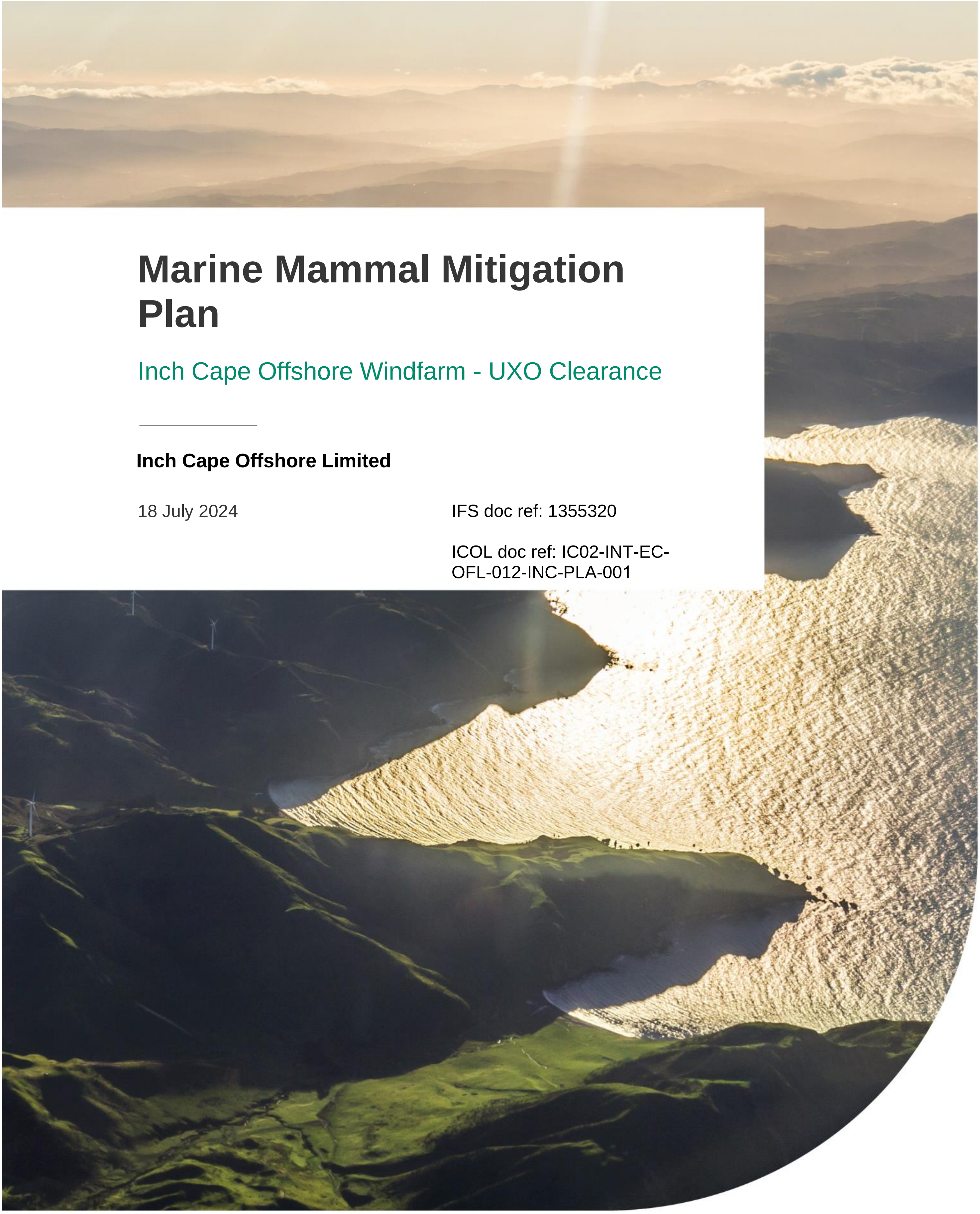

Marine Mammal Mitigation Plan

Inch Cape Offshore Windfarm - UXO Clearance

Inch Cape Offshore Limited

18 July 2024

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Document history

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Acronyms and Abbreviations

Acronyms and Abbreviations	
ADD	Acoustic Deterrent Device
ALARP	As Low as Reasonably Practicable
CI	Confidence Interval
cUXO	Confirmed UXO
DA	Development Area
ECC	Export Cable Corridor
EEC	European Economic Community
EPS	European Protected Species
EU	European Union
FCS	Favourable Conservation Status
HRA	Habitat Regulations Assessment
IAMMWG	Inter Agency Marine Mammal Working Group
ICOL	Inch Cape Offshore Limited
JNCC	Joint Nature Conservation Committee
kHz	Kilohertz
km	Kilometre
m	Metre
ML	Marine Licence
MMMP	Marine Mammal Mitigation Plan
MMO	Marine Mammal Observer
MPA	Marine Protected Area
MU	Management Unit
NAS	Noise Abatement System
NEQ	Net Explosive Quantity
OWF	Offshore Wind Farm
PAM	Passive Acoustic Monitoring
PTS	Permanent Threshold Shift
pUXO	Potential UXO
RA	Risk Assessment
RIAA	Report to Inform Appropriate Assessment
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SCANS	Small Cetaceans in European Atlantic Waters and the North Sea
SCOS	Special Committee on Seals
SEI	Supporting Environmental Information

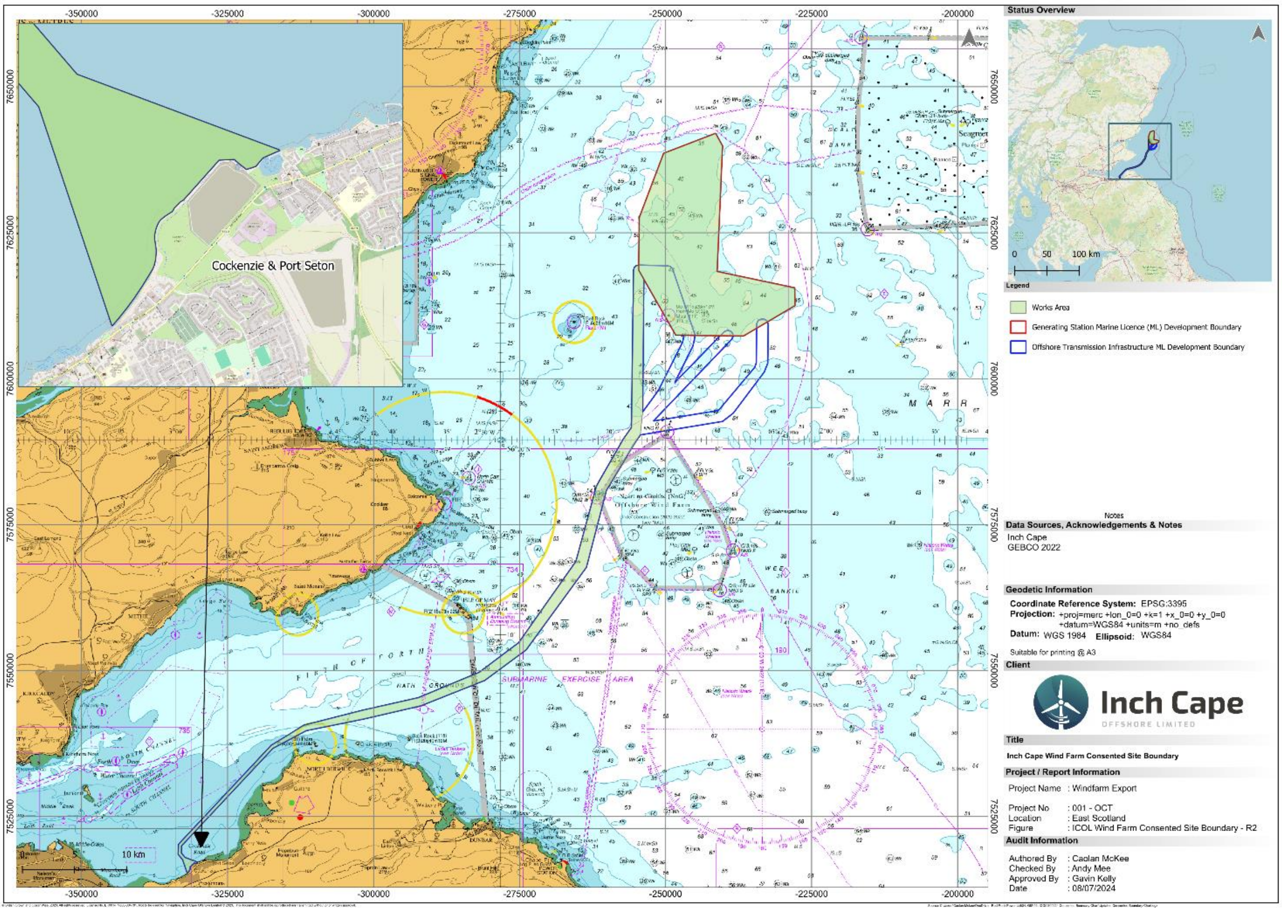
Acronyms and Abbreviations	
SEL	Sound Exposure Level
SNH	Scottish Natural Heritage
SPL	Sound Pressure Level
STW	Scottish Territorial Waters
UK	United Kingdom
UXO	Unexploded Ordnance
WTG	Wind Turbine Generators

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 turbine generators (WTGs) and be located approximately 15 km to the east of the Angus coastline (Figure 1.1). The Development Area (DA) is in water depths of between 40 - 59 m.

It is possible that unexploded ordnance (UXO) may be present on the site (DA and offshore export cable corridor (ECC)). Following potential unexploded ordnance (pUXO) target investigation work, and prior to installation of the Inch Cape OWF, UXO clearance work may be required. A Marine Licence (ML) is being sought for this (UXO clearance) work. This marine mammal mitigation plan (MMMP) will accompany the ML application and will be followed during all UXO clearance work.

Figure 1.1: Inch Cape OWF site location



2. Purpose of this Document

The purpose of this document is to:

- Describe the proposed UXO clearance work associated with the Inch Cape OWF; and
- Outline the MMMP.

This document provides information about the proposed UXO clearance work, legislation and guidance relevant to marine megafauna (cetaceans, seals, basking sharks and marine turtles), marine mammal occurrence in the project area, a description and assessment of potential impacts, and the mitigation proposed. The MMMP is detailed in section 7.2.

This MMMP accompanies an application for a ML for clearance of the UXO. Alongside this MMMP, a 'Supporting Environmental Information (SEI)' (doc ref: IC02-INT-EC-OFL-012-INC-RPT-003) and Report to Inform Appropriate Assessment (RIAA)' document (doc ref: IC02-INT-EC-OFL-012-INC-RPT-004) has also been produced to support the ML application. The SEI document should be read alongside this document for further details on the proposed approach and methodologies in relation to the work. The SEI and RIAA document considers any potential impacts and the necessary mitigation measures required to ensure that no significant or adverse (in Habitat Regulations Assessment (HRA) terms) effects will occur (including to marine mammals). This MMMP is one such measure for marine mammals. A European Protected Species (EPS) Risk Assessment (RA; doc ref: IC02-INT-EC-OFL-012-INC-RPT-006) for the UXO clearance work has also been produced.

The MMMP provides procedures for minimising disturbance and injury to marine mammals from the planned UXO clearance work. The measures detailed in this MMMP are based upon an estimated size and number of confirmed UXOs (cUXOs).

The MMMP will be used as the Work Brief detailing the specific mitigation actions required during each phase of the clearance work (for marine mammals). Toolbox Talks will be given prior to commencement of work to ensure that all relevant personnel are aware of the mitigation requirements and actions.

Compliance with the MMMP will be confirmed through submission of Marine Mammal Observer (MMO) Reports and Joint Nature Conservation Committee (JNCC) Marine Mammal Recording Forms (see section 7.1).

2.1. Information used to develop MMMP

The MMMP has been written using the following guidance:

- The JNCC best practice guidance for offshore activities, including the use of explosives (JNCC, 2010a);
- The 2022 UXO clearance joint interim position statement (which applies to England, Northern Ireland and Scotland; OGL, 2022) and prioritises low noise alternatives over high order detonations; and
- The 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, 2023).

It is considered that adherence to these guidance documents and position statement constitutes best practice and will minimise the risk of injury to marine mammals.

3. Planned Work

The objective of the proposed UXO clearance work is to reduce the risk of UXO to as low as reasonably practicable (ALARP) status for personnel, vessels and the project infrastructure once installed.

It is anticipated that a maximum of 85 cUXO targets may be present at the Project (DA and ECC) and require clearance. It is anticipated that 75 cUXO targets will be cleared using low order clearance methods whilst 10 cUXO may require high order clearance methods. These numbers are based on the findings from the UXO Threat and RA which is based on current published data on UXO presence in the project area.

It is likely that different types of cUXO may be present (Table 3.1), many of which are likely to have been subject to degradation or burying over time. It is anticipated that the largest UXO will have a net explosive quantity (NEQ) of 254 kg in the DA and 1,179 kg in the ECC.

A variety of options for managing UXOs on site are available and will be considered on a case-by-case basis:

- Micro-siting i.e., avoidance of UXO;
- Relocation ('lift and shift') of UXO (where deemed safe to do so); and
- Clearance of UXO using either low or high order clearance. Low order clearance will be used in the first instance. Detonation by controlled explosion (high order clearance) will be used as a last resort.

Low order clearance (deflagration) is preferable to high order clearance (detonation) as it avoids the high pressures associated with an explosion by using a small initiation explosive to 'burn away' the target explosive material within the UXO. Different sized initiation explosives may be required for different sized UXOs. Here low order initiation explosives of 0.05 kg and 0.25 kg have been assessed.

All relocation and clearance work will be undertaken by specialists in accordance with the appropriate regulations and guidance.

Table 3.1: Types and sizes of UXO which may be present in the Inch Cape OWF DA and ECC

NEQ (kg TNT)	Description	Location	
		DA	ECC
6	Small WWII Projectile	x	
15	Artillery Projectile		x
25	Small WWII Aerial Bomb	x	x
49	Large WWII Projectile	x	x
130	Medium WWII Aerial Bomb		x
165	WWI Mine	x	x
220	Large WWII Aerial Bomb	x	x
227	British WWII Mine	x	x
254	WWI Torpedo	x	x
354	WWII Aerial Torpedo		x
1179	German WWII Mine		x

Source: UXO Threat and RA.

3.1. Proposed Vessels

It has not yet been confirmed which vessels will be used for the UXO clearance work. It is likely that up to three vessels will be required:

- An 'ROV/dive support vessel' from which any charges will be set and on which the mitigation personnel will be based; and
- A 'guard vessel' which will undertake preparation and implementation of the detonations and from which the Acoustic Deterrent Device (ADD) will be deployed.
- A 'bubble curtain vessel' or similar for the deployment of a noise abatement system (NAS) if required.

3.2. Timing and Duration

The UXO clearance work will be undertaken between the start of Q4 2024 and the end of Q2 2025. However, there is potential that further UXO clearance may be required later in the construction programme of the Inch Cape OWF (July 2025 to August 2027) if any additional UXO are discovered.

4. Legislation

4.1. Cetaceans (and Marine Turtles)

All species of cetacean (whales, dolphins and porpoises) and marine turtles 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 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 an EPS, as listed under Annex IV of the Habitats Directive;
- Damage or destroy, or cause deterioration of the breeding sites or resting places of an 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 an 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;
- 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 it belongs; and
- **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 licence can be granted:

1. The licence 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 Inch Cape OWF (DA and ECC) is within the 12 nm limit of Scotland's Territorial Waters. However, sound from the proposed work has the potential to affect animals within both Scottish Territorial and offshore waters. Both the Habitats and Offshore Regulations therefore apply.

4.2. Phocid Seals

Unlike cetaceans, phocid seals are not listed on Annex IV of the Habitats Directive and are therefore not EPS. Both grey and harbour seal are however listed on Annex II (animal and plant species of community interest whose conservation requires the designation of SACs) and Annex V (animal and plant species of community interest whose taking in the wild and exploitation may be the subject of management measures) of the Habitats Directive.

In addition, harbour and grey seals are UK Biodiversity Action Plan priority species.

In Scotland seals are also protected under the Marine (Scotland) Act 2010 and the Protection of Seals (Designation of Haul-Out Sites) (Scotland) Order 2014.

4.3. Basking Sharks

Basking sharks are protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) meaning that it is an offence to:

- Intentionally or recklessly kill, injure or take fish;
- Possess or sell fish; and
- Intentionally or recklessly disturb or harass fish.

5. Marine Mammal Occurrence in the Working Area

Six marine mammal species are considered to occur on a relatively common basis in vicinity of the Inch Cape OWF: Harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus),* white-beaked dolphin (*Lagenorhynchus albirostris*), minke whale (*Balaenoptera acutorostrata*), grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*) (Arso Civil *et al*., 2021; Carter *et al*., 2022; 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].

5.1. 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 fourth Small Cetaceans in European Atlantic Waters and the North Sea (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 5.1. The relevant Inter Agency Marine Mammal Working Group (IAMMWG) Management Unit (MU) (whole and UK portion) abundance estimates are also provided and can be considered as the reference populations.

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

Table 5.1: Harbour porpoise density and reference population abundance

Density (animals per km^2)	Management Unit	Abundance	95% confidence interval (CI)*
0.5985	North Sea	346,601	289,498 - 419,967
	UK Portion of North Sea	*159,632*	*127,442 - 199,954*

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

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

5.2. 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 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 (Gilles *et al.,* 2023). As such, a density surface was created for the inshore bottlenose dolphin population using the most recent population estimate for east Scotland. The five-year weighted average for

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

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).

Additionally, in the absence of a density estimate for bottlenose dolphins from the SCANS-IV survey, the density of bottlenose dolphins in the vicinity of the Inch Cape OWF from SCANS-III has been used and is provided in Table 5.2 (Hammond *et al.* 2021). The IAMMWG has accounted for the two ecotypes by defining two MUs, the Coastal East Scotland MU and the Greater North Sea MU (whole and UK portion). The abundance estimates for these are provided in Table 5.2. Considering that both inshore and offshore bottlenose dolphins may be impacted by the proposed work, the management units have 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 5.2: Bottlenose dolphin reference population abundance estimates

Density (animals per km^2)	Management Unit	Abundance	95% CI
0.0298	Coastal East Scotland	224	214 - 234
	Greater North Sea	2,022	548 - 7,453
	UK Portion of Greater North Sea	*1,885*	*476 - 7,461*

Source: IAMMWG (2023).

5.3. 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 5.3. The relevant IAMMWG MU (whole and UK portion) abundance estimates are also provided and can be considered as the reference population.

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

Table 5.3: White-beaked dolphin density and reference population abundance

Density (animals per km^2)	Management Unit	Abundance	95% CI
0.0799	Celtic and Greater North Seas	43,951	28,439 - 67,924
	UK Portion of Celtic and Greater North Seas	*34,025*	*20,026 - 57,807*

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

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

5.4. 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 subsequent surveys the distribution appeared to remain consistent until the recent SCANS-IV survey which 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 5.4. Block NS-D is the highest density block for minke whales from this survey. The relevant IAMMWG MU (whole and UK portion) abundance estimates are also provided and can be considered as the reference populations.

The closest protected area for minke whale (Southern Trench Marine Protected Area (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 5.4: Minke whale density and reference population abundance

Density (animals per km^2)	Management Unit	Abundance	95% CI
0.0419	Celtic and Greater North Seas	20,118	14,061 - 28,786
	UK Portion of Celtic and Greater North Seas	10,288	6,210 - 17,0412

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

5.5. 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 (ECC) 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 5.5 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 estimates were created for the Inch Cape OWF (DA and ECC) plus a 30 km buffer. The size of this buffer was based on the maximum range calculated for temporary threshold shift for phocids in water (Barham, 2024). Abundance estimates were also calculated for both the Inch Cape OWF plus 30 km buffer and the East Scotland Seal Management Area. 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 5.5: Seal density and reference population abundance estimates

Species	Density (animals per km^2)	Management Unit	Abundance estimates calculated from Carter *et al.* (2022)	SCOS (2022) abundance estimate
Grey seal	1.2660	East Scotland	18,259	10,106
Harbour seal	0.0474	East Scotland	377	262

Source: Appendix A, SCOS 2022.

5.6. Other Marine Megafauna

Basking sharks (and to a lesser extent marine turtles) are considered very occasional visitors to the Inch Cape OWF area. The mitigation specified for marine mammals is also considered to be relevant/appropriate for these species.

6. Description of Potential Impacts

During the UXO clearance work there is potential for marine mammals to be impacted and consequently mitigation may be required. To accurately calculate the mitigation required an understanding of the level of the potential impacts is required. Further details on potential effects are provided in the EPS Risk Assessment (doc ref: 1355322; IC02-INT-EC-OFL-012-INC-RPT-006). An overview of the potential effects of anthropogenic noise on marine mammals is also provided here.

6.1. 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 6.1).

Potential effects of underwater noise on marine mammals that may require mitigation include:

- Lethal effects and physical injury; and
- Auditory injury.

Behavioural responses by marine mammals currently do not require additional mitigation exceeding what is required to avoid lethal effects, physical injury and auditory injury (e.g., pre-work searches, use of an acoustic deterrent device (ADD) and use of a noise abatement system (NAS); see section 7). This is because some of the proposed mitigation (e.g., ADD use) relies on inducing a behavioural response in order that animals move out of the zone of a more deleterious potential effect. The potential for behavioural responses has therefore not been assessed in this document (it has been covered in the EPS Risk Assessment; doc ref: 1355322; IC02-INT-EC-OFL-012-INC-RPT-006).

Table 6.1: 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	0.15 – 160
Very high frequency cetacean	Harbour porpoise	0.2 – 160
Phocid carnivores in water	Harbour seal Grey seal	0.05 – 86

Source: Southall et al. (2019).

6.1.1. Lethal Effects and Physical Injury

Because of the increased hazardousness of the shock wave associated with underwater detonations, potential physiological effects include mortality and direct (i.e., non-auditory) tissue damage known as primary blast injury (Finneran and Jenkins, 2012; Robinson *et al*., 2022). Primary blast injuries from explosive detonations are the result of differential compression and rapid re-expansion of adjacent tissues of different acoustic properties (e.g., between gas-filled and fluid-filled tissues or between bone and soft tissues). These injuries usually manifest themselves in the gas-containing organs (lung and gut) and auditory structures (e.g., rupture of the eardrum across the gas-filled spaces of the outer and inner ear).

6.1.2. Auditory Injury

Southall *et al.* (2019) provide thresholds for received sound levels that have the potential to induce the onset of auditory injury in marine mammals (Table 6.2). 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*. (2010b) proposes that a permanent shift in the hearing thresholds (PTS) of a marine mammal would constitute an injury offence (in terms of EPS legislation). The Southall *et al*. criteria for injury are based on quantitative sound level and exposure threshold over which PTS onset could occur (Table 6.2). If it is likely that a marine mammal could become exposed to sound at or above the levels proposed, then there is a risk that an injury offence (in terms of EPS legislation) could occur.

Table 6.2: Permanent threshold shift (PTS) thresholds

Functional hearing group	Example species	Impulsive		Non-impulsive
		SPLpeak	SEL	SEL
Low frequency cetacean	Minke whale	219	183	199
High frequency cetacean	Bottlenose 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).

6.2. Potential Impacts from UXO Clearance Work Pre-Mitigation

The predicted impact ranges from the proposed UXO clearance work pre-mitigation were modelled by Subacoustech Environmental (Subacoustech; Barham, 2024). Modelling was carried out for all four marine mammal hearing groups.

Because the pUXO investigations have yet to take place, a range of UXO types and sizes have been assessed (Table 3.1). Note, not all charge weights were modelled by Subacoustech; as a precaution, the modelled impact range for the next heaviest weight has been used in these cases.

As noted by Barham (2024), the large number of unknown variables that will affect the output of UXO located for an extended period on the seabed lead to a great degree of uncertainty which makes accuracy challenging in a desktop assessment. The assessment uses calculations based on a methodology proposed by Soloway and Dahl (2014), following Arons (1954) and MTD (1996). It is expected that the presented ranges overestimate the actual ranges of impact that would occur in practice, both from physical sound propagation and biological perspective.

The calculation parameters were all chosen to be conservative, leading to an upper estimate for source noise levels, and the risk of impact will be reduced over increasing range as the initial shock wave dissipates. This is not only due to the reduction in absolute noise level, but also the changing characteristics of the propagating sound wave.

This assessment has used the impulsive ranges. As noted in Barham (2024), these ranges are most relevant close to the blast. At greater ranges, and especially acoustically in shallow water, the sound pulse will spread out in time, becoming less 'sharp' and thus less injurious. Active research is currently underway into the identification of the distance at which the pulse can be considered effectively non-impulsive (likely to be at around 3.5 km from the source; Hastie *et al*., 2019). Because the modelled non-impulsive ranges (Barham, 2024) are smaller than this transition point the impulsive ranges have been used in this assessment. This assessment is therefore overly conservative.

The MMMP has been designed around the greatest (i.e., worst case) potential impact ranges which are those for very high frequency cetaceans (i.e., harbour porpoise). It should be noted that if the potential impacts on harbour porpoise are predicted to be negated through mitigation, this will also be the case for all other marine mammal species.

6.2.1. Lethal Effects and Physical Injury

Although the potential for lethal effects and physical injury has not been modelled it is assumed that, in the absence of mitigation, they may occur as a result of the proposed UXO clearance work should individuals be present in close proximity to any high order detonations.

6.2.2. Auditory Injury

The modelled PTS impact ranges for very high frequency cetaceans (harbour porpoise) for the various potential charge weights are shown in Table 6.3 below. For low order clearance the greatest of the impulsive PTS impact ranges (SPLpeak/SEL_{ss}) is 0.99 km. For the greatest of the high order charges (i.e., the worst case), the greatest of the impulsive PTS impact ranges is 16.6 km.

Using these ranges, and assuming that spreading is approximately spherical (area = πr^2), the number of harbour porpoise which have the potential to be present within the zones of potential impact has been estimated (Table 6.4) using the SCANS-IV density estimate for Block NS-D (Table 5.1) where the Inch Cape OWF is located. The percentage of the relevant reference populations (Table 5.1) this represents has also been presented.

Table 6.3: Pre-mitigation PTS ranges (km) – very high frequency cetaceans (harbour porpoise)

Charge weight (kg TNT)		Impulsive		Non-impulsive
		SPL_{peak} (km)	SEL_{ss} (km)	SEL_{ss} (km)
Low Order	**0.05**	0.58	0.08	0.003
	0.25	0.99	0.11	0.004
High Order	**6**	2.80	0.32	0.016
	15	3.90	0.47	0.025
	25	4.60	0.56	0.033
	49	5.70	0.71	0.045
	130	8.60	1.00	0.081
	165	8.60	1.00	0.081
	220	9.60	1.10	0.094
	227	9.60	1.10	0.094
	254	10.00	1.10	0.099
	354	11.10	1.30	0.110
	1179	16.60	1.70	0.190

Source: Barham (2024)

Table 6.4: Number of harbour porpoise which have the potential to be present within the pre-mitigation zones of potential impact

Charge weight (kg)		SPL_{peak} range (km)	Area (km²)	Number of individuals	% of reference population	
					MU	UK portion of MU
Low Order	**0.05**	0.58	1.1	1	<0.001	0.001
	0.25	0.99	3.1	2	0.001	0.001
High Order	**6**	2.80	24.6	15	0.004	0.009
	15	3.90	47.8	29	0.008	0.018
	25	4.60	66.5	40	0.011	0.025
	49	5.70	102.1	61	0.018	0.038
	130	8.60	232.4	139	0.040	0.087
	165	8.60	232.4	139	0.040	0.087
	220	9.60	289.5	173	0.050	0.108
	227	9.60	289.5	173	0.050	0.108
	254	10.00	314.2	188	0.054	0.118
	354	11.10	387.1	232	0.067	0.145
	1179	16.60	865.7	518	0.149	0.324

7. Marine Mammal Mitigation

The purpose of the measures proposed in the MMMP is to minimise the potential for injury to marine mammals from the proposed UXO clearance work. Although termed marine mammal mitigation, the Plan will also be applied to basking sharks and marine turtles, should they be present.

The MMMP will be used as the Work Brief detailing the specific mitigation actions required by the marine mammal mitigation personnel during each phase of the clearance work. Toolbox Talks will either be given by the offshore ECoW or marine mammal mitigation personnel prior to commencement of work to ensure that all relevant personnel are aware of the mitigation requirements.

7.1. Recording and Reporting

The personnel deployed for mitigation purposes will record information using the JNCC Marine Mammal Recording Forms (and guide to using marine mammal recording forms)[3]. The completed forms, and a MMO Report, will be submitted to MD-LOT. The MMO Report will include all the information detailed in section 3 of the JNCC guidelines for using explosives (JNCC, 2010a).

7.2. MMMP

This MMMP has been written using the following guidance:

- The JNCC guidelines for the use of explosives (JNCC, 2010a);
- The 2022 UXO clearance joint interim position statement (which applies to England, Northern Ireland and Scotland; OGL, 2022) and prioritises low noise alternatives over high order detonations;
- The 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, 2023); and
- The JNCC 'Marine mammals and noise mitigation' webpage (https://jncc.gov.uk/our-work/marine-mammals-and-noise-mitigation/#alternatives-when-clearing-unexploded-ordnance).

It is considered that adherence to these guidance documents and position statement constitutes best practice and will minimise the risk of injury to marine mammals.

7.2.1. Avoidance of UXO

The following methods for avoiding UXO will be considered on a case-by-case basis:

- Micro-siting i.e., avoidance of UXO; and
- Relocation ('lift and shift') of UXO (where deemed safe to do so).

It should be noted that if relocation ('lift and shift') of any UXO is undertaken, and it is deemed that there is potential for accidental detonation during this process, the full mitigation procedure for the appropriate UXO charge weight will be undertaken.

7.2.2. UXO Clearance

UXO clearance work will only commence during the hours of daylight and good visibility (i.e., when conditions are suitable for visual monitoring and visibility exceeds 1 km).

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3 https://hub.jncc.gov.uk/

Low order methods will be used in the first instance. Three attempts will be made before moving to high order clearance methods. High order clearance will only be used by exception with evidence provided to demonstrate that low order clearance has not been successful.

The mitigation protocol to be implemented depends on if low order (deflagration) or high order (detonation) UXO clearance methods are to be used. The protocol for low order UXO clearance is outlined in section 7.2.2.1 and is valid for all low order UXO clearance undertaken. The protocol for high order UXO clearance is outlined in section 7.2.2.2 and varies depending on the weight of the UXO being disposed. For example, all high order clearance will require an ADD to be used to encourage animals to flee from the zone of potential harm (auditory injury i.e., PTS) but high order clearance of greater weight UXO (≥ 130 kg) will also require the use of a NAS.

7.2.2.1. Protocol for Low Order UXO Clearance

Pre-work search

At least two dedicated MMOs and one dedicated passive acoustic monitoring (PAM) operator will undertake concurrent pre-work searches of 60 minutes in length prior to commencement of clearance work. Searches of a 1 km radius mitigation zone centred on the location of the upcoming sound source will be conducted. Clear channels of communication between the MMOs/PAM operator and relevant crew will be established prior to commencement of any operations. The MMOs/PAM operator will be informed sufficiently in advance of any proposed work so that a full pre-work search can be completed prior to work commencing.

Should a marine mammal be detected in the mitigation zone during the pre-work search by the MMOs or PAM operator, and it cannot be confirmed that the animal has moved out of the mitigation zone at the end of the search, a minimum of a 20-minute delay from the time of the last detection will be required prior to any clearance work taking place.

Following all UXO clearance work, a post-detonation search of at least 15 minutes' duration will be conducted within the mitigation zone by the MMOs (JNCC, 2010a).

Use of an ADD

ADD use is not required for low order clearance using small charge weights (0.05 and 0.25 kg; see Appendix B, Table B.1).

7.2.2.2. Protocol for High Order UXO Clearance

Pre-work search

At least two dedicated MMOs and one dedicated PAM operator will undertake concurrent pre-work searches of 60 minutes in length prior to commencement of clearance work. Searches of a 1 km radius mitigation zone centred on the location of the upcoming sound source will be conducted. Clear channels of communication between the MMOs/PAM operator and relevant crew will be established prior to commencement of any operations. The MMOs/PAM operator will be informed sufficiently in advance of any proposed work so that a full pre-work search can be completed prior to work commencing.

Should a marine mammal be detected in the mitigation zone during the pre-work search by the MMOs or PAM operator, and it cannot be confirmed that the animal has moved out of the mitigation zone at the end of the search, a minimum of a 20-minute delay from the time of the last detection will be required prior to any clearance work taking place. The ADD procedure (see below) will start after at least 30 minutes of the pre-work search has been conducted to avoid any animals being in close proximity to the ADD prior to it being turned on. The pre-work search will continue throughout the period of ADD use and during the detonation procedure.

Following all UXO clearance work, a post-detonation search of at least 15 minutes' duration will be conducted within the mitigation zone by the MMOs (JNCC, 2010a).

Use of an ADD

For all high order UXO detonations, use of an ADD is required to ensure that any animals that may be present within the zone of potential effect leave the area prior to work commencing. The duration of the ADD procedure is dependent on the weight of the charge to be cleared and has been calculated based on the greatest of the PTS impact ranges (for calculations see Appendix B). The durations for activation of the ADD, according to the different UXO weights, are described in Table 7.1 below. The ADD use durations required have been rounded up to the nearest 5 minutes for ease of use in the field as well as to provide a small buffer (precautionary approach). The ADD procedure will start after at least 30 minutes of the pre-work search has been conducted to avoid any animals being in close proximity to the ADD prior to it being turned on. For UXOs greater than 49 kg in weight, a NAS will also be used. This reduces the required duration of ADD use (see Table 7.1).

Following the JNCC (2010a) guidelines, the ADD will be positioned in close proximity to the upcoming sound source, which may not necessarily be the location of the vessel or MMOs/PAM operator. A specific member of the crew (which is not one of the MMOs or PAM operator) will be tasked with deployment and operation of the ADD. The ADD will be monitored to ensure it's working. Detonation will occur promptly after ADD deactivation to minimise the chances of animals beginning to return prior to detonation.

Table 7.1: Period of ADD use for high order clearance by UXO weight (a NAS will be used for all UXOs >49 kg in weight)

UXO weight (kg)	High Order										
					NAS used						
	6	15	25	49	130	165	220	227	254	354	1179
Period of ADD use (mins)	25	35	45	60	40	40	50	50	50	55	90

Use of a NAS

Should high order UXO clearance be required, a NAS (e.g., bubble curtain) will be used for all UXOs >49 kg in weight in order to reduce potential noise impacts. It is thought that using a NAS causing a 6 dB reduction in peak sound pressure level (SPL) will reduce the radius, within which the level is above a given threshold, by around half (as a minimum) and the corresponding area by about 75% (Verfuss *et al.*, 2019). This estimated reduction was used to revise the estimated PTS impact ranges and consequent ADD use durations required to ensure no animals will be present in the zone of potential impact (Appendix B).

The NAS will be applied after visual searches, ADD use, and any delays are complete (immediately prior to detonation). If bubble curtains are to be used they will not be switched on if animals are within the 1 km visual mitigation zone to avoid animals being trapped within the curtain (however, this should not be the case if the prior visual searches and ADD use have been undertaken).

7.2.2.3. Summary of the MMMP

The mitigation stages and durations based on the different weights of UXOs to be cleared can be found in Table 7.2 and

Table 7.3 below.

Table 7.2: Summary of the MMMP

Approach	Mitigation measures
Micro-siting	Locations within the DA and ECC will be 'micro-sited' to avoid UXO and prevent the need for clearance where deemed safe to do so
Lift and shift	The 'lift and shift' approach (moving the UXO to another location) will be considered on a case-by-case basis where deemed safe to do so
Low order clearance	Pre-work search (min. 60 mins) Low order clearance Post-detonation search (min. 15 mins)
High order clearance	Pre-work search (min. 60 mins) Use of an ADD (see Table 7.4) Use of a NAS (UXO >49 kg) High order clearance Post-detonation search (min. 15 mins)

Table 7.3: MMMP: Outline of pre-work search and period of ADD use by UXO weight

Mitigation phase		UXO weight (kg)												
		Low order		High Order										
								NAS used						
		0.5	0.25	6	15	25	49	130	165	220	227	254	354	1179
Visual and passive acoustic pre-work search (mins)		60	60	35	30	30	30	30	30	30	30	30	30	30
	Period of ADD use (mins)	0	0	25	35	45	60	40	40	50	50	50	55	90
Total mitigation time (mins)		60	60	60	65	75	90	70	70	80	80	80	85	120

7.2.3. Vessels

Where possible and appropriate, vessels will not exceed 14 knots to minimise disturbance to sensitive species.

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:

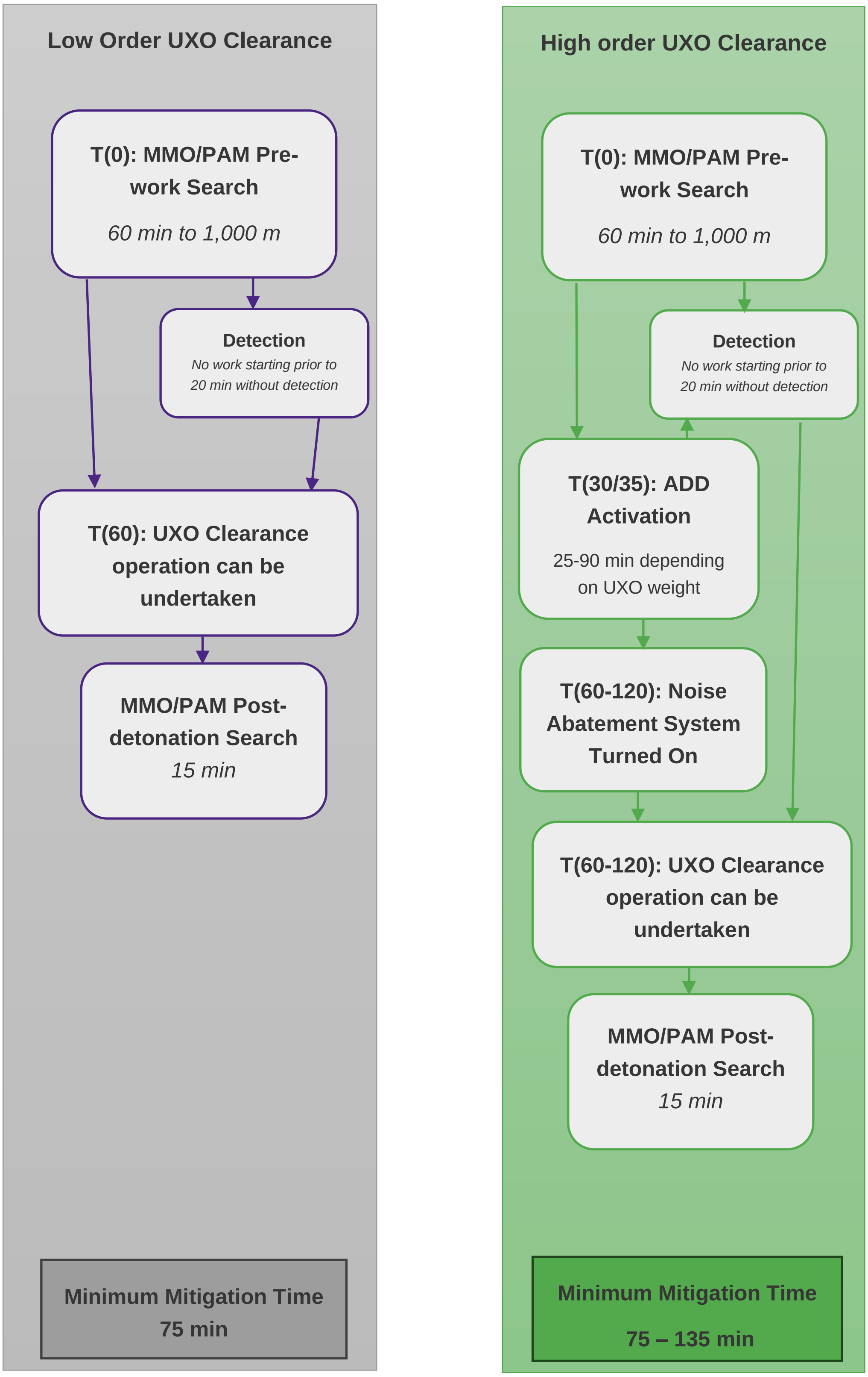
- The Officer on watch will ensure that EPS, basking sharks and seals are avoided where safe to do so; and
- The Officer on watch will minimise high powered manoeuvres or rapid changes of course where this does not impair safety.

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].

4 Scottish Marine Wildlife Watching Code | NatureScot

5 Download.ashx (sharktrust.org)

7.3. Mitigation Plan Flow Chart



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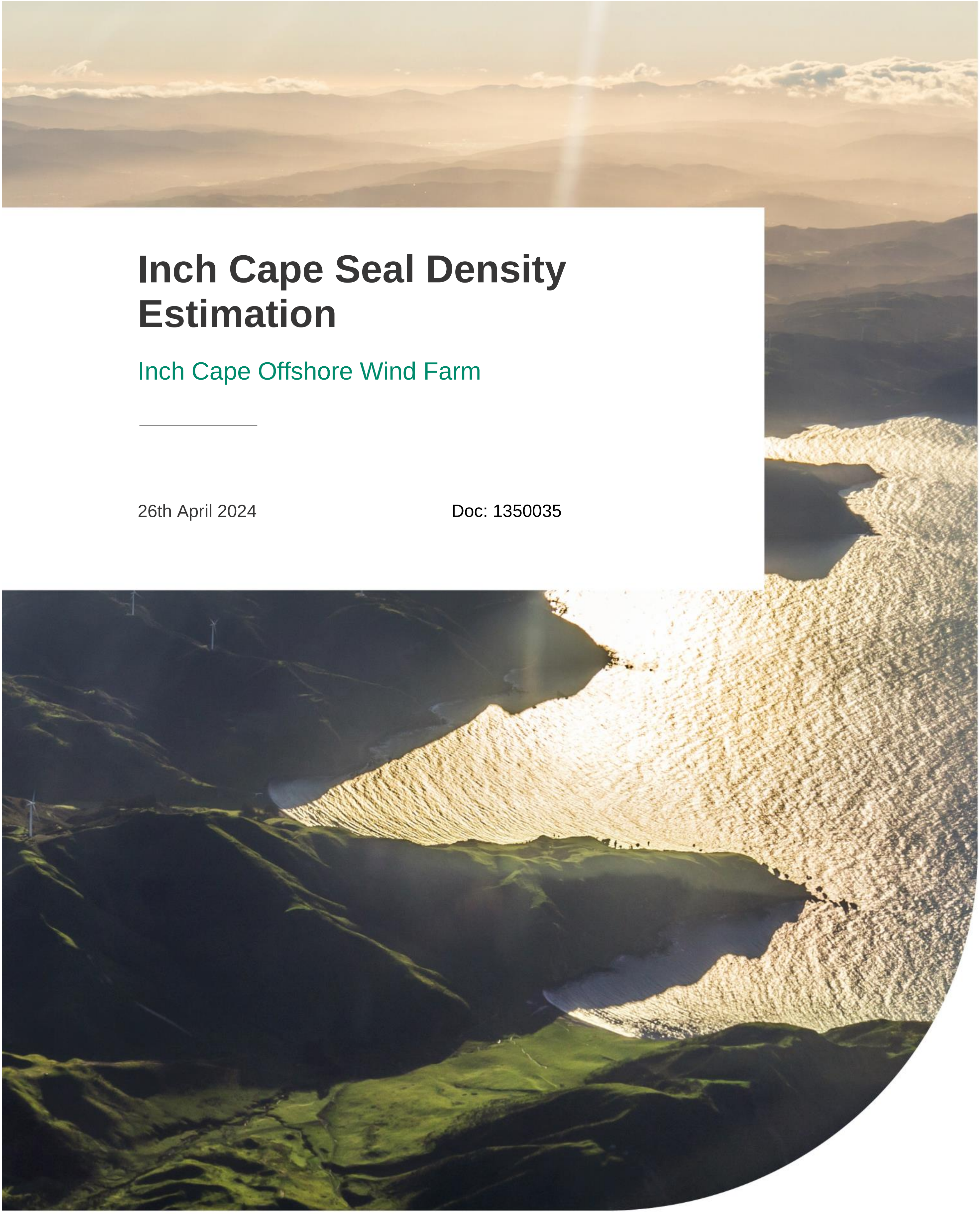
Appendices

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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Document history

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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:

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

Where N is the counted population (see table below), H is the haul out proportion, and S is the proportion at sea. When $\hat{N}$ 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

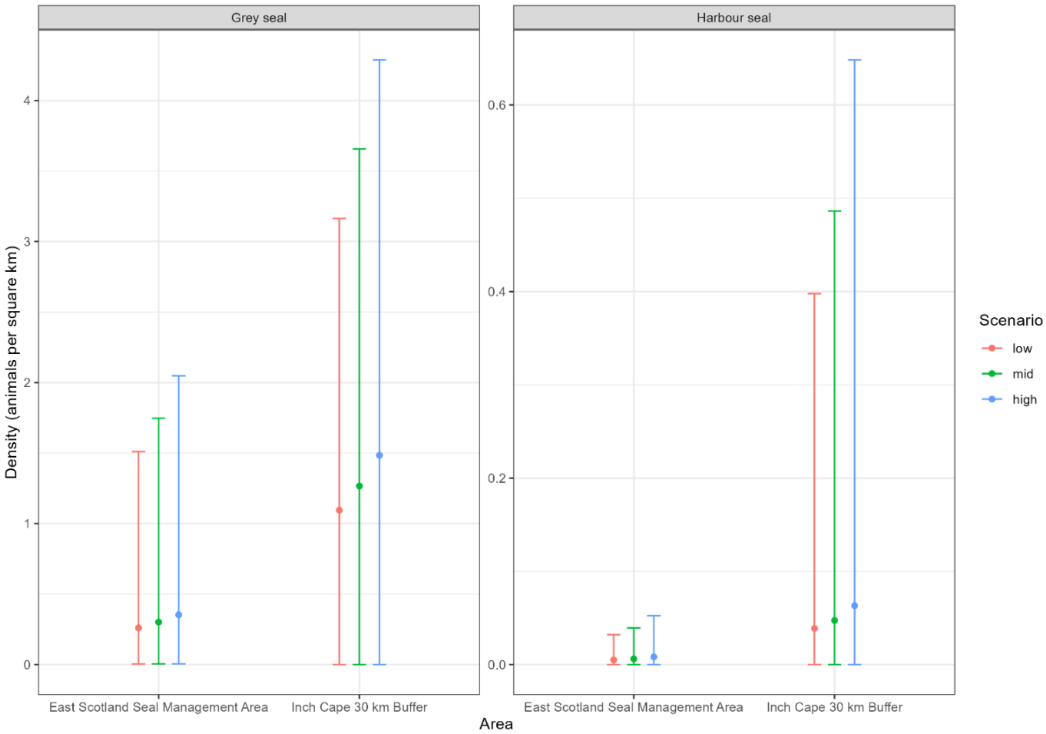


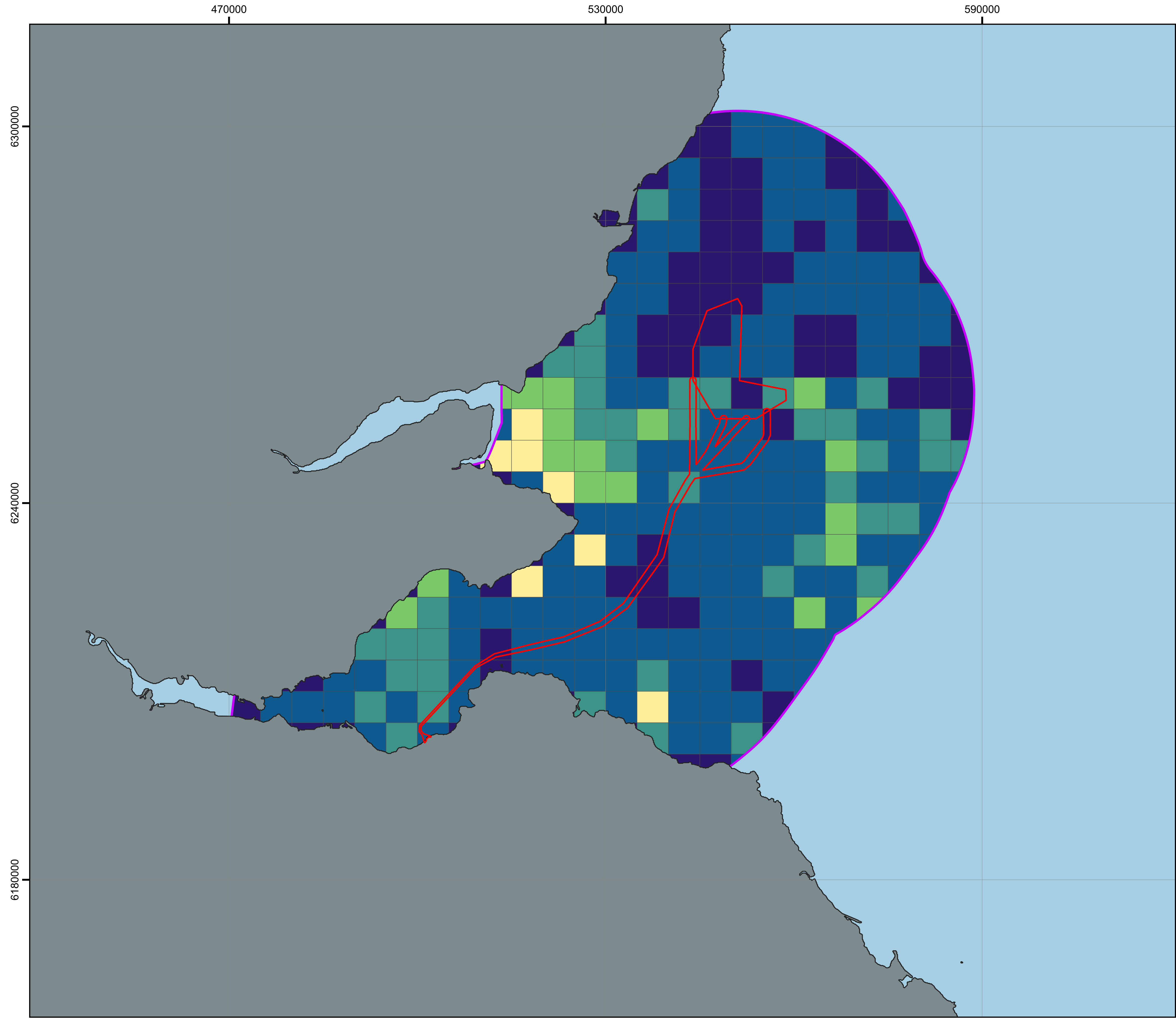
Figure 2.1: Estimated density of seals within a 30 km buffer of the Inch Cape Project development area (the windfarm footprint and export cable corridor), and the East Scotland Seal Management Area. Low, mid and high scenarios represent ranges of haul out proportion estimates used in calculations.

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



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.

Scale @ A3: 1:600,000

Coordinate System: WGS 84 UTM Zone 30N

0 100 200 300 400 km

N

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

Ref: GB200491_M_604_A

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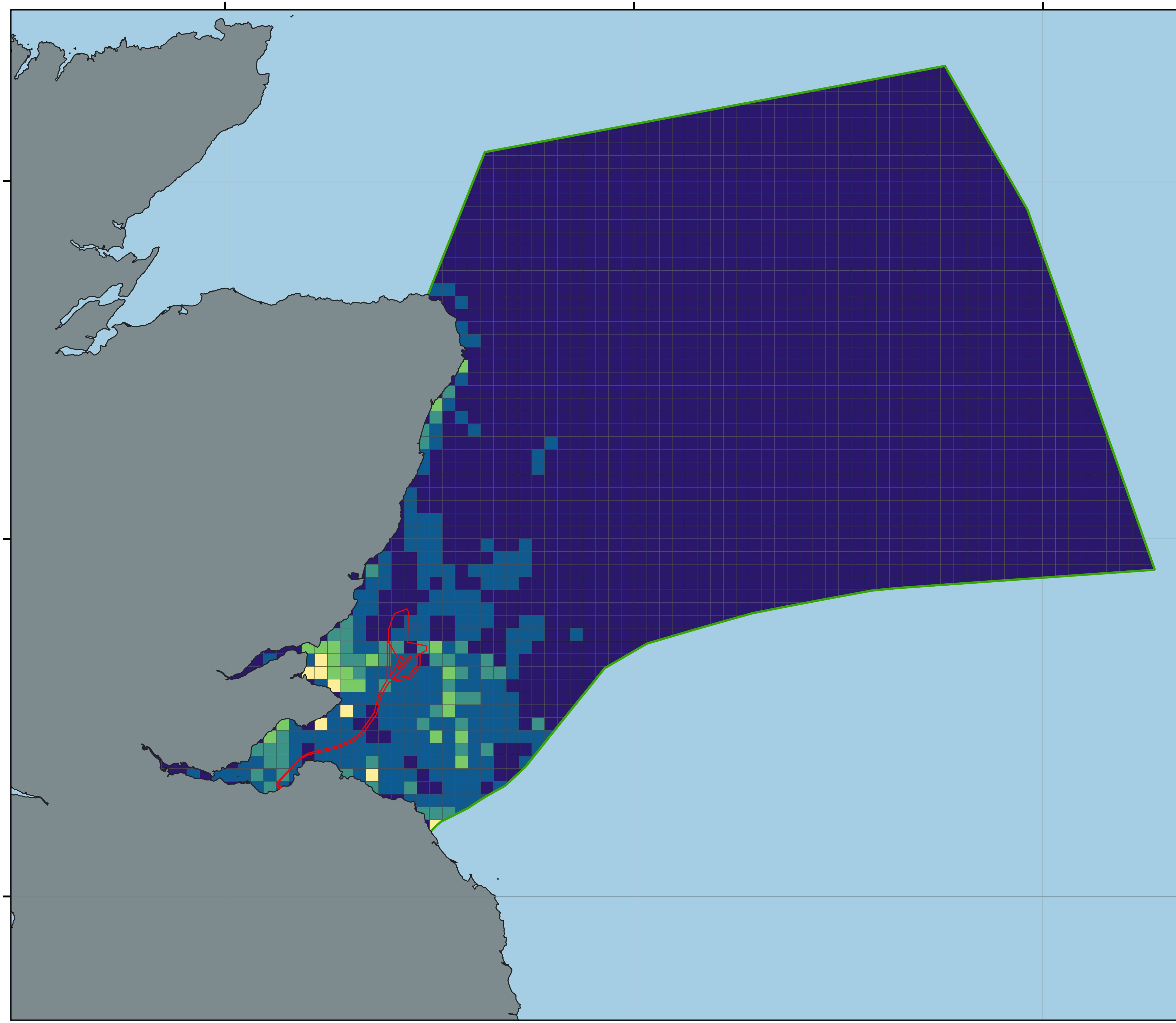

Project:

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.

Scale @ A3: 1:1,500,000

Coordinate System: WGS 84 UTM Zone 30N

0 200 400 600 800 km

N

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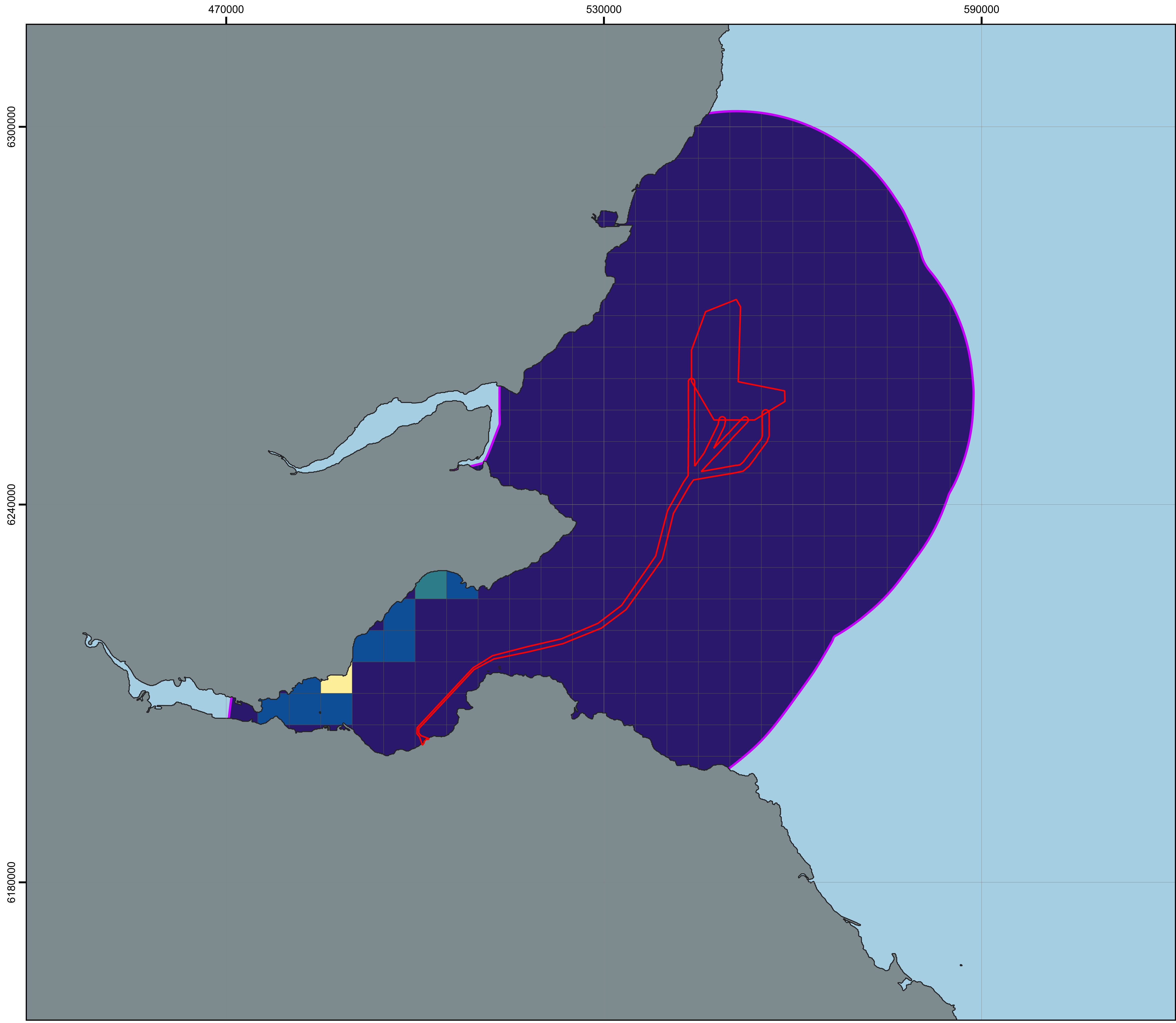
2.3. Harbour seal

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.

Scale @ A3: 1:600,000

Coordinate System: WGS 84 UTM Zone 30N

0 100 200 300 400 km

N

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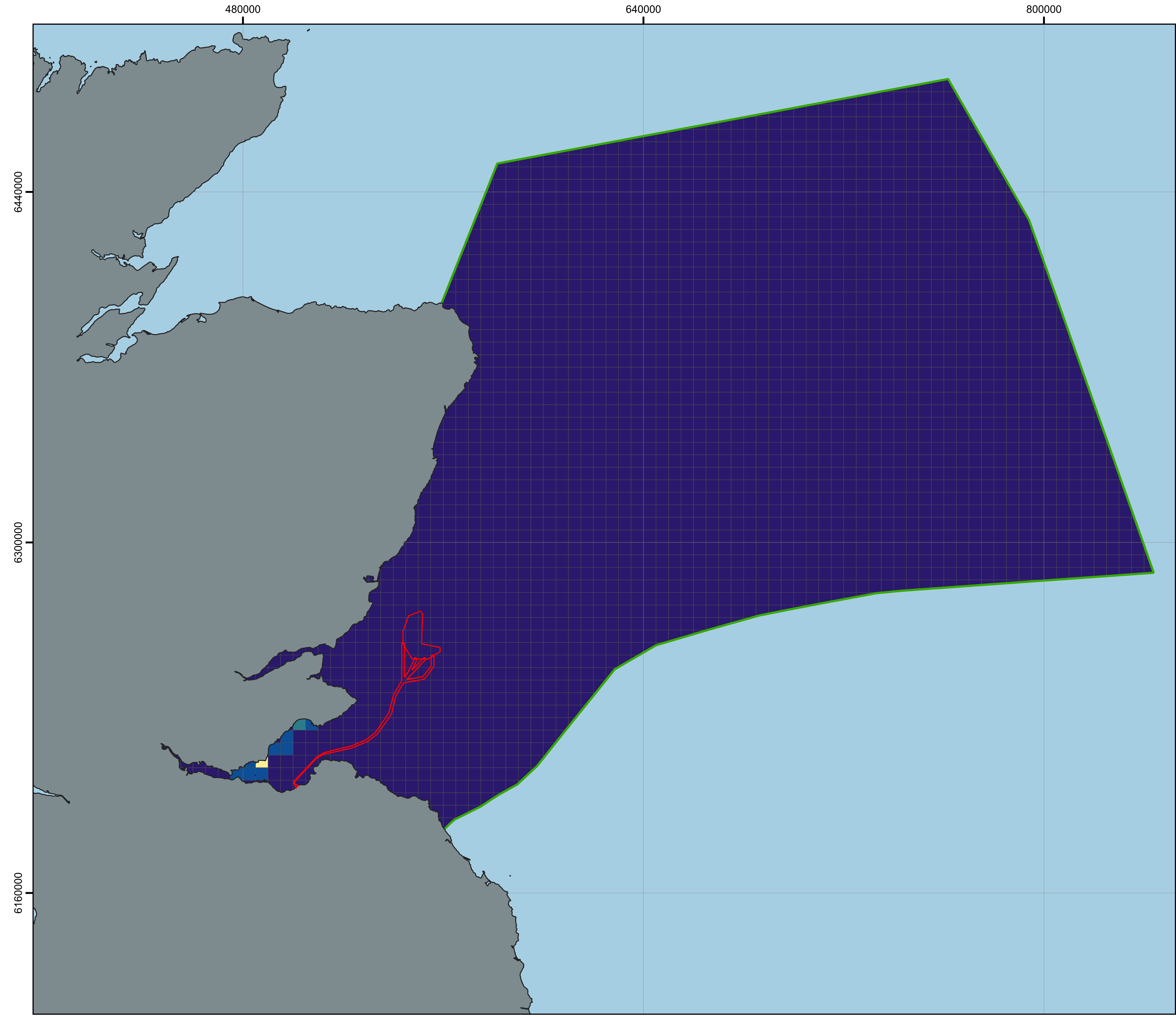

Project:

Inch Cape Offshore Windfarm

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.

Scale @ A3:1:1,500,000

Coordinate System: WGS 84 UTM Zone 30N

0 200 400 600 800 km

N

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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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B. Duration of ADD Use Calculations

The duration of the ADD use for each of the possible UXO charge weights (Table 3.1) was calculated based on how much time is needed for a harbour porpoise (traveling at a flee speed of 1.4 m/s, 1.5 m/s, or 1.97 m/s (SNH, 2016; Otani *et al*., 2000; Kastelein *et al*., 2018, respectively)) to move out of the impact zone within which there is potential for auditory injury for each potential charge weight (Table 6.3). This duration was adjusted to take account of the 1 km mitigation zone cleared during the pre-work search and the reduction in PTS impact range from the use of a NAS for high order clearance >49 kg (see section 7.2.2.2). The ADD use durations required have been rounded to the nearest 5 minutes (Table 7.2) and the consequential clearance ranges calculated (Table B.1).

Using these ranges, and assuming that spreading is approximately spherical (area = πr2 (where r = the range cleared)), the number of harbour porpoise estimated to be in the clearance zone has been estimated using the SCANS-IV density estimate for Block NS-B (Table 5.1) where the Inch Cape OWF is located. By subtracting these estimates from the number of harbour porpoise with potential to be impacted pre-mitigation (Table 6.4) after the NAS has been used, the number of individuals remaining in the impact zone post-mitigation was calculated (Table B.2).

Table B.2 shows that post-mitigation no harbour porpoises are at risk of auditory injury from the UXO clearance activities and therefore the ADD use durations calculated are adequate for the proposed work.

Due to the larger PTS impact ranges for very high frequency cetaceans, harbour porpoises represent the worst case of potential impacts on marine mammals. Therefore, it is assumed that the ADD use durations calculated (for harbour porpoise) will be adequate to clear the zone of potential impact of all other marine mammal species.

Table B.1: Range cleared of very high frequency cetaceans (harbour porpoise) post-mitigation

Charge weight (kg TNT)		SPL_{peak} (km)		Range cleared (km)						
				Pre-work search	ADD use			Total (pre-work search and ADD use)		
		No mitigation	After use of a NAS for UXO >49 kg		1.4 m/s flee speed	1.5 m/s flee speed	1.97 m/s flee speed	1.4 m/s flee speed	1.5 m/s flee speed	1.97 m/s flee speed
Low Order	**0.05**	0.58	0.58	1	0	0	0	1	1	1
	0.25	0.99	0.99	1	0	0	0	1	1	1
High Order	**6**	2.8	2.8	1	2.1	2.25	2.96	3.1	3.25	3.96
	15	3.9	3.9	1	2.94	3.15	4.14	3.94	4.15	5.14
	25	4.6	4.6	1	3.78	4.05	5.32	4.78	5.05	6.32
	49	5.7	5.7	1	5.04	5.4	7.09	6.04	6.4	8.09
	130	8.6	4.30	1	3.36	3.6	4.73	4.36	4.6	5.73
	165	8.6	4.30	1	3.36	3.6	4.73	4.36	4.6	5.73
	220	9.6	4.80	1	4.2	4.5	5.91	5.2	5.5	6.91
	227	9.6	4.80	1	4.2	4.5	5.91	5.2	5.5	6.91
	254	10	5.00	1	4.2	4.5	5.91	5.2	5.5	6.91
	354	11.1	5.55	1	4.62	4.95	6.5	5.62	5.95	7.5
	1179	16.6	8.30	1	7.56	8.1	10.64	8.56	9.1	11.64

Table B.2: Number of harbour porpoise which have the potential to be present within the zones of potential impact post mitgation

Charge weight (kg)		Number of individuals impacted				
		No mitigation	After use of a NAS for UXO >49 kg	Post pre-work search and ADD use		
				1.4 m/s flee speed	1.5 m/s flee speed	1.97 m/s flee speed
Low Order	**0.05**	1	n/a	0	0	0
	0.25	2	n/a	0	0	0
High Order	**6**	15	n/a	0	0	0
	15	29	n/a	0	0	0
	25	40	n/a	0	0	0
	49	61	n/a	0	0	0
	130	139	35	0	0	0
	165	139	35	0	0	0
	220	173	43	0	0	0
	227	173	43	0	0	0
	254	188	47	0	0	0
	354	232	58	0	0	0
	1179	518	130	0	0	0

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