, which is where the greatest impact will occur, is not identified as particularly important marine mammal habitat. As such the potential impact magnitude on marine mammal species and their associated designated sites are assessed **negligible, short term, and reversible**, and the resulting effect is **minor: non-significant**.

16.5.1.2.3 Sub Bottom Profiler Survey Operations

Geophysical surveys will be conducted within the Consenting Corridor before, during and after the cable installation works, in order to inform the final route design, verify the as-built position of the cables, and ensure they are adequately protected. SBP is used to investigate the shallow (generally < 10m) subsurface structure beneath the seabed. The SBP directs a focussed acoustic pulse toward the seafloor, and will likely be deployed on an ROV or towed device, close to the sea floor. It is likely that a Chirp SBP system will be used during the pre and post-installation surveys, which generates acoustic pulses in a frequency range from 1kHz to 10kHz, with sound pressure levels up to 200dB re 1 μ Pa at 1 m. The frequency range of the SBP means it will be detectable by all marine mammal species likely to be present in the vicinity of the Consenting Corridor. This results in a worst-case marine mammal disturbance range of 464m from the SBP (Table 16.6).

The marine mammal disturbance zone resulting from the SBP operations is therefore localised, and confined to the lower reaches of the water column, adjacent to the SBP. A single survey vessel will be used during all survey operations, and as such the disturbance zone will be limited to a single point within the Consenting Corridor at any one time. The SBP will move through the Consenting Corridor as the survey progresses and can therefore be seen as transient. The survey operations which will involve the use of SBPs will occur during five isolated periods over the 4-year marine installation period, including:

- Pre-installation marine route surveys – 3 months;

- Four individual 3-month long cable burial and protection campaigns; and
- Post installation survey – 1 month.

As such, SBP operations will occur during a total of 16 months during the 4-year installation phase. The zone of disturbance could inhibit marine mammal foraging in the vicinity of the survey vessel, mask communication and result in displacement from the area. It is also noted that the disturbance from SBP is transient, and will move with the survey vessel, and hence marine mammals will be able to return to the area or resume normal foraging, and communication as soon as the vessel moves past. In addition, the zone of disturbance will be confined to the lower reaches of the water column which is not identified as being important habitat to the marine mammal receptors. As such, the SBP noise may result in some disturbance to marine mammals but is unlikely to result in population level effects. The impacts are therefore assessed as **low, short term, and reversible**, and the resulting effect is **moderate: Significant**.

Since marine mammals are highly mobile, it is also necessary to assess the potential for indirect impacts on the marine mammal designated sites, through impacts on their designated features. As detailed in Section 16.4.1, the relevant sites are the Moray Firth SAC designated for bottlenose dolphins and the Southern Trench pMPA designated in part for minke whales. Bottlenose dolphins primarily utilise coastal waters in Scotland, and so their exposure to the SBP noise will be further limited, as the survey operations progress offshore, as such no impacts on the conservation objects of the Moray Firth SAC are expected. With regard the Southern Trench pMPA, the SBP noise may result in low level disturbance and displacement to individual minke whales in the vicinity of the survey vessel. However, the localised and temporary nature of the disturbance means it is not likely to result in population level effects, hence no impact on the conservation status of the site is expected. As such the indirect impacts on the marine mammal designated sites resulting from SBP noise are assessed as **no change**.

Since the survey corridor passes through the Southern Trench pMPA, the direct impacts on this site are assessed separately. As detailed above, without mitigation the use of SBP could result in indirect impacts on the pMPA through the effects on the minke whale designated features of the site, although these are unlikely to compromise the conservation objectives of the site. With regard to direct effects, 19km of the Consenting Corridor is within the pMPA, hence considering the disturbance range of 464m, minke whales within 1763Ha of the site will be subject to disturbance as a result of the SBP operations. This equates to 0.7% of the total area of the designated site. It is unlikely that temporary, transient, and localised disturbance within such a small proportion of the Southern Trench pMPA will affect the site's conservation objectives. As such the direct impacts on this site are assessed as **negligible, short term, and reversible**, and the resulting effect is **negligible: non-significant**.

16.5.1.3 Physical Injury

The concurrent underwater noise, disturbance, and increased sediment loading in the immediate vicinity of the cable installation tools, vessels, and associated equipment make it extremely unlikely that a marine mammal would enter an area where it is at risk of being injured through a direct interaction with the installation equipment. In addition, cable installation is a slow process, and as such the vessel and tools utilised will be moving slowly. Marine mammals are highly manoeuvrable and acutely aware of their environment; making it further unlikely that an interaction leading to injury will occur. The impact on marine mammals and their associated designated sites is therefore assessed as **no change**.

16.5.1.4 Indirect Effects on Prey Species

Chapter 15: Fish and Shellfish identified potential impacts on the fish and shellfish species within the cable installation corridor and surrounding area, which include the primary prey items of marine mammals. No significant impacts were identified on any species by the Fish and Shellfish EclA, and as such no substantial changes in the distribution or abundance of marine mammal prey species are expected. There the potential indirect impacts on marine mammals and their associated designated sites through changes to prey availability are assessed as **no change**.

16.5.2 Operation Phase Impacts

16.5.2.1 Water Quality

The only activities that could lead to a degradation in water quality during the operation of the NorthConnect interconnector are repairs to the marine infrastructure. As detailed in Chapter 2: Project Descriptions, repairs to the HVDC cables and associated infrastructure may be necessary during the life span of the project, in the event of damage or to maintain rock berms if they become eroded. One repair every three years is assumed as a worst-case based on previous project experiences, and so over the lifetime of the project (40 years), repairs could occur 14 times. Repairs to the HVDC cable will involve recovering the damaged section of the cable to the surface and making the necessary repair, before re-laying and trenching using similar techniques to those employed during the installation phase. Where rock berms need to be repaired, a rock placement vessel will be used to place remedial rock.

The effects to changes in water quality on marine mammal and their associated designated sites are assessed in Section 16.5.2.1 as being negligible, short term, and reversible, with a resulting impact of minor: non-significant. Since the techniques used for cable repair will be similar to those used in installation, the effects on water quality will be broadly similar. However, given the anticipated infrequency of repair operations and the short duration required in comparison to the cable installation, the impacts on marine mammals are assessed as **no change**.

16.5.2.2 Noise and Vibration (Underwater)

The activities associated with the operation of the NorthConnect interconnector which could give rise to underwater noise emissions are repair operations, and routine surveys of the HVDC cables. Details of the repair operations are provided in Section 16.5.3.1; given the repair operations will employ similar techniques and vessels to those used during in the installation phase, the underwater noise emission will be analogous to those assessed in Section 16.5.2.2. The impacts of vessel noise and cable burial activities during installation are assessed as being non-significant. Given the similarity in the techniques and equipment which will be employed, and the infrequent nature of repair works; the underwater noise impacts on marine mammals and their designated sites associated with repairs to the cable infrastructure are assessed as **no change**.

Routine surveys of the HVDC cables will be required throughout the operation of the NorthConnect interconnector in order to ensure the cables remain properly protected and aren't being exposed through scour. The survey schedule can only be determined once the cables are installed and full details of the final burial depths and external protection measures are understood. However, as a base case; the full cable route will be inspected 2 years following commissioning, thereafter every 5 years. Some critical sections of the route, such as those in areas of mobile sediments may need to be surveyed more frequently.

The operational surveys of the cable will utilise similar SBPs to those employed during the installation surveys, as detailed in Section 16.2.2.3. As such, the underwater noise impacts on marine mammal species resulting from the use of SBP during the operational surveys are assessed as **low, short term, and reversible**, and the resulting effect is **moderate: Significant**. However, given the infrequency of the survey operations during the operational phase, the impacts on the Moray Firth SAC and the Southern Trench pMPA are assessed as **no change**.

16.5.2.3 Electromagnetic Fields

When operational, the HVDC will emit a magnetic field. As it is a direct current cable then no electric induced fields will be created, and any electric fields will be contained within the cable armouring. An assessment of the EMFs created by the project is provided in Chapter 18: Electromagnetic Fields & Sediment Heating. As a worst-case of burial depths of 0.4m in hard substrates and 0.5m in soft substrates, then the magnetic field at the seabed would be at most 640 μ T, and would reduce to <300 μ T within 2m of the seabed at both worst-case and best-case separation distances.

With the exception of minke whales, white beaked dolphins, and killer whales; all cetaceans likely to be present in the vicinity of the Consenting Corridor are magnetosensitive and have shown to respond directly to geomagnetic or magnetic fields (Gill et al., 2005). No magnetosensitivity has been identified in pinniped species. The impact on minke whales and the Southern Trench pMPA, white beaked dolphins, killer whales, grey seals, and common seals is therefore assessed as **no change**.

Magnetosensitive cetaceans are considered to use the Earth's natural magnetic field to aid navigation during migrations. Therefore, magnetic fields generated by the NorthConnect HVDC cables may cause disruption to migrations by affecting an animal's ability to navigate (Gill et al., 2005). However cetacean migration generally occurs in open water, and the strength of the magnetic fields generated by the cables will attenuate to baseline within a few metres from the cable to will not affect animals in the pelagic environment. As such, it is very unlikely that a migrating cetacean will encounter the magnetic anomaly resulting from the NorthConnect cables, and if they do, any effect on navigation will be extremely localised and short lived, and will not lead to any significant effect deviation from an animal's natural migration route. The impacts of EMF on magneto sensitive cetaceans and the Moray Firth SAC is therefore assessed as **negligible, long term, and reversible**, with a resulting effect of **minor: non-significant**.

16.6 Mitigation Measures

Where potential significant effects on marine mammals have been identified in Section 16.5, appropriate mitigation will be provided in order to reduce the magnitude of the impact. A summary of the marine mammal mitigation proposed installation of the NorthConnect marine HVDC cables is outlined below, this will be implemented via a Marine Mammal Protection Plan.

16.6.1 Scottish Marine Wildlife Watching Code

In order to prevent excessive harassment of marine mammals by vessels working on the NorthConnect Project, all vessels will be required to follow the guidance set out in SNH's 'Scottish Marine Wildlife Watching Code' (SNH, Undated). This document provides best practice guidance on how to navigate vessels in the vicinity of marine mammals.

16.6.2 Sub Bottom Profiler Marine Mammal Mitigation

The only aspects of the NorthConnect project assessed has having the potential to result in significant impacts on marine mammals is the use of SBP during the installation and operation phases. In order to minimise these impacts, Marine Mammal Observation (MMO) and Passive Acoustic Monitoring (PAM) protocols will be utilised for the start-up of SBP operations, based on the JNCC guidelines for minimising the risk of injury and disturbance to marine mammals from geophysical surveys (JNCC, 2017).

It should be noted that the protocols set out in JNCC guidance have been modified to take account of the fact that the SBP devices likely to be utilised will not have the capacity to perform a soft start. The level of mitigation has also been reduced to ensure it is proportionate to the greatly reduced risk to marine mammals posed by the marine survey, compared to the seismic survey operations for which the guidelines are broadly intended.

The SBP mammal mitigation will be utilised for all SBP operations both during installation and operation, and will provide the following measures:

- A 200m mitigation zone will be established around SBP device (noise source);
- Trained marine mammal observers (MMO) will conduct a 20min pre-watch prior to the commencement of SBP operations;
 - If the 200m mitigation zone remains clear of marine mammals during the watch, permission will be given to start up the SBP; and
 - If a marine mammal is sighted within the mitigation zone, SBP operations will be delayed until the zone has been clear of marine mammals for at least 10min.
- If conditions are unsuitable for visual observations (darkness, fog reducing visibility to <200m, or sea states >Beaufort 4); passive acoustic monitoring (PAM) will be utilised by a trained PAM operator to monitor the mitigation zone;
- Once SBP operations have commenced, there will be no requirement to stop works if a marine mammal enters the mitigation zone, as long as SBP operations have been continuous, with no breaks exceeding 10min;
- If a break in operations exceeds 10min but is less than 30min in duration; the following conditions will apply:
 - If an MMO/PAM operator has been on watch during the break, and the mitigation zone remains clear of marine mammals, the SBP can be restarted immediately;
 - If an MMO/PAM operator has been on watch during the break, and a marine mammal is observed within the mitigation, the SBP will not be restarted the zone has been clear of marine mammals for at least 10min; and
 - If no marine mammal observations have been conducted during a break exceeding 10min, a 20min pre-watch will be conducted before the SBP can be restarted, as detailed above.
- If a break in operation exceeds 30min in duration, a 20min pre-watch will be required before restarting the SBP.
- When a turn between survey lines is required, the following provisions will be made:
 - If the turn duration will not exceed 40min; the SBP shall continue to operate. As such the survey operation will be continuous and no additional watches are required.
 - If the turn duration will exceed 40min; the SBP will be shut down, and a 20min pre-watch will be required to restart the SBP on the new line.

- All MMO/PAM operations will be recorded using the JNCC marine mammal reporting forms template and submitted to Marine Scotland once the works are complete.

16.7 Residual Effects

Following the identification of appropriate mitigation for the impacts assessed to be significant in Section 16.5, these aspects have been reassessed in order to ascertain the residual impacts.

16.7.1 Sub Bottom Profiler Operations

The implementation of SBP marine mammal protocols will ensure that animals are not present within the immediate vicinity of the noise source when the SBP is started. As a result, the risk of causing disturbance is considerably reduced. A residual risk remains that marine mammals may be displaced from the area around survey vessel during SBP operations, however the magnitude of displacement is low, and the area of displacement will move as the survey operations progress, hence marine mammals will quickly be able to return to the area. The residual impact magnitude is therefore assessed as **negligible, short term and reversible**, meaning that the residual effect on marine mammals and their designated sites is **minor: non-significant**.

Note that this assessment applies to the residual impacts of SBP operations during both the installation and operational phases.

16.8 Cumulative Impacts

Marine mammals are wide-ranging and hence there may be cumulative impacts arising as a result of the installation or operation of other marine developments. Effects are considered in relation to the marine installation phase of the NorthConnect HVDC cabling, but not for the operation phase as once installed the subsea cables are not expected to have any impact on the marine mammal receptors.

The following developments have been considered as part of this assessment:

- **Moray East/West Offshore Windfarm Development**
- **Inch cape Offshore Windfarm**
- **Neart na Gaoithe Offshore Windfarm**
- **Seagreen Phase 1 Windfarm**
- Beatrice Offshore Windfarm*
- European Offshore Wind Development Centre EOWDC, Aberdeen Bay*
- Hywind Scotland Pilot Park Offshore Windfarm*
- Kincardine Offshore Windfarm, 8 6MW Floating Turbines*
- Aberdeen Harbour Dredge and Harbour Extension Project*
- Peterhead Port Authority Harbour Masterplan*
- **North Sea Network Link Interconnector cable**
- **NorthConnect HVDC subsea cable** (rest of the North Sea: from UK median line-start of Norwegian fjord)

Any cumulative effects on the marine mammal receptors are most likely to occur during the installation phase of the NorthConnect HVDC cabling project, as no cumulative effects during the operational phase are expected. Therefore, those projects which do not overlap in construction phases do not require further consideration as part of the cumulative assessment and are marked with an * in the above list.

The potential effects during construction of the remaining projects (marked in bold in the above list) are then considered. Table 16.8 provides the minimum distances between the NorthConnect Consenting Corridor and each of the projects identified as having an overlapping construction period.

Table 16.8 Distances to Marine Projects with Overlapping Construction Periods.

Project	Distance from NorthConnect Consenting Corridor
NorthConnect HVDC Subsea Cables (Norwegian waters)	Adjacent
Moray East/West Offshore Windfarm Development	100km
Inch Cape Offshore Windfarm	110km
Seagreen Phase 1 Windfarm	110km
Neart na Gaoithe Offshore Windfarm	130km
North Sea Network Link Interconnector	130km

The only aspect of the NorthConnect project with the potential to result in cumulative effects with other projects with overlapping construction period is the disturbance resulting from underwater noise generated by SBP survey operations. Of the 6 projects identified as having overlapping construction period, 5 are windfarms. Windfarm construction can result in significant underwater noise emissions, due to the piling operations required to install their subsea elements. Typical marine mammal disturbance ranges resulting from wind farm piling noise are provided in Table 16.9.

Table 16.9 Marine Mammal Disturbance Ranges from Offshore Windfarm Construction (BOWL 2012, EDP 2013, & Mainstream 2016).

Marine mammal Hearing Group	Relevant Species	Predicted Disturbance Range
High Frequency Cetaceans	Harbour Porpoise	~55km
Mid Frequency Cetaceans	Bottlenose Dolphin, White beaked Dolphin, Short Beaked Common Dolphin, Atlantic White Sided Dolphin, Long Finned Pilot Whale, Killer Whale, and Risso's Dolphin.	~40km
Low Frequency Cetaceans	Minke Whale	~85km
Pinnipeds	Grey Seal and Common Seal	~50km

The predicted disturbance ranges resulting from the construction of the relevant offshore wind projects are not predicted to overlap with the NorthConnect Consenting Corridor (Tables 16.8 and 16.9), hence there is no potential for direct cumulative impacts between these projects and NorthConnect. With regard to indirect cumulative effects, due to the wide-ranging nature of marine mammals, it is likely that animals present in the vicinity of the NorthConnect Consenting Corridor may also utilise the waters affected by the windfarm project underwater noise emissions, hence there is the potential for indirect cumulative effects resulting from the SBP noise emissions. However, the disturbance range resulting from the SBP operations is only 464m, hence the additional area affected by underwater noise emissions from NorthConnect does not constitute a significant change from baseline, in comparisons to the areas affected by the windfarm projects. Hence the cumulative impact resulting from SBP noise emissions is assessed as **minor: non-significant**.

With regard the cumulative impacts with the NorthConnect HVDC cable installation in Norwegian waters, installation will be occurring concurrently with the installation in UK waters. Since the construction techniques, cable specification, and maintenance requirements in Norwegian will be

analogous to those detailed above for UK waters, the potential impacts on marine mammals will also be the same. Impacts will not be synergistic given the distance occurring between the majority of installation activities. It is also assumed that the same mitigation will be applied in Norwegian Waters, as has been detailed in this EIAR. As such the cumulative impacts are assessed as **minor: non-significant**.

16.9 Summary

This chapter has considered the potential impacts of construction and operation of the NorthConnect Development on relevant marine mammal receptors. The summary of the effects is shown in Table 16.10. The NorthConnect HVDC cable installation is expected to result in only temporary, non-significant residual impacts during the installation phase for marine mammals in the vicinity of the Consenting Corridor. Operationally, some longer-term effects are predicted, but again with mitigation, these are assessed as being non-significant.

Table 16.10. Summary of Marine Mammal Impacts and Mitigation.

Receptor and Value Relevant Species		Phase	Predicted Impact	Impact Magnitude	Likelihood of Impact	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Southern Trench pMPA	National	Installation	Displacement/foraging impairment due to increased sediment loading from cable burial and rock placement works.	Negligible Negative Short Term Reversible	Likely	Negligible: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Negligible: non-significant
		Installation	Injury/displacement due to release of hazardous substances.	Negligible Negative Short Term Reversible	Unlikely	Negligible: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Negligible: non-significant
		Installation	Displacement/foraging impairment due to release of drilling fluids.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Disturbance due to DP vessel noise.	Negligible Negative Short Term Reversible	Likely	Negligible: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Negligible: non-significant
		Installation	Disturbance due to Non-DP vessel noise.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Disturbance due to cable burial noise.	Negligible Negative Short Term Reversible	Likely	Negligible: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Negligible: non-significant
		Installation	Disturbance due to SBP survey operation noise.	Negligible Negative Short Term Reversible	Likely	Negligible: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Negligible: non-significant

Receptor and Value Relevant Species		Phase	Predicted Impact	Impact Magnitude	Likelihood of Impact	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Southern Trench pMPA	National	Installation	Injury through interactions with cable installation equipment.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Foraging impairment due to indirect effects on prey species.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Displacement/foraging impairment due to increased sediment loading from cable repair operations.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Disturbance due to cable burial noise during cable repairs.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Disturbance due to SBP survey operation noise.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Disruption of migration due to EMF.	No Change	-	None	No Specific mitigation required.	No Change	None
Moray Firth SAC	International	Installation	Displacement/foraging impairment due to increased sediment loading from cable burial and rock placement works.	Negligible Negative Short Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Injury/displacement due to release of hazardous substances.	Negligible Negative Short Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant

Receptor and Value Relevant Species		Phase	Predicted Impact	Impact Magnitude	Likelihood of Impact	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Moray Firth SAC	International	Installation	Displacement/foraging impairment due to release of drilling fluids.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Disturbance due to DP vessel noise.	Negligible Negative Short Term Reversible	Likely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Disturbance due to Non-DP vessel noise.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Disturbance due to cable burial noise.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Disturbance due to SBP survey operations.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Injury through interactions with cable installation equipment.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Foraging impairment due to indirect effects on prey species.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Displacement/foraging impairment due to increased sediment loading from cable repair operations.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Disturbance due to cable burial noise during cable repairs.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Disturbance due to SBP survey operations.	No Change	-	None	No Specific mitigation required.	No Change	None

Receptor and Value Relevant Species		Phase	Predicted Impact	Impact Magnitude	Likelihood of Impact	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Moray Firth SAC	International	Operation	Disruption of migration due to EMF.	Negligible Negative Long Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Long Term Reversible	Minor: non-significant
Harbour Porpoise	International	Installation	Displacement/foraging impairment due to increased sediment loading from cable burial and rock placement works.	Negligible Negative Short Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Injury/displacement due to release of hazardous substances.	Negligible Negative Short Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Displacement/foraging impairment due to release of drilling fluids.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Disturbance due to DP vessel noise.	Negligible Negative Short Term	Likely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term	Minor: non-significant
		Installation	Disturbance due to Non-DP vessel noise.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Disturbance due to cable burial noise.	Negligible Negative Short Term Reversible	Likely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant

Receptor and Value Relevant Species		Phase	Predicted Impact	Impact Magnitude	Likelihood of Impact	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Harbour Porpoise	International	Installation	Disturbance due to SBP survey operations.	Low Negative Short Term Reversible	Likely	Moderate: Significant	Provision of SBP marine mammal protocol, and adherence to the Scottish Marine Wildlife Watching Code.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Injury through interactions with cable installation equipment.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Foraging impairment due to indirect effects on prey species.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Displacement/foraging impairment due to increased sediment loading from cable repair operations.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Disturbance due to cable burial noise during cable repairs.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Disturbance due to SBP survey operations.	Low Negative Short Term Reversible	Likely	Moderate: Significant	Provision of SBP marine mammal protocol, and adherence to the Scottish Marine Wildlife Watching Code.	Negative Negligible Short Term Reversible	Minor: non-significant

Receptor and Value Relevant Species		Phase	Predicted Impact	Impact Magnitude	Likelihood of Impact	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Harbour Porpoise	International	Operation	Disruption of migration due to EMF.	Negligible Negative Long Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Long Term Reversible	Minor: non-significant
Bottlenose Dolphin	International	Installation	Displacement/foraging impairment due to increased sediment loading from cable burial and rock placement works.	Negligible Negative Short Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Injury/displacement due to release of hazardous substances.	Negligible Negative Short Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Displacement/foraging impairment due to release of drilling fluids.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Disturbance due to DP vessel noise.	Negligible Negative Short Term Reversible	Likely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Disturbance due to Non-DP vessel noise.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Disturbance due to cable burial noise.	Negligible Negative Short Term Reversible	Likely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant

Receptor and Value Relevant Species		Phase	Predicted Impact	Impact Magnitude	Likelihood of Impact	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Bottlenose Dolphin	International	Installation	Disturbance due to SBP survey operations.	Low Negative Short Term Reversible	Likely	Moderate: Significant	Provision of SBP marine mammal protocol, and adherence to the Scottish Marine Wildlife Watching Code.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Injury through interactions with cable installation equipment.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Foraging impairment due to indirect effects on prey species.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Displacement/foraging impairment due to increased sediment loading from cable repair operations.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Disturbance due to cable burial noise during cable repairs.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Disturbance due to SBP survey operations.	Low Negative Short Term Reversible	Likely	Moderate: Significant	Provision of SBP marine mammal protocol, and adherence to the Scottish Marine Wildlife Watching Code.	Negative Negligible Short Term Reversible	Minor: non-significant

Receptor and Value Relevant Species		Phase	Predicted Impact	Impact Magnitude	Likelihood of Impact	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Bottlenose Dolphin	International	Operation	Disruption of migration due to EMF.	Negligible Negative Long Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Long Term Reversible	Minor: non-significant
Minke Whale	International	Installation	Displacement/foraging impairment due to increased sediment loading from cable burial and rock placement works.	Negligible Negative Short Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Injury/displacement due to release of hazardous substances.	Negligible Negative Short Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Displacement/foraging impairment due to release of drilling fluids.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Disturbance due to DP vessel noise.	Negligible Negative Short Term Reversible	Likely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Disturbance due to Non-DP vessel noise.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Disturbance due to cable burial noise.	Negligible Negative Short Term Reversible	Likely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant

Receptor and Value Relevant Species		Phase	Predicted Impact	Impact Magnitude	Likelihood of Impact	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Minke Whale	International	Installation	Disturbance due to SBP survey operations.	Low Negative Short Term Reversible	Likely	Moderate: Significant	Provision of SBP marine mammal protocol, and adherence to the Scottish Marine Wildlife Watching Code.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Injury through interactions with cable installation equipment.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Foraging impairment due to indirect effects on prey species.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Displacement/foraging impairment due to increased sediment loading from cable repair operations.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Disturbance due to cable burial noise during cable repairs.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Disturbance due to SBP survey operations.	Low Negative Short Term Reversible	Likely	Moderate: Significant	Provision of SBP marine mammal protocol, and adherence to the Scottish Marine Wildlife Watching Code.	Negative Negligible Short Term Reversible	Minor: non-significant
		Operation	Disruption of migration due to EMF.	No Change	-	None	No Specific mitigation required.	No Change	None

Receptor and Value Relevant Species		Phase	Predicted Impact	Impact Magnitude	Likelihood of Impact	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
White-Beaked Dolphin	International	Installation	Displacement/foraging impairment due to increased sediment loading from cable burial and rock placement works.	Negligible Negative Short Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Injury/displacement due to release of hazardous substances.	Negligible Negative Short Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Displacement/foraging impairment due to release of drilling fluids.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Disturbance due to DP vessel noise.	Negligible Negative Short Term Reversible	Likely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Disturbance due to Non-DP vessel noise.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Disturbance due to cable burial noise.	Negligible Negative Short Term Reversible	Likely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Disturbance due to SBP survey operations.	Low Negative Short Term Reversible	Likely	Moderate: Significant	Provision of SBP marine mammal protocol, and adherence to the Scottish Marine Wildlife Watching Code.	Negative Negligible Short Term Reversible	Minor: non-significant

Receptor and Value Relevant Species		Phase	Predicted Impact	Impact Magnitude	Likelihood of Impact	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
White-Beaked Dolphin	International	Installation	Injury through interactions with cable installation equipment.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Foraging impairment due to indirect effects on prey species.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Displacement/foraging impairment due to increased sediment loading from cable repair operations.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Disturbance due to cable burial noise during cable repairs.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Disturbance due to SBP survey operations.	Low Negative Short Term Reversible	Likely	Moderate: Significant	Provision of SBP marine mammal protocol, and adherence to the Scottish Marine Wildlife Watching Code.	Negative Negligible Short Term Reversible	Minor: non-significant
		Operation	Disruption of migration due to EMF.	No Change	-	None	No Specific mitigation required.	No Change	None
Other Cetaceans	International	Installation	Displacement/foraging impairment due to increased sediment loading from cable burial and rock placement works.	Negligible Negative Short Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant

Receptor and Value Relevant Species		Phase	Predicted Impact	Impact Magnitude	Likelihood of Impact	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Other Cetaceans	International	Installation	Injury/displacement due to release of hazardous substances.	Negligible Negative Short Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Displacement/foraging impairment due to release of drilling fluids.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Disturbance due to DP vessel noise.	Negligible Negative Short Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Disturbance due to Non-DP vessel noise.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Disturbance due to cable burial noise.	Negligible Negative Short Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Disturbance due to SBP survey operations.	Low Negative Short Term Reversible	Unlikely	Moderate: Significant	Provision of SBP marine mammal protocol, and adherence to the Scottish Marine Wildlife Watching Code.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Injury through interactions with cable installation equipment.	No Change	-	None	No Specific mitigation required.	No Change	None

Receptor and Value Relevant Species		Phase	Predicted Impact	Impact Magnitude	Likelihood of Impact	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Other Cetaceans	International	Installation	Foraging impairment due to indirect effects on prey species.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Displacement/foraging impairment due to increased sediment loading from cable repair operations.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Disturbance due to cable burial noise during cable repairs.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Disturbance due to SBP survey operations.	Low Negative Short Term Reversible	Unlikely	Moderate: Significant	Provision of SBP marine mammal protocol, and adherence to the Scottish Marine Wildlife Watching Code.	Negative Negligible Short Term Reversible	Minor: non-significant
		Operation	Disruption of migration due to EMF (All species except Killer Whales)	Negligible Negative Long Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Long Term Reversible	Minor: non-significant
		Operation	Disruption of migration due to EMF (Killer Whales Only)	No Change	-	None	No Specific mitigation required.	No Change	None
Grey Seal	International	Installation	Displacement/foraging impairment due to increased sediment loading from cable burial and rock placement works.	Negligible Negative Short Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant

Receptor and Value Relevant Species		Phase	Predicted Impact	Impact Magnitude	Likelihood of Impact	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Grey Seal	International	Installation	Injury/displacement due to release of hazardous substances.	Negligible Negative Short Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Displacement/foraging impairment due to release of drilling fluids.	Negligible Negative Short Term Reversible	Likely	Minor: non-significant	Drilling fluids pumped out prior to breakout into marine environment.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Disturbance due to DP vessel noise.	Negligible Negative Short Term Reversible	Likely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Disturbance due to Non-DP vessel noise.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Disturbance due to cable burial noise.	Negligible Negative Short Term Reversible	Likely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Disturbance due to SBP survey operations.	Low Negative Short Term Reversible	Likely	Moderate: Significant	Provision of SBP marine mammal protocol, and adherence to the Scottish Marine Wildlife Watching Code.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Injury through interactions with cable installation equipment.	No Change	-	None	No Specific mitigation required.	No Change	None

Receptor and Value Relevant Species		Phase	Predicted Impact	Impact Magnitude	Likelihood of Impact	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Grey Seal	International	Installation	Foraging impairment due to indirect effects on prey species.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Displacement/foraging impairment due to increased sediment loading from cable repair operations.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Disturbance due to cable burial noise during cable repairs.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Disturbance due to SBP survey operations.	Low Negative Short Term Reversible	Likely	Moderate: Significant	Provision of SBP marine mammal protocol, and adherence to the Scottish Marine Wildlife Watching Code.	Negative Negligible Short Term Reversible	Minor: non-significant
		Operation	Disruption of migration due to EMF.	No Change	-	None	No Specific mitigation required.	No Change	None
Common Seal	International	Installation	Displacement/foraging impairment due to increased sediment loading from cable burial and rock placement works.	Negligible Negative Short Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Injury/displacement due to release of hazardous substances.	Negligible Negative Short Term Reversible	Unlikely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant

Receptor and Value Relevant Species		Phase	Predicted Impact	Impact Magnitude	Likelihood of Impact	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Common Seal	International	Installation	Displacement/foraging impairment due to release of drilling fluids.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Disturbance due to DP vessel noise.	Negligible Negative Short Term Reversible	Likely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Disturbance due to Non-DP vessel noise.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Disturbance due to cable burial noise.	Negligible Negative Short Term Reversible	Likely	Minor: non-significant	No Specific mitigation required.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Disturbance due to SBP survey operations.	Low Negative Short Term Reversible	Likely	Moderate: Significant	Provision of SBP marine mammal protocol, and adherence to the Scottish Marine Wildlife Watching Code.	Negative Negligible Short Term Reversible	Minor: non-significant
		Installation	Injury through interactions with cable installation equipment.	No Change	-	None	No Specific mitigation required.	No Change	None
		Installation	Foraging impairment due to indirect effects on prey species.	No Change	-	None	No Specific mitigation required.	No Change	None

Receptor and Value Relevant Species		Phase	Predicted Impact	Impact Magnitude	Likelihood of Impact	Significance (Absence of Secondary Mitigation)	Mitigation Summary	Residual Impact Magnitude	Significance of Residual Effect
Common Seal	Common Seal	Operation	Displacement/foraging impairment due to increased sediment loading from cable repair operations.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Disturbance due to cable burial noise during cable repairs.	No Change	-	None	No Specific mitigation required.	No Change	None
		Operation	Disturbance due to SBP survey operations.	Low Negative Short Term Reversible	Likely	Moderate: Significant	Provision of SBP marine mammal protocol, and adherence to the Scottish Marine Wildlife Watching Code.	Negative Negligible Short Term Reversible	Minor: non-significant
		Operation	Disruption of migration due to EMF.	No Change	-	None	No Specific mitigation required.	No Change	None

Key

	Significant Effect
--	--------------------

16.10 References

- Cheney, B., Graham, I.M., Barton, T.R., Hammond, P.S. and Thompson, P.M. 2018. Site Condition Monitoring of bottlenose dolphins within the Moray Firth Special Area of Conservation: 2014-2016. Scottish Natural Heritage Research Report No. 1021.
- CIEEM, 2016. Guidelines for ecological impact assessment in the UK and Ireland: terrestrial, freshwater and coastal. In (2nd ed.): Chartered Institute of Ecology and Environmental Management.
- BOWL, 2012. Beatrice Offshore Windfarm Environmental Statement.
- Bureau of Ocean Energy Management (BOEM) Office of Renewable Energy Programs, 2012. Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts, Environmental Assessment. *Published by U.S. Department of the Interior, October 2012.*
- EDP Renewables, 2013. Inch Cape Offshore Windfarm – Offshore Environmental Statement.
- Evans, P.G.H., Anderwald, P. & Baines, M.E. 2003. UK cetacean status review. Report to English Nature and the Countryside Council for Wales. *Sea Watch Foundation, Oxford. 160pp.*
- European Commission, 1992. Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.
- Gill, A.B., Gloyne-Phillips, I., Neal, K.J. & Kimber, J.A., 2005. The potential effects of electromagnetic fields generated by sub-sea power cables associated with offshore wind farm developments on electrically and magnetically sensitive marine organisms – a review. Report to Collaborative Offshore Wind Research into the Environment (COWRIE) group, Crown Estates.
- Gubbay S, Earll R, 2000. Review of literature on the effects of oil spills on cetaceans. SNH Review No. 3.
- Hammond, P.S., MacLeod, K., Northridge, S.P., Thompson, D. & Matthiopoulos, J., 2003. Background information on marine mammals relevant to Strategic Environmental Assessment 4. *Sea Mammal Research Unit, St Andrews.*
- IAMMWG, 2015. Management Units for cetaceans in UK waters (January 2015). *JNCC Report No. 547, JNCC Peterborough.*
- JNCC, 2010. The protection of marine European Protected Species from injury and disturbance. Guidance for the marine area in England and Wales and the UK offshore marine area. *Joint Nature Conservation Committee, Natural England and Countryside Council for Wales. 119pp.*
- JNCC, 2018. UK SAC Site List. <http://jncc.defra.gov.uk/page-1458>. Accessed 17/04/2018.
- LGL Alaska Research Associates and Jasco Applied Sciences, 2010. Marine Mammal Monitoring and Mitigation During Marine Geophysical Surveys by Shell Offshore Inc. in the Alaskan Chukchi and Beaufort Seas. *July – October 2010:90 - Day Report.*
- Mainstream Renewable Power, 2016. Neart na Gaoithe Offshore Windfarm Environmental Statement.
- Marine Scotland, 2018. National Marine Plan Interactive Website: <https://marinescotland.atkinsgeospatial.com/nmpi/>. Accessed 23/03/18.
- Northridge, S.P., Tasker, M.L., Webb, A. & Williams, J.M. 1995. Distribution and relative abundance of harbour porpoises (*Phocoena phocoena* L.), white-beaked dolphins (*Lagenorhynchus albirostris* Gray), and minke whales (*Balaenoptera acutorostrata* Lacepède) around the British Isles. *ICES Journal of Marine Science. 52, 55-66.*
- NRP. (2017). NorthConnect technical report on Ornithological surveys.
- Paxton, C.G.M., Scott-Hayward, L.A.S. and Røstad, E., 2014. Statistical approaches to aid the identification of Marine Protected Areas for minke whale, Risso's dolphin, white-beaked dolphin and basking shark. Scottish Natural Heritage Commissioned Report No. 594.

- Pirotta E, Eva Laesser B, Hardaker A, Riddoch N, Marcoux M, & Lusseau D. 2013. Dredging displaces bottlenose dolphins from an urbanised foraging patch. *Marine Pollution Bulletin: Vol 74, Issue 1*, Pages 396-402.
- Reid, J.B., Evans, P.G.H., & Northridge, S.P., 2003. Atlas of Cetacean distribution in north-west European waters, 76 pages, colour photos, maps. *Paperback, ISBN 1 86107 550 2*.
- SCOS. 2017. Scientific Advice on Matters Related to the Management of Seal Populations: 2017.
- SNH, 2014. Scottish MPA Project Data Confidence Assessment – Southern Trench MPA Proposal
- SNH, (Undated). The Scottish Marine Wildlife Watching Code (SMWWC).
- Southall B. L., Bowles A. E., Ellison W. T., Finneran J. J., Gentry R. L., Greene Jr. C. R., Kastak D., Ketten D. R., Miller J. H., Nachtigall P. E., Richardson W. J., Thomas J. A., and Tyack P. L., 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. *Aquatic Mammals 33*, 411 - 521.
- Statoil, 2015. Hywind Scotland Pilot Park – Environmental Statement.
- Tyler-Walters, H., James, B., Carruthers, M. (eds.), Wilding, C., Durkin, O., Lacey, C., Philpott, E., Adams, L., Chaniotis, P.D., Wilkes, P.T.V., Seeley, R., Neilly, M., Dargie, J. & Crawford-Avis, O.T. 2016. Descriptions of Scottish Priority Marine Features (PMFs). Scottish Natural Heritage Commissioned Report No. 406.