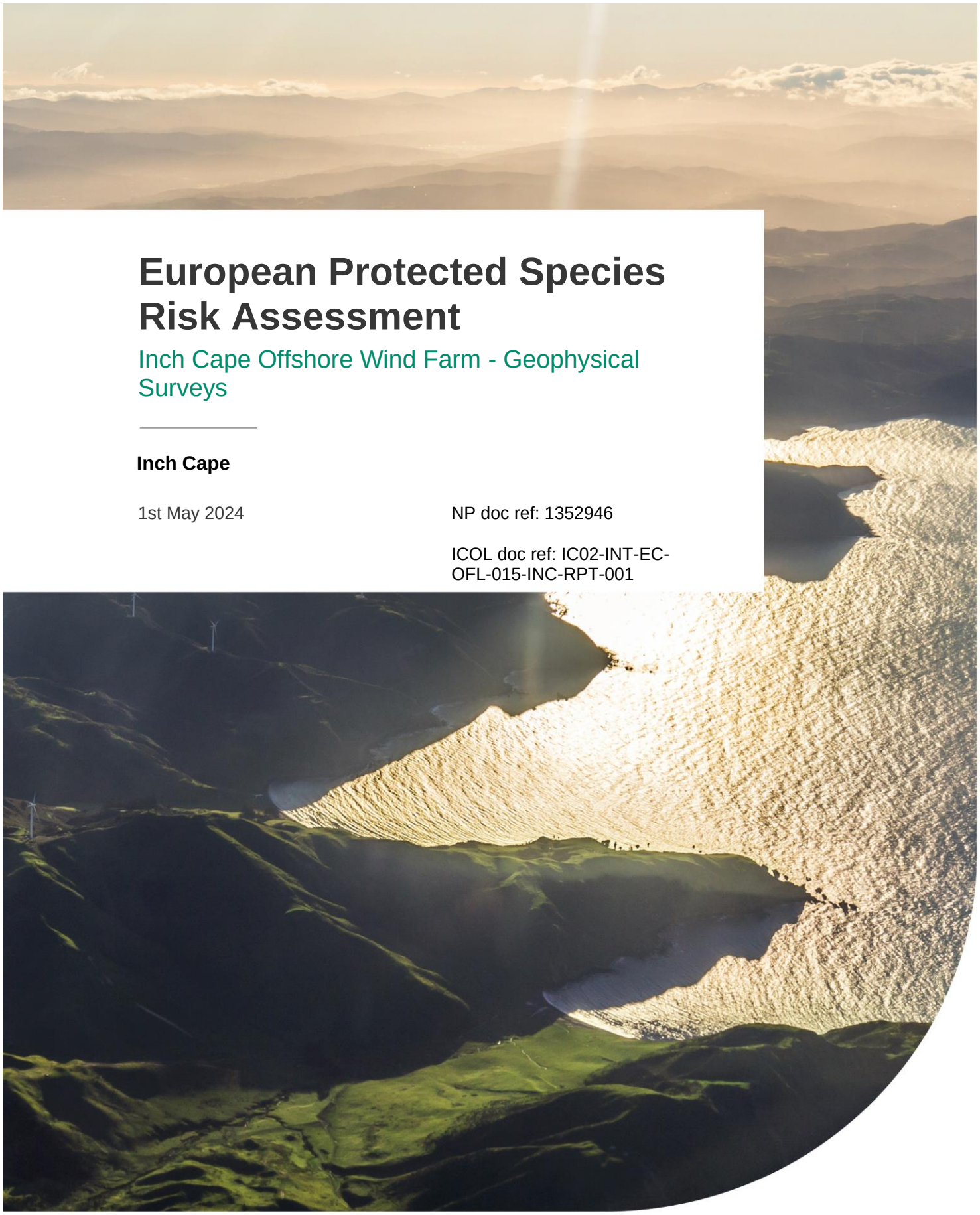

European Protected Species Risk Assessment

Inch Cape Offshore Wind Farm - Geophysical Surveys

Inch Cape

1st May 2024

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Author	[Redacted], Assistant Environmental Consultant, [Redacted], Principal Environmental Consultant	10/04/2024
Checked	[Redacted] Principal Environmental Consultant	18/04/2024
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Client Details	
Contact	[Redacted]
Client Name	Inch Cape
Address	Fifth Floor Office Suite 40 Princes Street Edinburgh EH2 2BY UNITED KINGDOM

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Local Office:

Ochil House
Springkerse Business Park
Stirling
FK7 7XE
SCOTLAND
UK
Tel: +44 (0) 1786 542 300

Reg No: SC177881

Registered Office:

The Natural Power Consultants Limited
The Green House
Forrest Estate, Dalry
Castle Douglas, Kirkcudbrightshire
DG7 3XS

VAT No: GB 243 6926 48

Contents

Acronyms & Abbreviations	
BEIS	Department for Business, Energy & Industrial Strategy
CI	Confidence Interval
dB	Decibel
EDR	Effective Deterrence Range
EEC	European Economic Community
EPS	European Protected Species
EU	European Union
FCS	Favourable Conservation Status
IAMMWG	Inter Agency Marine Mammal Working Group
ICOL	Inch Cape Offshore Limited
JNCC	Joint Nature Conservation Committee
kHz	Kilohertz
km	Kilometre
m	Metre
MBES	Multi Beam Echo Sounder
MMO	Marine Mammal Observer
MPA	Marine Protected Area
MU	Management Unit
µPa	Micropascal
μPa^2s	Micropascal squared second
NOAA	National Oceanic and Atmospheric Administration
OWF	Offshore Wind Farm
PAM	Passive Acoustic Monitoring
PTS	Permanent Threshold Shift
SAC	Special Area of Conservation
SBES	Single Beam Echo Sounder
SBP	Sub-Bottom Profiler
SCANS	Small Cetaceans in European Atlantic Waters and the North Sea
SCOS	Special Committee on Seals
SEL	Sound Exposure Level
SNH	Scottish Natural Heritage
SPL	Sound Pressure Level
SSS	Side Scan Sonar
STW	Scottish Territorial Waters
UK	United Kingdom
USBL	Ultra-Short Baseline
UXO	Unexploded Ordnance

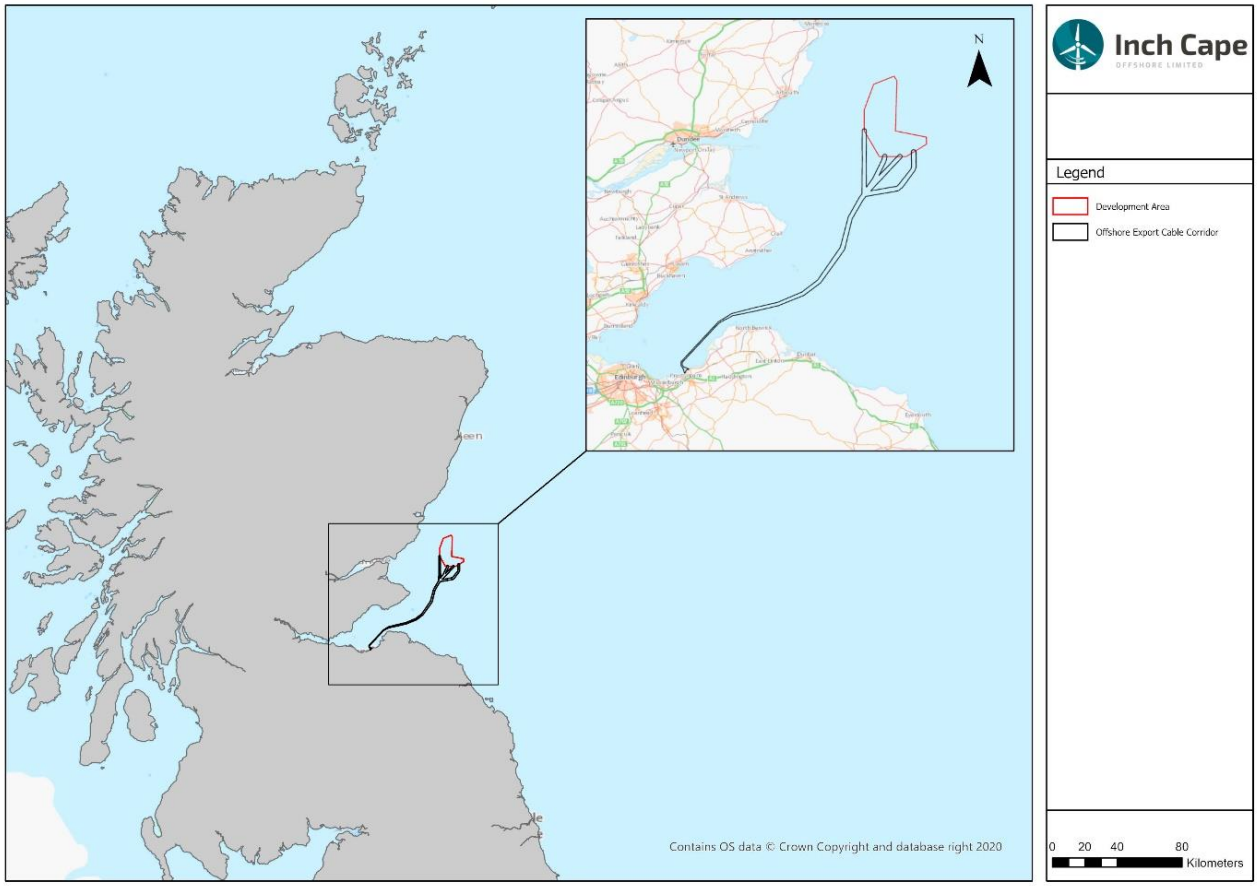
1. Introduction

Inch Cape Offshore Limited (ICOL) has consent to develop an offshore wind farm (OWF) in the outer Firth of Tay region within Scottish Territorial Waters (STW). The consented Inch Cape OWF will comprise up to 72 wind turbines and be located approximately 15 km to the east of the Angus coastline (Figure 1.1). The Development Area is in water depths of between 40 - 57 m.

Prior to the installation of Inch Cape OWF, a geophysical survey is required to provide complete pre-construction survey data to inform clearance activities, refine cable routing, structure and cable installation. Several phases of site investigation have previously taken place on the ICOL site, details of which can be found in the Inch Cape Offshore Wind Farm Site Data document ref: C02-INT-EN-DEN-006-INC-DES-001.

This document assesses the potential risk to marine European Protected Species (EPS), basking sharks and seals from the proposed geophysical surveys in order to ascertain whether EPS and basking shark licences are required and can be awarded.

Figure 1.1: Inch Cape Offshore Wind Farm site location



2. Planned Geophysical Survey Work

2.1. Survey Methods

The survey will be conducted using electromagnetic or acoustic tools (Table 2.1) along the proposed array area and cable route corridor. All equipment listed may not be required but has been included within this risk assessment to cover the full possible scenario. Where exact equipment specifications are currently unknown estimated likely ranges are provided in *italics*.

Table 2.1: Equipment proposed for the geophysical survey

Equipment type	Frequency range (kHz)	Suitable examples	Maximum Source Pressure Level (dB re 1 µPa @ 1 m)
Ultra-Short Baseline (USBL)	20-34	Sonardyne Mini-Ranger 2	194
	19-34	Sonardyne Ranger 2	194
		Sonardyne WSM 6+	
	20-34	- Type 8370-1111	187
	20-34	- Type 8370-4112	196
Multi Beam Echo Sounder (MBES)	*>200 (200-400)*	N/A - not within hearing range	*N/A (216)*
Side Scan Sonar (SSS)	Tri-frequency capability towfish: 120, 410 & 850 or 230, 540 & 850	EdgeTech 2050-DSS*	*210-224*
	Tri-frequency capability towfish: 230,540 & 850	EdgeTech 4205	*210-224*
Single Beam Echo Sounder (SBES)	>200	N/A - not within hearing range	*N/A (210)*
Sub-Bottom Profiler (SBP)	Primary: approx. 100 Secondary: 4 - 15	Innomar SES-2000 medium-100 Parametric SBP	>247
	0.3-1.2	Dura-Spark UHD 400 sparker system and GeoEel LH-16 Digital Gel Streamer	226

**Note that the EdgeTech 2050-DSS is a combined SSS and SBP.*

2.2. Proposed Vessels

Although vessels to be used for the proposed geophysical surveys are yet to be confirmed, it is anticipated that up to three vessels may be used to allow for the surveying of intertidal, nearshore and offshore areas.

2.3. Timing and Duration

The earliest estimated date of mobilisation for the geophysical survey will be 1st August 2024. The aim is to have completed the surveys by the 31st May 2025. A more specific work timetable will be provided by ICOL closer to the start of the works. Survey operations will be undertaken on a 24-hour basis where conditions allow.

3. Legal Requirement

All species of cetacean in waters around the UK are considered EPS under Annex IV of the Habitats Directive (Council Directive 92/43/EEC) which covers animal and plant species of community interest in need of strict protection.

The need to consider EPS in waters off Scotland comes from two articles of legislation, these are:

- The Conservation (Natural Habitats &c.) Regulations 1994 (as amended in Scotland) which transposes the Conservation of Natural Habitats and Wild Fauna and Flora Directive (Council Directive 92/43/EEC; referred to as the Habitats Directive) into Scottish law. This legislation covers Scottish Territorial Waters; and
- The Conservation of Offshore Marine Habitats and Species Regulations 2017 (known as the Offshore Regulations) which transpose the Habitats Directive into UK law for all offshore activities. This legislation covers UK waters beyond the 12 nm limit.

Both of these regulations (collectively known as the 'Habitat and Offshore Marine Regulations') provide for the designation of protected European sites (Special Areas of Conservation (SACs)) and the protection of EPS as designated under the Habitats Directive.

The Offshore Regulations state in section 45, that it is an offence to:

- Deliberately capture, kill or injure any wild animal of a EPS, as listed under Annex IV of the Habitats Directive;
- Damage or destroy, or cause deterioration of the breeding sites or resting places of a EPS; and
- Deliberately disturb EPS (in particular disturbance which is likely to impair the ability of a significant group of animals of that species to survive, breed, rear, or nurture their young, or which might affect significantly their local distribution or abundance).

The Conservation of Habitats and Species Regulations 1994 (as amended in Scotland) state, under section 39, that it is an offence to:

- Deliberately or **recklessly** capture, kill or injure a wild animal of a EPS, as listed under Annex IV of the Habitats Directive;
- Damage or **recklessly** destroy, or cause deterioration of the breeding sites or resting places of an EPS; and
- Deliberately or **recklessly** disturb EPS (in particular disturbance which is likely to impair their ability to survive, breed, reproduce, nurture their young, migrate or hibernate, or which might affect significantly their local distribution or abundance).
- Disturb **any** EPS in a matter that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species to which is belongs;
- **Deliberately or recklessly disturb any dolphin, porpoise or whale (cetacean) through Regulation 39 (2).**

The additional protection afforded by the Conservation of Habitats and Species Regulations 1994 (as amended in Scotland) has been shown in **bold** in the list above. It is therefore an offence to deliberately or recklessly disturb a single cetacean in Scottish Territorial Waters.

In addition, any means of capturing or killing which is indiscriminate and capable of causing the local disappearance of - or serious disturbance to - any population of EPS is an offence.

Licences may be granted by the Marine Directorate (on behalf of the Scottish Ministers) which would allow otherwise illegal activities to go ahead.

Three tests must be passed before a license can be granted:

1. The license must relate to one of the purposes referred to in Regulation 44, which are:
    a. scientific research or educational purposes;
    b. ringing or marking, or examining any ring or mark on, wild animals;
    c. conserving wild animals, including wild birds, or wild plants or introducing them to particular areas;

d. conserving natural habitats;

e. protecting any zoological or botanical collection;

f. preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment;

g. preventing the spread of disease; or

h. preventing serious damage to livestock, foodstuffs for livestock, crops, vegetables, fruit, growing timber or any other form of property or to fisheries;

2. There must be no satisfactory alternative (Regulation 44, 3a); and
3. The action authorised must not be detrimental to the maintenance of the population of the species concerned at a Favourable Conservation Status (FCS) in their natural range (Regulation 44, 3b).

FCS is defined in the Habitats Directive as the following:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable element of its natural habitats;
- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and
- There is, and will probably continue to be, a sufficiently large habitat to maintain its population on a long-term basis.

The proposed Cable Route and Development Area are both within the 12 nm limit of Scotland's Territorial Waters. However, sound from the proposed works has the potential to affect animals within both Scottish Territorial and offshore waters. Both the Habitats and Offshore Regulations therefore apply.

3.1. Guidance

The Marine Directorate and Scottish Natural Heritage (SNH) (now Nature Scot) produced guidance for Scottish inshore waters 'The protection of Marine European Protected Species from injury and disturbance' in March 2014 (Marine Scotland and SNH, 2014). This guidance was updated in July 2020 (Marine Scotland and SNH, 2020). Marine Directorate recognise that the guidance '…reflects a precautionary approach…' to the interpretation of the Habitats Directive with regards to EPS and requires the careful examination of the potential impact of proposed offshore activities, and the resultant noise produced, on individual animals likely to be present at the location.

The guidance states that the two main potential causes of death or injury are physical contact (with a vessel) and anthropogenic noise. Likelihood of disturbance for individuals includes factors such as:

- Spatial and temporal distribution of the animal in relation to the activity;
- Any behaviour learned from prior experience with the activity;
- Similarity of the activity to biologically important signals (particularly important in relation to activities creating sound); and
- The motivation of the animal to remain within the areas (e.g. food availability).

Likelihood of potential impacts should include the following considerations:

- Type of activity;
- Duration and frequency of the activity;
- Extent of the activity;
- Timing and location of the activity; and
- Other known activities in the area at the same time.

4. EPS in Region of the Inch Cape OWF

4.1. Cetaceans

Four cetacean species are considered to occur on a relatively common basis in the vicinity of the Inch Cape OWF: Harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus),* white beaked dolphin (*Lagenorhynchus albirostris*) and minke whale (*Balaenoptera acutorostrata*) (Arso Civil *et al*. 2021, Gilles *et al.* 2023, IAMMWG, 2023).

Occasional visitors to the region include common dolphin (*Delphinus delphis*), Risso's dolphin (*Grampus griseus*), white-sided dolphin (*Lagenorhynchus acutus*), killer whale (*Orcinus orca*), long-finned pilot whale (*Globicephala melas*) and fin whale (*Balaenoptera physalus)*. Sightings of humpback whale (*Megaptera novaeangliae*) and sei whale (*Balaenoptera borealis*) have also been recorded in recent years[1].

4.1.1. Harbour Porpoise

The harbour porpoise is widespread around the UK, including the North Sea, Irish Sea, the seas west of Ireland and Scotland, and northwards to Orkney and Shetland. Since the 1990s it has become much less common around the Northern Isles, but it appears to be returning to the English Channel and southern North Sea, where it was infrequent in the late 1980s. The recent SCANS-IV survey results, the latest in a series of large-scale surveys for cetaceans in European Atlantic waters, show that the harbour porpoise population in the North Sea is stable and there is very little difference in the estimated abundance from 2016 – 2022 (Gilles *et al.,* 2023).

Harbour porpoise density in the vicinity of the Inch Cape OWF, from SCANS-IV, is provided in Table 4.1. The relevant Inter Agency Marine Mammal Working Group (IAMMWG) Management Unit (MU) abundance estimate is also provided and can be considered as the reference population.

The closest designated site for harbour porpoise (Southern North Sea SAC) is greater than 200 km from the Inch Cape OWF.

Table 4.1: Harbour porpoise density and reference population abundance

Density (animals per km^2)	Management Unit	Abundance	95% Confidence Interval (CI)* for MU Abundance Estimate
0.5985	North Sea	346,601	289,498 - 419,967

Source: Gilles et al. (2023) – SCANS-IV Block NS-D; IAMMWG (2023).

** An interval which is expected to typically contain the parameter being estimated.*

4.1.2. Bottlenose Dolphin

Both inshore and offshore bottlenose dolphin ecotypes are recognised in UK waters. The two largest inshore bottlenose dolphin populations are located in the Moray Firth, East Scotland and Cardigan Bay, Wales, which both have SACs designated for them. The east coast of Scotland bottlenose dolphin population has expanded south since the 1990s and now around 53% of the population uses the Tay Estuary and surrounding waters, which is adjacent to the Inch Cape OWF (Arso Civil *et al.* 2021).

Due to the behaviour and social structure of the inshore bottlenose dolphin population, which regularly travels along the coastline in close-knit groups, it is difficult to represent their population density accurately. For example, the recent SCANS-IV survey did not detect any bottlenose dolphins in the relevant survey block for the Inch Cape OWF and therefore no density was estimated. As such, a density surface was created using the most recent population

[1] https://www.seawatchfoundation.org.uk/recentsightings/

estimate for east Scotland. The five-year weighted average for the East Coast population (224, CIs: 214-234)[2] was assumed to be split 50:50 between the east coast (from Rattray Head south) and the Moray Firth (Cape Wrath to Rattray Head). The 20 m depth contour was used to differentiate between the 'coastal strip' (where inshore bottlenose dolphins tend to be encountered) and the 'non-coastal strip' (where inshore bottlenose dolphins tend not to be encountered). The choice of the 20 m contour was informed by data from the south side of the Moray Firth where greater than 95% of sightings made were within the 20 m depth contour (Culloch and Robinson, 2008; Robinson *et al*., 2007). The 112 individuals assumed to be present on the east coast (i.e., 50% of the population of 224 individuals) were distributed evenly across the area inside the 20 m depth contour on a 5 km x 5 km grid. Zero density was used beyond the 20 m depth contour and within the Forth and Inner Tay (where bottlenose dolphins are known not to be regularly present).

The IAMMWG has accounted for the two ecotypes by defining two MUs, the Coastal East Scotland MU and the Greater North Sea MU. The abundance estimates for both of these is provided in Table 4.2. Considering that only inshore bottlenose dolphins are predicted to have the potential to be impacted by the proposed geophysical surveys, the Coastal East Scotland MU has been used as the reference population.

The closest designated site for bottlenose dolphins (Moray Firth SAC) is greater than 200 km from the Inch Cape OWF, however, with the southerly expansion of the east Scotland bottlenose dolphin population there is likely high connectivity between the Proposed Development and animals from the population which uses this SAC.

Table 4.2: Bottlenose dolphin reference population abundance estimates

Management Unit	Abundance	95% Confidence Interval (CI) for MU Abundance Estimate
Coastal East Scotland	224	214 - 234
Greater North Sea	2,022	548 - 7,453

Source: IAMMWG (2023).

4.1.3. White-beaked Dolphin

White-beaked dolphins are detected predominantly offshore in UK waters and their highest densities have been estimated around the Shetland Islands, northern North Sea and northwest Scotland (Gilles *et al*., 2023). The density of white-beaked dolphins in the vicinity of the Inch Cape OWF, from SCANS-IV, is provided in Table 4.3. The relevant IAMMWG MU abundance estimate is also provided and can be considered as the reference population.

There are no designated sites (SACs) for white-beaked dolphins (the species is not listed on Annex II of the Habitats Directive).

Table 4.3: White-beaked dolphin density and reference population abundance

Density (animals per km^2)	Management Unit	Abundance	95% Confidence Interval (CI) for MU Abundance Estimate
0.0799	Celtic and Greater North Seas	43,951	28,439 - 67,924

Source: Gilles et al. (2023) – SCANS-IV Block NS-D; IAMMWG (2023).

4.1.4. Minke Whale

Minke whales are the smallest of the baleen whales and are widespread around the UK. There was some evidence that minke whale distribution in the North Sea was shifting south between 1994 and 2005 (Hammond *et al.* 2013). In sequential surveys the distribution seemed to stay the same until the observed distribution from the recent

[2] https://www.nature.scot/doc/east-coast-scotland-bottlenose-dolphins-estimate-population-size-2015-2019

SCANS-IV survey showed many sightings further south in the North Sea than previously seen. There is no evidence of a change in abundance for minke whales in the North Sea from 1989-2022 (Gilles *et al*., 2023).

Minke whale density in the vicinity of the Inch Cape OWF, from SCANS-IV, is provided in Table 4.4. Block NS-D is the highest density block for minke whales from this survey. The relevant IAMMWG MU abundance estimate is also provided and can be considered as the reference population.

The closest protected area for minke whale (Southern Trench MPA) is approximately 98 km from the Inch Cape OWF at its closest point. There are no designated sites (SACs) for minke whales (the species is not listed on Annex II of the Habitats Directive).

Table 4.4: Minke whale density and reference population abundance

Density (animals per km^2)	Management Unit	Abundance	95% Confidence Interval (CI) for MU Abundance Estimate
0.0419	Celtic and Greater North Seas	20,118	14,061 - 28,786

Source: Gilles et al. (2023) – SCANS-IV Block NS-D; IAMMWG (2023).

4.2. Marine Turtles

In addition to marine mammals, there are up to five species of marine turtle which have been sighted in British waters. The leatherback turtle (*Dermochelys coriacea*) is the most commonly recorded species in UK waters however, the species is thought to be at the most extreme northern limit of its natural range in UK waters with its range being limited by the 15ºC isotherm (McMahon and Hays, 2006; BEIS, 2016). Sightings in the North Sea are uncommon with most UK sightings occurring in the Irish Sea (BEIS, 2016). Due to the low likelihood of occurrence of marine turtles in the vicinity of the Inch Cape OWF, they have not been considered further. However, any mitigation proposed for cetacean EPS will also be applied to marine turtles.

4.3. Other (non-EPS) Species

4.3.1. Basking Shark

Basking sharks are protected under Schedule 5 of the Wildlife and Countryside Act 1981. There have been few sightings of this species in the North Sea (Drewery, 2012; Wilson *et al*., 2020) which indicates a low abundance in the vicinity of the Inch Cape OWF. Due to their habit of feeding at slow speed very close to the surface, basking sharks are potentially at risk from collision with boat traffic (Wilson *et al*., 2020). In contrast, although there is little information on sound detection in basking sharks, there is no direct evidence of sound causing basking shark mortality or stress (Wilson *et al*., 2020). Although the potential effects of noise on basking sharks have not therefore been assessed, any mitigation measures proposed for EPS will also be applied to basking sharks.

4.3.2. Seals

Two seal species occur on a relatively common basis in the North Sea: Grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*) (Carter *et al*., 2022).

Grey seals

Grey seals are among the rarest seals in the world; the UK population represents about 40% of the world population and 95% of the EU population. Grey seals spend most of the year at sea and may range widely in search of prey. They come ashore in autumn to form breeding colonies on rocky shores, beaches, in caves, occasionally on sandbanks, and on small largely uninhabited islands.

In the east of Scotland the most recent estimate of grey seal pup production is 7,261 pups (2019) and the most recent August count of adult grey seals is 2,707 (2021) (SCOS, 2022).

The closest SAC which lists grey seal as a qualifying interest feature (Isle of May SAC) is 4 - 5 km from the Inch Cape OWF (cable corridor) at its closest point. The Isle of May SAC has a stable or potentially declining population of grey seals with an estimated pup production of 1,885 (2019) and an August count of 97 (2021) (SCOS 2022).

Harbour seals

Harbour seals have a near-circumpolar distribution, with at least four subspecies recognised. Only the eastern Atlantic subspecies occurs in Europe. The UK population represents about 5% of the world population and approximately 50% of the EU population. Harbour seals are the characteristic seal of sandflats and estuaries but are also found on rocky shores in Scotland. As pups swim almost immediately after birth, seals can breed on sheltered tidal areas where banks allow access to deep water. Seals may range widely in search of prey, but individuals often return to favoured haul-out sites. The closest SAC which lists harbour seal as a qualifying interest feature (Firth of Tay and Eden Estuary) is approximately 25 km from the Inch Cape OWF at its closest point.

In east Scotland harbour seals are in decline. A complete survey of the East Scotland Seal Management Area was carried out by the Sea Mammal Research Unit in 2021. A total of 261 harbour seals were counted, which was 26% lower than the previous survey in 2016, of which 41 were in the Firth of Tay and Eden Estuary SAC (SCOS 2022).

Table 4.5 provides absolute density and abundance estimates for both grey and harbour seals, which were calculated using the relative density of at-sea distribution estimates from Carter *et al.* (2022). The methodology for making these estimates is provided in Appendix A. The density and abundance estimates described in Appendix A were created for both the East Scotland Seal Management Area and the Inch Cape OWF (array area and cable route) plus a 30 km buffer (an area designed specifically for estimating impacts from UXO clearance). The East Scotland Seal Management Area estimates are deemed most appropriate for the geophysical survey work assessed here and are the figures presented in Table 4.5. Minimum abundance estimates (N_{min}) are also provided for the East Scotland Seal Management Area in SCOS (2022). As these estimates are more conservative than the modelled abundance estimates both are presented and used as the reference population for grey seals and harbour seals.

Table 4.5: Seal density and reference population abundance

Species	Density (animals per km^2)	Management Unit	Abundance estimates calculated using Carter *et al.* (2022)	SCOS (2022) abundance estimate
Grey seal	0.3016	East Scotland	18,259	10,106
Harbour seal	0.0051	East Scotland	377	262

Source: Appendix A, SCOS 2022.

5. Risk Assessment

During the proposed geophysical survey, there is potential for marine EPS and seals to be impacted. The main activities associated with the work which may impact these species are:

- Increased anthropogenic noise from geophysical survey and positioning equipment; and
- Collision risk (with the survey vessel(s)).

Increased anthropogenic noise from the survey vessels themselves has been considered as a potential impact but has not been assessed individually. This is because noise from the survey vessel(s) is unlikely to significantly increase vessel noise in this area and any displacement due to noise from the survey vessels alone is likely to be small-scale and temporary. The vessels will be on survey, and therefore emitting other sounds, for the majority of the time they are at sea. This potential impact (increased anthropogenic noise from geophysical survey and positioning equipment) has been assessed.

5.1. Overview of the Potential Effects of Anthropogenic Noise on Marine Mammals

It is widely documented that marine mammals are sensitive to underwater noise with the level of sensitivity depending on the hearing ability of the species (Table 5.1).

Potential effects of underwater noise on marine mammals can be summarised as:

- Auditory injury; and
- Behavioural responses.

Table 5.1: Marine mammal hearing ranges

Functional hearing group	Example species	Estimated auditory bandwidth (kHz)
Low frequency cetacean	Minke whale	0.007 - 35
High frequency cetacean	Bottlenose dolphin, white-beaked dolphin	0.15 - 160
Very high frequency cetacean	Harbour porpoise	0.2 - 180
Phocid carnivores in water	Harbour seal, grey seal	0.05 - 86

Source: NOAA (2018); Southall et al. (2019).

5.1.1. Auditory Injury (PTS)

Southall *et al.* (2019) provide thresholds for received sound levels that have the potential to induce the onset of auditory injury (Permanent Threshold Shift – PTS) in marine mammals (Table 5.2). Sound from geophysical survey and positioning equipment is generally impulsive (whereas sound from other sources e.g., vessels, is non-impulsive i.e., continuous). It is worth noting that the criteria refer only to the 'onset' of injury risk rather than a confident assessment of an occurrence of the effect.

JNCC *et al*. (2010) proposes that a permanent shift in the hearing thresholds (PTS) of an EPS would constitute an injury offence. The Southall *et al*. criteria for injury are based on quantitative sound level and exposure thresholds over which PTS onset could occur (Table 5.2). If it is likely that an EPS could become exposed to sound at or above the levels proposed, then there is a risk that an injury offence could occur.

Table 5.2: Permanent threshold shift (PTS) thresholds

Functional hearing group	Example species	Impulsive		Non-impulsive
		SPLpeak (dB re 1 µPa)	SEL (dB re 1 µPa^{2}s)	SEL (dB re 1 µPa^{2}s)
Low frequency cetacean	Minke whale	219	183	199
High frequency cetacean	Bottlenose dolphin White-beaked dolphin	230	185	198
Very high frequency cetacean	Harbour porpoise	202	155	173
Phocid carnivores in water	Harbour seal Grey seal	218	185	201

Source: Southall et al. (2019).

5.1.2. Behavioural Responses

Behavioural responses may arise where an activity is audible (see Table 5.1) and at a level above ambient noise. However, the most likely response will be temporary, for example, there is evidence that short-term disturbance caused by a commercial two-dimensional seismic survey does not lead to long-term displacement of harbour porpoises (Thompson *et al.*, 2013). For harbour porpoises, it is recommended that a 5 km effective deterrence range (EDR) is used for the type of equipment to be used in the proposed geophysical works (e.g. SBP, MBES) (JNCC, 2020). Without suitable alternative data being available it is assumed the same deterrence ranges applies to the other marine mammals assessed here. This assumption is likely conservative.

5.2. Increased Anthropogenic Noise from Geophysical Survey and Positioning Equipment

The geophysical survey and positioning equipment used during the survey will increase levels of anthropogenic noise in the marine environment as it operates by producing and receiving sound. A summary of the equipment types proposed for use is provided in Table 2.1.

5.2.1. Prediction of Potential Impact of MBES and SBES

The high frequency sounds produced by the Multi Beam Echo Sounder (MBES) and Single Beam Echo Sounder (SBES) all fall outside the hearing range of the marine mammals assessed (Table 2.1, Table 5.1). There is therefore no risk of auditory injury or behavioural responses from the use of this equipment and no mitigation is required. This is supported by the advice from the JNCC, who do not advise the use of mitigation for the use of MBES in shallow waters (<200 m) (JNCC, 2017). This is because it is thought that the high frequency sounds produced by MBES attenuate more quickly than the lower frequencies used in deeper waters.

5.2.2. Prediction of Potential Impact of USBL, SSS and SBP

5.2.2.1. Auditory Injury

USBL

The sounds produced by the USBL equipment do fall within the hearing range of the marine mammals assessed (Table 2.1, Table 5.1). However, these sounds will not reach the SPL threshold (Table 5.2) therefore there is no risk of auditory injury onset from the use of this equipment and no mitigation is required.

SSS and SBP

The SBP and lowest frequency (120 kHz) of one of the Side Scan Sonars (SSS) to be used does fall within the hearing range of the marine mammals assessed (Table 2.1, Table 5.1). The maximum source level of the SSS (210-224 dB re. 1 µPa) and SBP (maximum SPL >247 dB re. 1 µPa) has the potential to induce the onset of instantaneous PTS at very close-range for low frequency cetaceans, very high frequency cetaceans and phocid carnivores in water (Southall *et al*., 2019).

However, it is likely that the presence of the survey vessel(s) will lead to small-scale temporary displacement of marine mammals, resulting in them being at sufficient distance from the survey equipment so as not to be susceptible to instantaneous auditory injury. Nonetheless, to remove the risk of auditory injury from the use of the SSS (if operated within audible frequencies) and SBP, mitigation will be required (see Section 6).

5.2.2.2. Behavioural Responses

The sound emitted by the USBL, SSS (if used at 120 kHz) and SBP falls within the hearing range of the marine mammals assessed and therefore has the potential to cause animals to respond behaviourally (Table 5.1). However, these pieces of equipment will likely be used as the survey vessel(s) is moving, and not stationary for a prolonged period, any behavioural avoidance in a location will likely be temporary and will not result in long-term displacement (Thompson *et al*., 2013).

Using the EDR of 5 km recommended for geophysical surveys for harbour porpoise (JNCC, 2020), the number of individuals for each marine mammal species assessed which have the potential to be affected has been estimated (Table 5.3). The area of potential effect was estimated using the formula: area = πr^2 = 78.54 km^2 (where r = 5 km). For all species, other than bottlenose dolphins, the number of animals and the percentage of the reference population estimated to be disturbed was estimated using the density estimates and reference population abundance estimates presented in Section 4. For bottlenose dolphins it is anticipated that only members of the inshore population may be disturbed. Using the 5 km EDR and the density surface created for the inshore bottlenose dolphin population (see Section 4.1.2) the maximum number of individuals which might have the potential to be disturbed was estimated. The abundance estimate for the Coastal East Scotland Management Unit was used as the reference population.

Considering the estimates provided in Table 5.3 there is potential for temporary behavioural avoidance from all marine mammal species assessed quantitatively as a result of the use of USBL, SSS (if used at 120 kHz) and SBP during the geophysical surveys. However, any such avoidance is very unlikely to significantly affect the local distribution or abundance of any species (the largest percentage of a reference population which has the potential to be affected is 2.679% for bottlenose dolphins, which is deemed negligible).

Table 5.3: The number of individuals estimated to have the potential to be disturbed by sound emitted by the USBL, SSS (if used at 120 kHz) and SBP systems

Species	Number of individuals within the area of potential effect	Percentage of reference population which has the potential to be affected	
Harbour porpoise	47	0.014	
Bottlenose dolphin	6	2.679	
White-beaked dolphin	6	0.014	
Minke whale	3	0.016	
		Modelled abundance from Carter *et al*. 2022	N_{min} abundance from SCOS 2022
Grey seal	24	0.130	0.234
Harbour seal	<1	0.106	0.153

5.3. Collision Risk

Vessel strikes are a known cause of mortality in marine mammals and basking sharks (Laist *et al*., 2001). Non-lethal collisions have also been documented (Laist *et al*., 2001; Van Waerebeek *et al*., 2007). Injuries from such collisions can be divided into two broad categories: blunt trauma from impact and lacerations from propellers. Injuries may result in individuals becoming vulnerable to secondary infections or predation.

Avoidance behaviour by marine mammals (e.g., bottlenose dolphins), is often associated with fast, unpredictable boats such as speedboats and jet-skis (Bristow and Reeves, 2001; Gregory and Rowden, 2001; Buckstaff, 2004), while neutral or positive reactions for other species have been observed with larger, slower moving vessels such as cargo ships (Sini *et al*., 2005).

5.3.1. Prediction of Potential Impact

The proposed survey work will require a maximum of three vessels following predetermined survey lines. The consistent speed and direction of travel employed will mean that animals can predict the path of the vessels and potentially alter their direction of travel, thus reducing the risk of collision. Additionally, the presence of up to three survey vessels is unlikely to significantly increase the vessel traffic in the area, especially as each vessel will be working in a different area (intertidal, nearshore, and offshore). Therefore, the increase in potential collision risk for marine mammals and basking sharks is considered to be negligible. During transits, when vessel speed may be greater, transit watches (section 6.2) will be conducted.

6. Mitigation Measures

6.1. Use of SSS and SBP

In order to ensure the absence of animals in the vicinity of the geophysical survey works, and to reduce the risk of auditory injury, mitigation measures will be enforced prior to use of the SSS (if used at 120 kHz) and SBP (and any other equipment assessed to have the potential to induce the onset of auditory injury). The mitigation will follow the JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys (JNCC, 2017) and the JNCC guidance for the use of Passive Acoustic Monitoring in UK waters for minimising the risk of injury to marine mammals from offshore activities (JNCC, 2023).

The mitigation measures are as follows:

- A non-dedicated but fully briefed Marine Mammal Observer (MMO) will undertake a pre-work search of a 500 m mitigation zone for 30 minutes prior to use of the equipment. If a marine mammal is detected within the mitigation zone then there will be a minimum 20-minute delay in starting the equipment from the time of the last detection of the animal within the mitigation zone. If marine mammals are detected during operation of the equipment there is no requirement to stop use of the equipment.
- A passive acoustic monitoring (PAM) operator[3] will undertake a pre-work acoustic search prior to the use of the equipment when a visual search by the MMO is not possible (e.g. high sea state conditions, low visibility or low light levels). Either a towed PAM system (with multiple hydrophones to allow distance determination to adequately monitor the 500 m mitigation zone) or a dipping hydrophone (any detections will be assumed to have occurred within the mitigation zone) will be used. If a marine mammal is detected the same delay protocol will be applied as for a visual search.
- Soft starts will be employed where equipment has the capability.
- If there are unplanned breaks in the operation of the equipment of greater than 10 minutes, then a full pre-work search will be carried out by either the MMO or PAM operator, where appropriate, before the equipment is turned back on. If the MMO or PAM operator continues monitoring for marine mammals during the breakdown period this time can contribute to the 30 minute pre-work search.
- Post-survey reports will be provided by the MMO and PAM operator following the JNCC guidelines for reporting (JNCC, 2017, JNCC, 2023).

6.2. Transit Watches

An observer on the bridge of all vessels will keep watch for EPS, basking sharks and seals during all transits to and from the work sites. Any sightings will be communicated to the Officer on watch as soon as is practicable and the following actions implemented:

- The Officer on watch will ensure that EPS, basking sharks and seals are avoided where safe to do so; and
- The Officer on watch will minimise high powered manoeuvres or rapid changes of course where this does not impair safety.

The observer may be the Master of the vessel, a member of the bridge crew, another member of the ship's crew or an MMO as appropriate. Observers will be briefed on the Scottish Marine Wildlife Watching Code[4] and Basking Shark Code of Conduct[5].

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[3] PAM operators will be suitably trained and have an appropriate level of experience of conducting PAM for mitigation.

[4] Scottish Marine Wildlife Watching Code | NatureScot

[5] Download.ashx (sharktrust.org)

6.3. Additional Measures

In addition, the following mitigation measures are proposed for non-EPS:

- In the months of September to December inclusive, any survey work within 20 km of the Isle of May SAC will start during daylight hours and in good sea states (Beaufort 3 or lower).
- In the last two weeks of July and the first two weeks of August, vessels will as far as is practicable employ slow speeds, steady courses and avoid sailing through large rafts of birds on the sea.

7. Assessment of Potential Offence

7.1. Increased Anthropogenic Noise from Geophysical Surveys

MBES and SBES

The conclusions of the assessment for effects as a result of increased anthropogenic noise from the use of MBES and SBES geophysical survey equipment are that:

- There is no potential for auditory injury to EPS; and
- There is no potential for behavioural responses from EPS (see section 5.2.1).

USBL, SSS and SBP

The conclusions of the assessment for effects as a result of increased anthropogenic noise from the use of USBL, SSS and SBP geophysical survey and positioning equipment are that:

- With mitigation for the SSS and SBP (see section 6.1) there is no potential for auditory injury to EPS (see section 5.2.2.1); and
- There is the potential for EPS to respond behaviourally (see Table 5.3, section 5.2.2.2). However, any disturbance is deemed short-term, sporadic, reversible, and without any likely negative effect on the species.

Considering the conclusion from this work, an **EPS licence (to disturb) will be required and can be granted** as advised from the guidance provided in the Conservation of Habitats and Species Regulations 1994 (as amended in Scotland).

7.2. Collision Risk

The risk of collision with vessels involved in the proposed geophysical survey work is negligible for the species likely to be present in this area (see section 5.3.1). Nonetheless, watches will be undertaken during transits whilst vessels will be moving more quickly (see section 6.2).

Considering that the presence of up to three survey vessels is unlikely to significantly increase the vessel traffic in the area then it is concluded that an EPS licence will not be required for this aspect of the proposed work.

8. References

Arso Civil, M., Quick, N. J., Mews, S., Hague, E., Cheney, B., Thompson, P. M., & Hammond, P. S. (2021). Improving understanding of bottlenose dolphin movements along the east coast of Scotland. Final report.: Report number SMRUC-VAT-2020-10 provided to European Offshore Wind Deployment Centre (EOWDC). March 2021 (unpublished).

BEIS (2016) Guidance. Oil and gas: environmental data. June 2016 [Online]. Available from: https://www.gov.uk/guidance/oil-and-gas-environmental-data

Bristow, T. and Reeves, E.I.S. (2001). Site fidelity and behaviour of bottlenose dolphins (Tursiops truncatus) in Cardigan Bay, Wales. Aquatic Mammals 27: 1-10.

Buckstaff, K.C. (2004). Effects of watercraft noise on the acoustic behaviour of bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay, Florida. Marine Mammal Science 20: 709-725.

Carter, M.I.D., Boehme, L., Cronin, M.A., Duck, C.D., Grecian, W.J., Hastie, G.D., Jessopp, M., Matthiopoulos, J., McConnell, B.J., Miller, D.L., Morris, C.D., Moss, S.E.W., Thompson, D., Thompson, P.M. & Russell, D.J.F. (2022). Sympatric seals, satellite tracking and protected areas: Habitat-based distribution estimates for conservation and management. *Front. Mar. Sci*. **9.** Available online at: https://doi.org/10.3389/fmars.2022.875869

Culloch, R. M., & Robinson, K. P. (2008). Bottlenose dolphins using coastal regions adjacent to a Special Area of Conservation in north-east Scotland. Journal of the Marine Biological Association of the United Kingdom, 88(6), 1237-1243.

Drewery, H.M. (2012). Basking shark (*Cetorhinus maximus*) literature review, current research and new research ideas. Marine Scotland Science Report 24/12.

Hammond, PS, Macleod, K, Berggren, P, Borchers, DL, Burt, ML, Cañadas, A, Desportes, G, Donovan, GP, Gilles, A, Gillespie, D, Gordon, J, Hedley, S, Hiby, L, Kuklik, I, Leaper, R, Lehnert, K, Leopold, M, Lovell, P, Øien, N, Paxton, C, Ridoux, V, Rogan, E, Samarra, F, Scheidat, M, Sequeira, M, Siebert, U, Skov, H, Swift, R, Tasker, ML, Teilmann, J, Van Canneyt, O & Vázquez, JA. (2013). Cetacean abundance and distribution in European Atlantic shelf waters to inform conservation and management. Biological Conservation 164: 107-122.

Gilles, A., Authier, M., Ramirez-Martinez, N.C., Araújo, H., Blanchard, A., Carlström, J., Eira, C., Dorémus, G., Fernández-Maldonado, C., Geelhoed, S.G.V., Kyhn, L., Laran, S., Nachtsheim, D., Panigada, S., Pigeault, R., Sequeira, M., Sveegaard, S., Taylor, N.L., Owen, K., Saavedra, C., Vázquez-Bonales, J.A., Unger, B. and Hammond, P.S. (2023). Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS-IV aerial and shipboard surveys. Final report published 29 September 2023. 64 pp. Available from: https://tinyurl.com/3ynt6swa

Gregory, P.R. and Rowden, A.A. (2001). Behaviour patterns of bottlenose dolphins (*Tursiops truncatus*) relative to tidal state, time of day and boat traffic in Cardigan Bay, West Wales. Aquatic Mammals 27: 105-113.

IAMMWG. (2023). Review of Management Unit boundaries for cetaceans in UK waters (2023). JNCC Report 734, JNCC, Peterborough, ISSN 0963-8091.

JNCC, Natural England and Countryside Council for Wales. (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.

JNCC (2020). Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs (England, Wales & Northern Ireland). JNCC Report No. 654, JNCC, Peterborough, ISSN 0963- 8091.

JNCC (2023) JNCC guidance for the use of Passive Acoustic Monitoring in UK waters for minimising the risk of injury to marine mammals from offshore activities. JNCC, Peterborough. https://hub.jncc.gov.uk/assets/fb7d345b-ec24-4c60-aba2-894e50375e33

Laist, D.W., Knowlton, A.R., Mead, J.G., Collet, A.S. and Podesta, M. (2001). Collisions between ships and whales. Marine Mammal Science 17: 35-75.

Marine Scotland and SNH. (2014). The protection of Marine European Protected Species from injury and disturbance. Guidance for Scottish Inshore Waters. March 2014.

Marine Scotland and SNH. (2020). The protection of Marine European Protected Species from injury and disturbance. Guidance for Scottish Inshore Waters (July 2020 Version).

McMahon, C.R. and Hays, G.C. (2006). Thermal niche, large-scale movements and implications of climate change for a critically endangered marine vertebrate. Global Change Biology 12: 1330-1338.

NOAA. (2018). 2018 Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. Available from: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustictechnical-guidance

Robinson, K. P., Baumgartner, N., Eisfeld, S. M., Clark, N. M., Culloch, R. M., Haskins, G. N., ... & Tetley, M. J. (2007). The summer distribution and occurrence of cetaceans in the coastal waters of the outer southern Moray Firth in northeast Scotland (UK). Lutra, 50(1), 19.

SCOS (2022). Scientific Advice on Matters Related to the Management of Seal Populations: 2022. Natural Environment Research Council Special Committee on Seals. Available from: https://www.smru.st-andrews.ac.uk/scos/scos-reports/

Sini, M.I., Canning, S.J., Stockin, K.A. and Pierce, G.J. (2005). Bottlenose dolphins around Aberdeen harbour, northeast Scotland: a short study of habitat utilization and the potential effects of boat traffic. Journal of the Marine Biological Association of the UK 85: 1547-1544.

Southall, B.L., Finneran, J.J., Reichmuth, C., Nachtigall, P.E., Ketten, D.R., Bowles, A.E., Ellison, W.T., Nowacek, D.P. and Tyack, P.L. (2019). Marine mammal noise exposure criteria: Updated scientific recommendations for residual hearing effects. Aquatic Mammals 45(2): 125-232.

Thompson, P.M., Brookes, K.L., Graham, I.M., Barton, T.R., Needham, K., Bradbury, G. and Merchant, N.D. (2013). Short-term disturbance by a commercial two-dimensional seismic survey does not lead to long-term displacement of harbour porpoises. Proceedings of the Royal Society B 280: 20132001.

Van Waerebeek, K., Baker, A.N., Félix, F., Gedamke, J., Iñiguez, M., Sanino, G.P., Secchi, E., Sutaria, D., van Helden, A. and Wang, Y. (2007). Vessel collisions with small cetaceans worldwide and with large whales in the Southern Hemisphere, an initial assessment. Latin American Journal of Aquatic Mammals 6(1): 43-69.

Wilson, C.M., Wilding, C.M. and Tyler-Walters, H. (2020). *Cetorhinus maximus* Basking shark. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews. Available from: https://www.marlin.ac.uk/species/detail/1438

Appendices

A. Inch Cape Density Estimation of Seals

- Inch Cape Density Estimation of Seals (doc ref: 1350035)

Inch Cape Seal Density Estimation

Inch Cape Offshore Wind Farm

26th April 2024

Doc: 1350035

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Author	[Redacted], Ecological Modeller	Senior	20th March 2024
Checked	[Redacted], Ecological Modeller	Principal	25th March 2024
Approved	[Redacted] Environmental Consultant	Principal	17th April 2024

Client Details	
Contact	[Redacted]
Client Name	
Address	Fifth Floor Office Suite 40 Princes Street Edinburgh EH2 2BY UNITED KINGDOM

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Local Office:

Ochil House
Springkerse Business Park
Stirling
FK7 7XE
SCOTLAND
UK
Tel: +44 (0) 1786 542 300

Reg No: SC177881

Registered Office:

The Natural Power Consultants Limited
The Green House
Forrest Estate, Dalry
Castle Douglas, Kirkcudbrightshire
DG7 3XS

VAT No: GB 243 6926 48

Contents

1. Methods

Inch Cape Offshore Limited (ICOL) has consent to develop an offshore wind farm (OWF) in the outer Firth of Tay region within Scottish Territorial Waters (STW). The consented Inch Cape Offshore Wind Farm will comprise up to 72 wind turbines and be located approximately 15 km to the east of the Angus coastline. The Development Area is in water depths of between 40 - 57 m.

During all stages of the pre-construction, construction and decommissioning of the Inch Cape OWF appropriate risk assessments will need to be produced for potential impacts on marine mammals. To inform these assessments accurate baseline information is required on the density and abundance of the different species.

The aim of the following work was to estimate harbour and grey seal densities within (1) the East Scotland Seal Management Area and (2) a 30 km buffer of the Inch Cape development area and cable route to inform impact assessments from the development of the Inch Cape OWF. To achieve this, published relative density surfaces are scaled by recent estimates of the at-sea population of each species; effectively distributing abundance across UK and Irish waters. This spatial distribution of abundance is then used to estimate both density and abundance in each area of interest.

1.1. Density surfaces

Carter *et al.*, 2022 predicted the relative at-sea distribution of harbour (*Phoca vitulina*) and grey seals (*Halichoerus grypus*), covering UK and Irish waters. The predicted distributions are derived for each species from telemetry data collected by grey (n=114) and harbour (n=239) seals from 26 sites between 2005 and 2019. Generalised Additive Mixed Models were used to predict regional distributions, while accounting for environmental drivers and location uncertainty from GPS tags. Model predictions were then weighted by the most recent regional counts of hauled out individuals and combined into a single distribution map for seals (of each species) at sea around the UK and Ireland. These predictions were used for the present work as they are available at a suitably fine-scale resolution (5 x 5 km grid cells), and entirely cover the region of interest.

These predicted density surfaces contain model-predicted relative densities that sum to 100% across each surface. For each species, a mean fitted surface with lower and upper 95% confidence intervals as separate layers were published. In both the lower and upper 95% confidence interval surfaces, the values do not sum to 100% (instead 48.6% and 172% respectively for harbour seals, for example). As a result, if these relative density surfaces are used to distribute abundance, the range of the confidence intervals of abundance will be inflated, as these relate to relative rather than absolute densities (Carter *et al.*, 2022, supplementary material). Consequently, the upper and lower confidence intervals of the density surfaces are not used here.

Since surfaces produced by Carter *et al.* 2022 are derived from telemetry data collected from seals from the UK and Ireland, densities do not contain animals from other countries which may visit UK and Irish waters. This also excludes animals that were hauled out during the peak foraging period, which these surfaces encompass. It should be noted that the metadata associated with the density surfaces urges caution when considering the relative density of both seal species on the east coast of the UK due to a lack of recent telemetry data or paucity of environmental data in this area (Carter *et al*., 2022, Supplementary material). However, given these distribution maps constitute the best available information they are used for this work.

1.2. Scaling surfaces from relative density to absolute abundance and density

To enable the conversion of relative seal density maps to absolute density, at-sea distribution density surfaces from Carter *et al.*, 2022 were scaled by the August population count for each species in Britain and Ireland, reported in the 2022 Special Committee on Seals (SCOS) report. Seals are counted in August as this is when harbour seals undergo an annual moult and therefore the majority of the population are hauled out and available to be counted. Grey seals are counted at the same time, despite being outside of their breeding period when they are also surveyed, and therefore a lower proportion of the population will be available to be counted. Since the SCOS counts only included hauled out individuals, this number was divided by the proportion of seals hauled out at the time of the count to give a total predicted population size. Proportions of grey seals hauled out originate from SCOS-BP 21/02, and harbour seal proportions are from Lonergan *et al.,* 2013. Since the desired outcome was an annual estimate of at-sea density based on the Carter surfaces, this number was then multiplied by an annual estimate for the proportion of seals at sea taken from the SCOS 2021 report which is based on work presented in Russell *et al.*, 2015, to give a predicted at-sea population count. The equation to calculate this count was therefore:

$$\widehat{N} = \frac{N}{H} \times S$$

Where N is the counted population (see table below), H is the haul out proportion, and S is the proportion at sea. When $\widehat{N}$ is multiplied by mean relative density values in each raster cell provided by Carter as a proportion, the sum totals the population estimate across the UK and Ireland. Values used are provided in Table 1.1. This method was used to create estimates of absolute abundance across UK and Irish waters, at 5 x 5 km resolution. The density per grid cell was also calculated by dividing the abundance by the cell area, resulting in a density of seals per km^2.

To account for uncertainty in the proportion of seals hauled out in August, a range of three values (a middle estimate, and associated low and high estimates) were used to estimate three different population sizes for each species. Each estimate was then scaled by the annual at-sea proportion to result in low, middle, and high estimates of the at-sea population size (see Table 1.1).

Table 1.1: Inputs used for surface scaling

Species	Count (hauled out, August)	Proportion hauled out in August (low-high estimates)	Total population size	Annual at-sea proportion	Annual at sea estimate for scaling Carter surfaces
Grey seal	44833	0.2515 (0.2907 - 0.2145)	178262 (154224 - 209012)	0.8616	153591 (132880 - 180084)
Harbour seal	34862	0.72 (0.88-0.54)	48419 (39615 - 64559)	0.8236	39878 (32627 - 53171)

Source: Grey seal proportions hauled out from SCOS-BP 21/02. Harbour seal proportion hauled out from Lonergan et al., 2013.

1.3. Areas assessed

Two subset areas were considered which are most relevant for the proposed works. 1) A 30 km buffer around the Inch Cape OWF boundary, and export cable corridor; 2) East Scotland Seal Management Area. The former approximately covers the maximum area estimated to be affected by unexploded ordnance (UXO) clearance during the Inch Cape OWF development, while the latter is a delineated management unit for seal conservation.

In each area, abundance for each species was summed under the three scenario levels based on the variance around the estimate of the proportion of seals hauled out during the counts. This is presented as absolute abundance and is also used to calculate the percentage of animals relative to the at-sea population. Additionally for each subset

area, the density per grid cell was calculated by dividing the abundance by the cell area (25 km^2), resulting in a density of seals per km^2. For cells that overlap the area of interest, the mean, 2.5th and 97.5th quantiles were calculated, once cells that overlapped land with zero seals estimated were removed – as the grid continues across the entire landmass of the UK and Ireland and including this would artificially decrease estimates.

2. Results

2.1. Summary

Grey seals are estimated to occur in higher densities in both areas of interest, compared to harbour seals, with mean densities spanning 1.10 – 1.48 grey seals per km^2 within a 30 km buffer of the Inch Cape development area, compared to 0.04 – 0.06 harbour seals per km^2 (see Table 2.1). Similarly in the East Scotland Seal Management Area, mean densities of grey seals were 0.26 – 0.35, compared to 0.005 – 0.008 for harbour seals. Further summary statistics are presented in Table 2.1 and Figure 2.1, and abundances of grey seals and harbour seals are examined in Sections 3.2 and 3.3 respectively.

Table 2.1: Density of grey and harbour seals (animals per km^2) at Inch Cape (with 30 km buffer) and within the East Scotland Seal Management Area. Densities are presented as means and lower and upper 95th quantiles

Species	Area	Scenario	Mean	2.5th quantile	97.5th quantile
Grey seal	Inch Cape	high	1.484405	0	4.287362
Grey seal	Inch Cape	low	1.095304	0	3.163533
Grey seal	Inch Cape	mid	1.266024	0	3.656617
Grey seal	East Scotland	high	0.353574	0.005737	2.048222
Grey seal	East Scotland	low	0.260893	0.004233	1.51133
Grey seal	East Scotland	mid	0.301557	0.004893	1.746893
Harbour seal	Inch Cape	high	0.063228	0	0.648302
Harbour seal	Inch Cape	low	0.038799	0	0.397822
Harbour seal	Inch Cape	mid	0.047421	0	0.486226
Harbour seal	East Scotland	high	0.008307	0	0.05254
Harbour seal	East Scotland	low	0.005097	0	0.03224
Harbour seal	East Scotland	mid	0.00623	0	0.039405

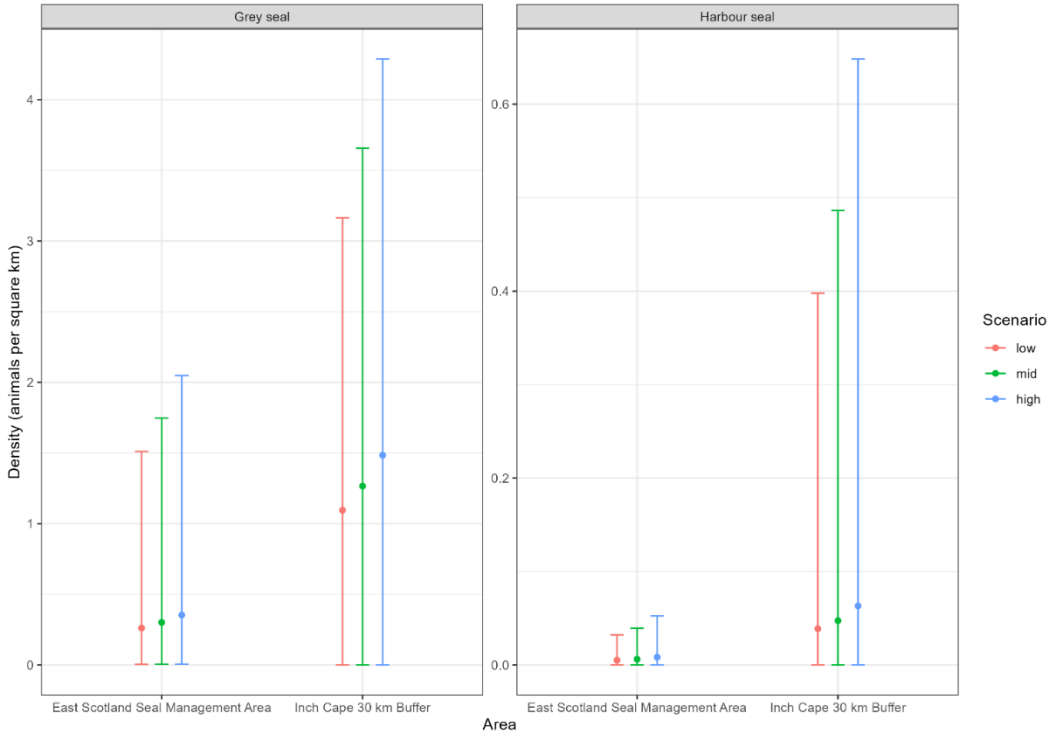

Figure 2.1: Estimated density of seals within a 30 km buffer of the Inch Cape Project development area (the windfarm footprint and export cable corridor), and the East Scotland Seal Management Area. Low, mid and high scenarios represent ranges of haul out proportion estimates used in calculations.

2.2. Grey seal

11.9% of the UK and Ireland at-sea population of grey seals are predicted to occur in the East Scotland Seal Management Area whilst 5.99% are predicted occur in the Inch Cape 30 km buffer (see Table 2.2). This equates to 18,259 (15,797 – 21,409) grey seals using the East Scotland Seal Management Area, compared to 9,210 (7,968 – 10,799) in the Inch Cape 30 km buffer. While the Inch Cape 30km buffer covers 10.5% of the total at-sea area of the East Scotland Seal Management Area, it contains an estimated 50.4% of the grey seals. This indicates that the Inch Cape development area is of relative importance within the East Scotland Seal Management Area. Grey seals appear to be predominantly distributed coastally; although to a lesser extent than harbour seals (Figure 2.2 and 2.3).

Table 2.2: Abundance estimates for grey seal within a 30 km buffer of the Inch Cape development ('Inch Cape') and East Scotland Seal Management Area ('East Scotland'). Low, mid and high scenarios represent ranges of haul out proportion estimates used in calculations. Abundance estimates are also presented as a percentage of the total estimated at-sea population in the UK and Ireland

Area	Level	Estimated abundance in Area	Estimated population at sea in UK & Ireland	Percentage of at sea population
East Scotland	Low	15797.08	132879.6	11.89
East Scotland	Mid	18259.29	153590.9	11.89
East Scotland	High	21408.91	180084.4	11.89
Inch Cape	Low	7968.34	132879.6	5.99
Inch Cape	Mid	9210.32	153590.9	5.99
Inch Cape	High	10799.05	180084.4	5.99

470000
530000
590000
6300000
6240000
6180000

Project:

Inch Cape Offshore Windfarm

Title:

Figure 2.2: Abundance of grey seals within the 30 km buffer of Inch Cape OWF

Key

- Development Area
- 30 km buffer from Development Area

Grey seal abundance per 5 km × 5 km grid cell

- 0 - 20
- 20 - 40
- 40 - 60
- 60 - 100
- 100 - 160

Carter *et al.*, 2022 published relative density of at-sea distribution of harbour and grey seals, covering UK and Irish waters.

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Scale @ A3: 1:600,000

Coordinate System: WGS 84 UTM Zone 30N

0 100 200 300 400 km

N

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Drawing by:
The Natural Power Consultants Limitec
The Green House
Forrest Estate, Dalry
Castle Douglas, DG7 3XS, UK
Tel: +44 (0)1644 430008
Fax: +44 (0)845 299 1236
Email: sayhello@naturalpower.com
www.naturalpower.com

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Project:

Inch Cape Offshore Windfarm

Title:

Figure 2.3: Abundance of grey seals within the East Scotland Management Unit

Key

- Development Area
- East Scotland Seal Management Unit

Grey seal abundance per 5 km × 5 km grid cell

- 0 - 20
- 20 - 40
- 40 - 60
- 60 - 100
- 100 - 160

Carter *et al.*, 2022 published relative density of at-sea distribution of harbour and grey seals, covering UK and Irish waters.

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Scale @ A3: 1:1,500,000

Coordinate System: WGS 84 UTM Zone 30N

N

0 200 400 600 800 km

Date: 18-04-24	Prepared by: AC	Checked by: KG
Ref: GB200491_M_605_A		

Drawing by:
The Natural Power Consultants Limitec
The Green House
Forrest Estate, Dalry
Castle Douglas, DG7 3XS, UK
Tel: +44 (0)1644 430008
Fax: +44 (0)845 299 1236
Email: sayhello@naturalpower.com
www.naturalpower.com

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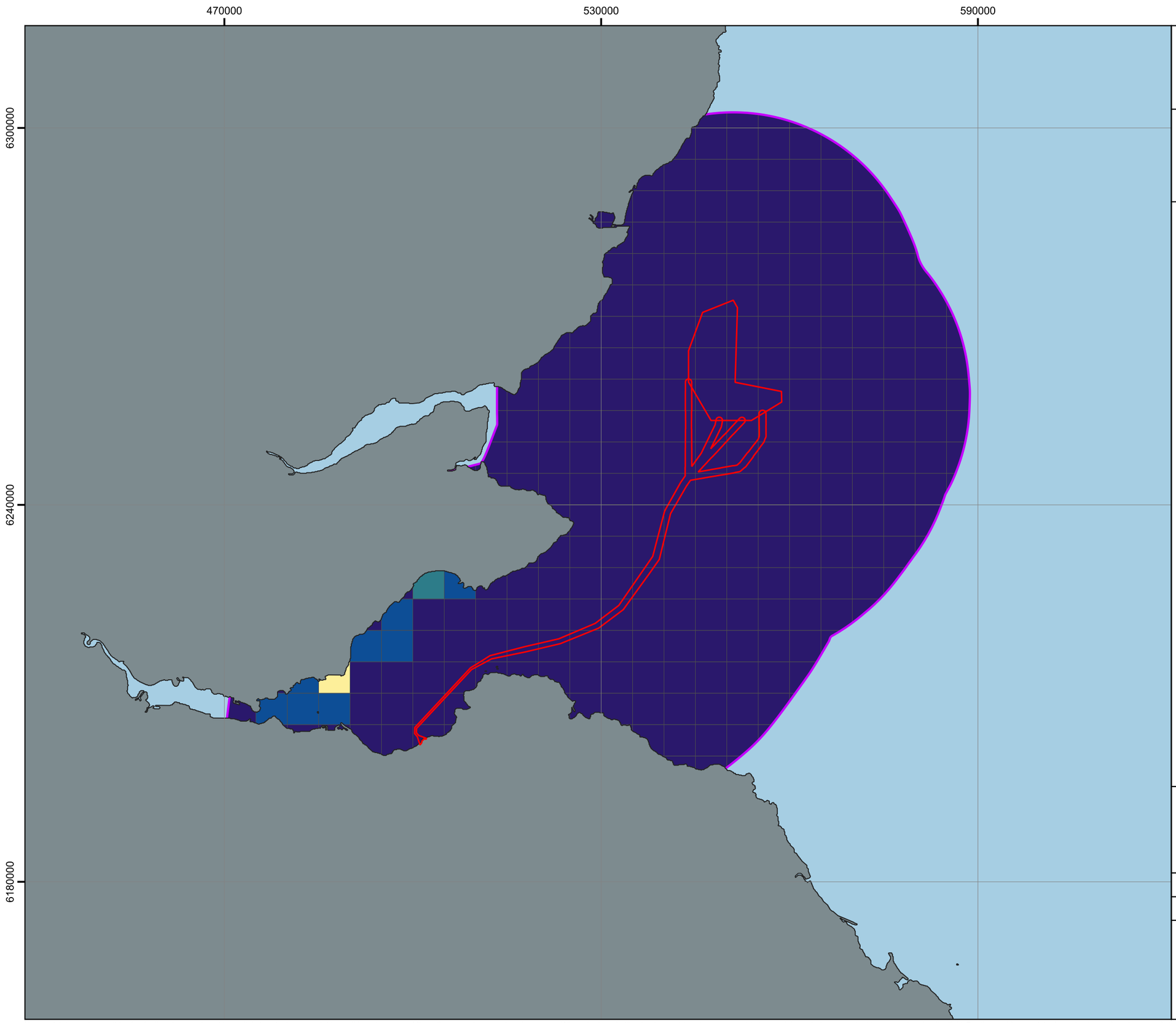
2.3. Harbour seal

0.95% of the UK and Ireland at-sea population of harbour seals are predicted to occur in the East Scotland Seal Management Area. However, a considerable proportion of these are expected to be present in the Inch Cape 30 km buffer which is predicted to contain 0.87% of the at-sea population (see Table 2.3). This equates to 377 (309 – 503) harbour seals using the East Scotland Seal Management Area, assuming a middle estimate of haul out proportion, compared to 345 (282 – 460) in the Inch Cape 30 km buffer. While the Inch Cape 30km buffer covers 10.5% of the total at-sea area of the East Scotland Seal Management Area, it contains an estimated 91.4% of the harbour seals. This indicates that the Inch Cape development area is of relative importance within the East Scotland Seal Management Area, due to a relatively high concentration of seal density occurring coastally within the development buffer (see Figure 2.4 and 2.5). It should be noted that where low abundances are shown in Figure 2.4 which are displayed as within the range of 0-10 seals, such as within the Tay and Eden Estuary SAC, there is variation within this and it does not represent an absence in all of these cells.

Table 2.3: Abundance estimates for harbour seal within a 30 km buffer of the Inch Cape development ('Inch Cape') and East Scotland Seal Management Area ('East Scotland'). Low, mid and high scenarios represent ranges of haul out proportion estimates used in calculations. Abundance estimates are also presented as a percentage of the total estimated at-sea population in the UK and Ireland

Area	Level	Estimated abundance in Area	Estimated population at sea in UK & Ireland	Percentage of at sea population
East Scotland	Low	308.64	32627.66	0.95
East Scotland	Mid	377.22	39878.25	0.95
East Scotland	High	502.97	53171.01	0.95
Inch Cape	Low	282.26	32627.66	0.87
Inch Cape	Mid	344.99	39878.25	0.87
Inch Cape	High	459.98	53171.01	0.87



Project:

Inch Cape Offshore Windfarm

Title:

Figure 2.4: Abundance of harbour seals within the 30 km buffer of Inch Cape OWF

Key

- Development Area
- 30 km buffer from Development Area

Harbour seal abundance per 5 km × 5 km grid cell

- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60

Carter *et al.*, 2022 published relative density of at-sea distribution of harbour and grey seals, covering UK and Irish waters.

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Scale @ A3: 1:600,000

Coordinate System: WGS 84 UTM Zone 30N

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0 100 200 300 400 km

Date: 18-04-24	Prepared by: AC	Checked by: KG

Ref: GB200491_M_606_A

Drawing by:

The Natural Power Consultants Limitec
The Green House
Forrest Estate, Dalry
Castle Douglas, DG7 3XS, UK
Tel: +44 (0)1644 430008
Fax: +44 (0)845 299 1236
Email: sayhello@naturalpower.com
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Title:

Figure 2.5: Abundance of harbour seals within the East Scotland Management Unit

Key

- Development Area
- East Scotland Seal Management Unit

Harbour seal abundance per 5 km × 5 km grid cell

- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60

Carter *et al.*, 2022 published relative density of at-sea distribution of harbour and grey seals, covering UK and Irish waters.

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0 200 400 600 800 km

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Drawing by:
The Natural Power Consultants Limitec
The Green House
Forrest Estate, Dalry
Castle Douglas, DG7 3XS, UK
Tel: +44 (0)1644 430008
Fax: +44 (0)845 299 1236
Email: sayhello@naturalpower.com
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3. References

Carter, M. I., Boehme, L., Cronin, M. A., Duck, C. D., Grecian, W. J., Hastie, G. D., ... & Russell, D. J. (2022). Sympatric seals, satellite tracking and protected areas: habitat-based distribution estimates for conservation and management. *Frontiers in Marine Science*, *9*, 875869.

Lonergan, M., Duck, C., Moss, S., Morris, C., & Thompson, D. (2013). Rescaling of aerial survey data with information from small numbers of telemetry tags to estimate the size of a declining harbour seal population. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *23*(1), 135-144.

Russell, D. J., McClintock, B. T., Matthiopoulos, J., Thompson, P. M., Thompson, D., Hammond, P. S., ... & McConnell, B. J. (2015). Intrinsic and extrinsic drivers of activity budgets in sympatric grey and harbour seals. *Oikos*, *124*(11), 1462-1472.

SCOS (Natural Environment Research Council Special Committee on Seals). *Scientific Advice on Matters Related to the Management of Seal Populations: 2021.* Available from: https://www.smru.st-andrews.ac.uk/files/2022/08/SCOS-2021.pdf (Accessed March 2024)

SCOS (Natural Environment Research Council Special Committee on Seals). *Scientific Advice on Matters Related to the Management of Seal Populations: 2022.* Available from: https://www.smru.st-andrews.ac.uk/files/2023/09/SCOS-2022.pdf (Accessed March 2024)

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