Eastern Green Link 3 (EGL 3) Protected Species Assessment & Marine Mammal Mitigation Plan (MMMP) EGL 3 Cable Route Survey

Prepared for: National Grid Electricity Transmission & Scottish Hydro Electric Transmission plc

collaborative environmental advisers

Date: April 2023
Document Reference: C01494_NGET_REP_D0124
Version Number: 01

[Redacted]

[Redacted]

Collaborative Environmental Advisers
Registered in England at Suite A, First Floor, 132 Winchester Road, Chandlers Ford, Hampshire, SO53 2DS
Registered number: 11114584

www.ceaenvironmental.co.uk

Record of Changes

Rev #	Date	Description	Approved
0	19 April 2023	First Draft for Client Review	[Redacted]
1	03 May 2023	Final	
2			
3			
4			
5			
6			

Distribution List

#	Function Title	Company	Name (optional)
1	Lead Marine Consents Officer	National Grid Electricity Transmission	[Redacted]
2	Marine Consents Officer	National Grid Electricity Transmission	
3	Marine Consents Manager	Scottish Hydro Electric Transmission Plc.	
4			
5			
Notes:			

Responsible for	Job Title	Name	Date	Signature
Content	Senior Consultant	[Redacted]	03/05/2023	[Redacted]
Checked & Approved	Director		03/05/2023	
Copyright:	CEA ©	Document Reference:	C01494_NGET_REP_D0124_Rev1	

This document has been checked in line with internal quality control requirements.

Table of Contents

Abbreviations

µPa	micropascal
AU	Assessment Units
AUV	Autonomous Underwater Vehicle
CEA	Collaborative Environmental Advisers Ltd.
CES	Coastal East Scotland
CGNS	Celtic and Greater North Sea
CPT	Cone Penetrometer Test
dB	Decibel
EDR	Effective Deterrence Range
EGL 3	Eastern Green Link 3
EPS	European Protected Species
GNS	Greater North Sea
GW	Gigawatt
HDD	Horizontal Directional Drilling
HVDC	High Voltage Direct Current
IAMMWG	Inter Agency Marine Mammal Working Group
IUCN	International Union of Conservation of Nature
kHz	kilohertz
km	kilometre
kV	kilovolt
MBES	Multi Beam Echo Sounder
MEC	Marine Environmental Consultant
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MMO	Marine Mammal Observer
MNR	Marine Noise Registry
MU	Management Unit
NGET	National Grid Electricity Transmission
NM	Nautical Mile
PAMO	Passive Acoustic Monitoring Operator
PSA	Protected Species Assessment
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SBP	Sub-Bottom Profiler
SCANS	Small Cetaceans in European Atlantic waters and the North Sea
SCOS	Special Committee on Seals (SCOS)
SEL	Sound Exposure Level
SMU	Seal Management Units
SPL	Sound Pressure Level

SSEN	Scottish and Southern Electricity Network (Legal entity Scottish Hydro Electric Transmission Plc)
SSS	Side Scan Sonar
USBL	Ultrashort baseline
VC	Vibrocore

1. Introduction

1.1. Project Background

National Grid Electricity Transmission (NGET) and Scottish Hydro Electric Transmission Plc (SHE Transmission) (also Scottish and Southern Electricity Networks Transmission (SSEN Transmission)) have contracted Collaborative Environmental Advisers Ltd. (CEA) to act as the Marine Environmental Consultant (MEC) providing marine routeing, consenting and environmental support for a High Voltage Direct Current (HVDC) strategic transmission network link known as Eastern Green Link 3 (EGL 3).

EGL 3 will link Peterhead in Scotland and South Humber in England and is being developed between NGET and SSEN Transmission. The HVDC marine cable will be approximately 554 km in length and will have a capacity of 2 GW operating at 525 kV. Completion is scheduled for 2030/31.

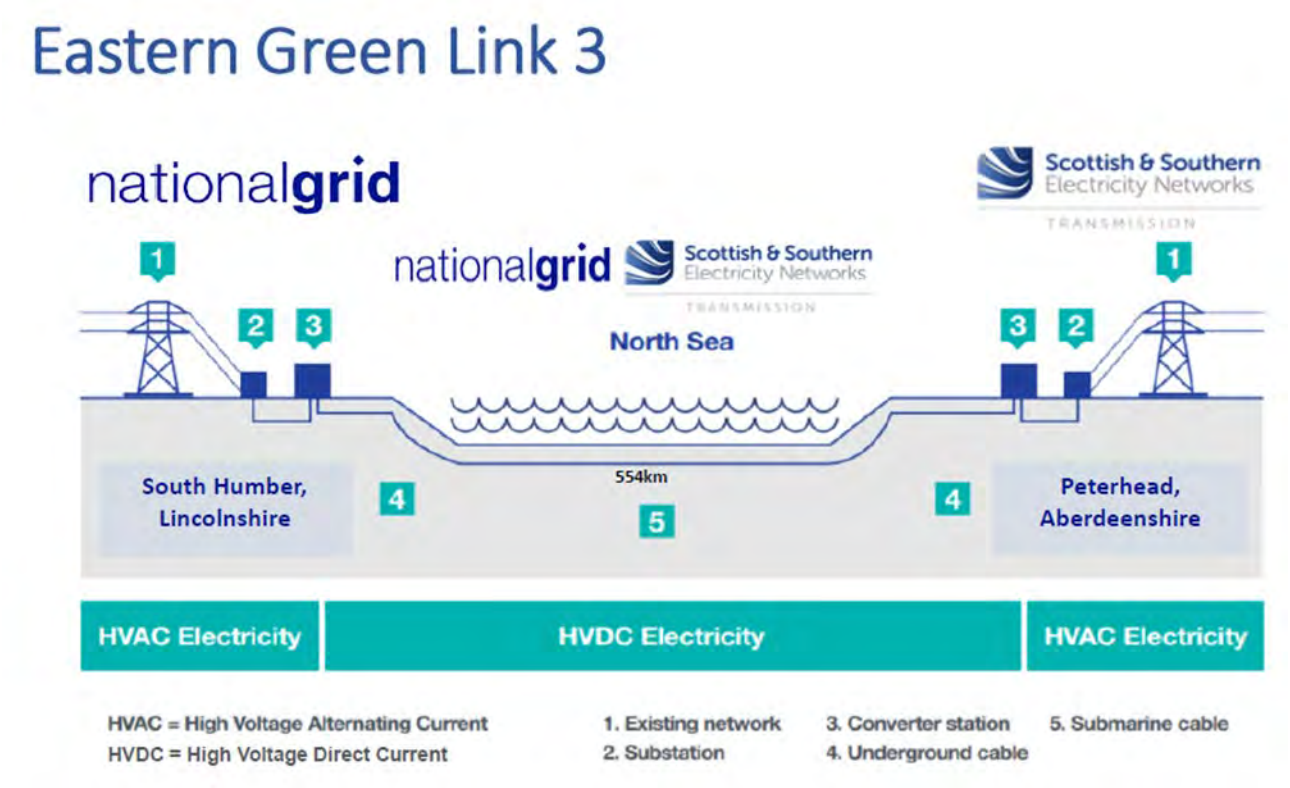


Figure 1-1 : Main infrastructure components of EGL 3

The Marine Scheme includes three distinct components, which are summarised, from north to south, below:

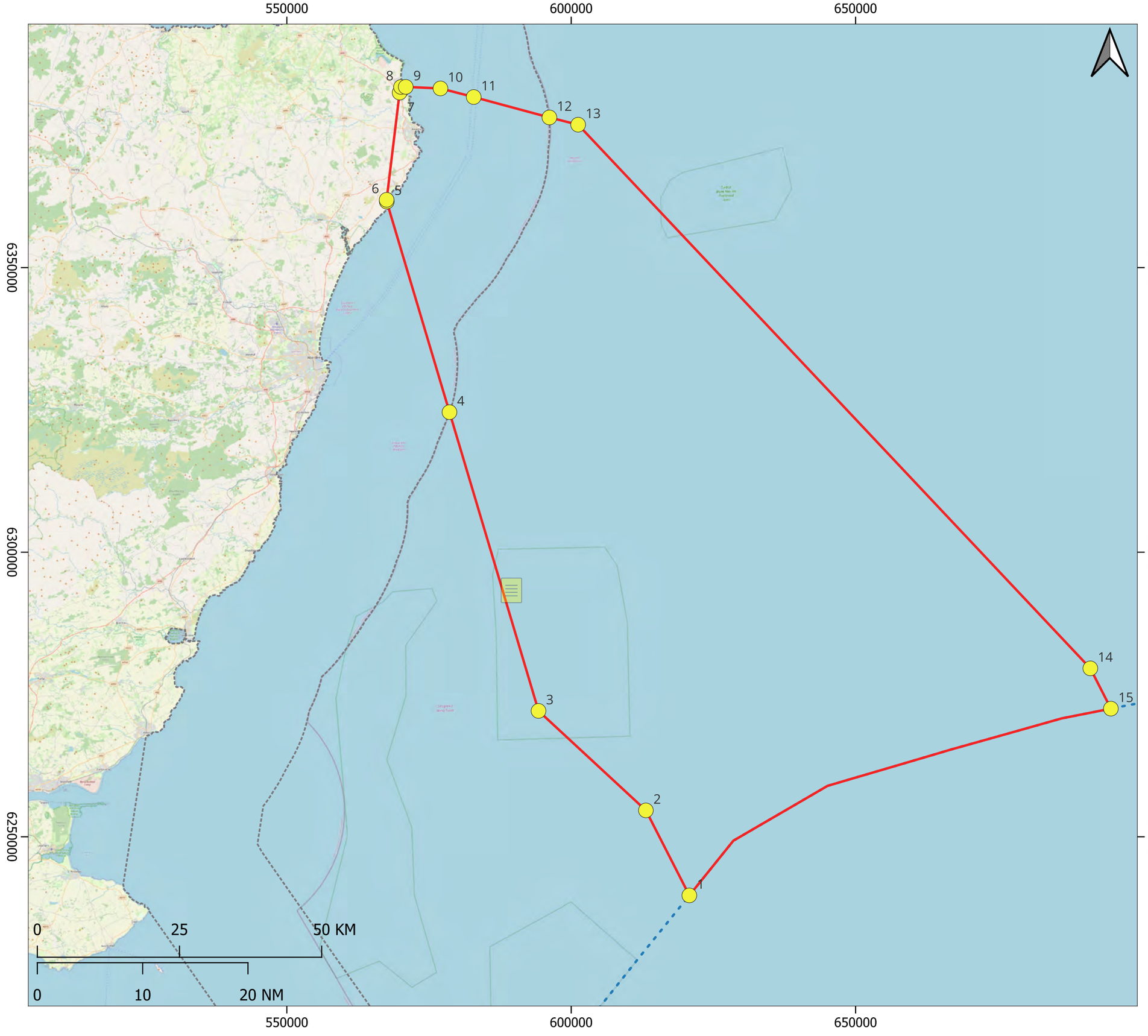
- Scottish Landfall: this is the area where the cable route transitions between the marine and terrestrial environment in Scotland.
- Marine Cable Route: This is the cable route from landfall to the 12 NM limit and beyond, within the seaward limit of the UK marine area. The cable follows a broad north to south alignment from Scotland toward landfall in England with distance along the cable route indicated as KP (kilometre point) markers with KP 0 defined at the English landfall.
- English Landfall: this is the area where the cable route transitions between the marine and terrestrial environment in England.

NGET and SSEN Transmission intend to undertake a marine cable route survey to include geophysical, geotechnical and benthic vessel-based surveys. The objective of the survey campaign is to obtain baseline data that will contribute to determining the physical and ecological conditions, the location and design of the final cable route and inform the environmental assessments necessary to obtain consent for the project.

Within Scottish inshore and offshore waters, NGET and SSEN Transmission will apply for A licence to disturb or injure marine European protected species (EPS Licence) and a basking shark (*Cetorhinus maximus*) licence. Figure 1-2 (Drawing C01494-EPS-EGL3-LOC-006-B) shows the EGL 3 Application Area within Scottish waters, which is the subject of this Protected Species Assessment. Within the Application Area the survey will consist of a 500 m to 1 km wide corridor, centred on a preferred cable route. Table 2-3 provides the latitude and longitudes of the coordinate points shown.

Figure 1-3 (Drawing C01494-EPS-EGL3-LOC-007-A) shows designated sites close to the Application Area.

A tender process for a survey contractor is underway. There is a potential survey mobilisation date of 01 July 2023, however this assessment assumes that the survey could commence at any time within the year. To allow for possible delays in survey deployment (e.g., due to poor weather conditions etc.) the licence applications are made for the period of 01 July 2023 to 30 June 2024.



EGL 3 Application Area

C01494-EPS-EGL3-LOC-006-B

EGL 3 Scottish Waters

Coordinate Points

EGL3 EPS Application Area

Scottish Adjacent Waters

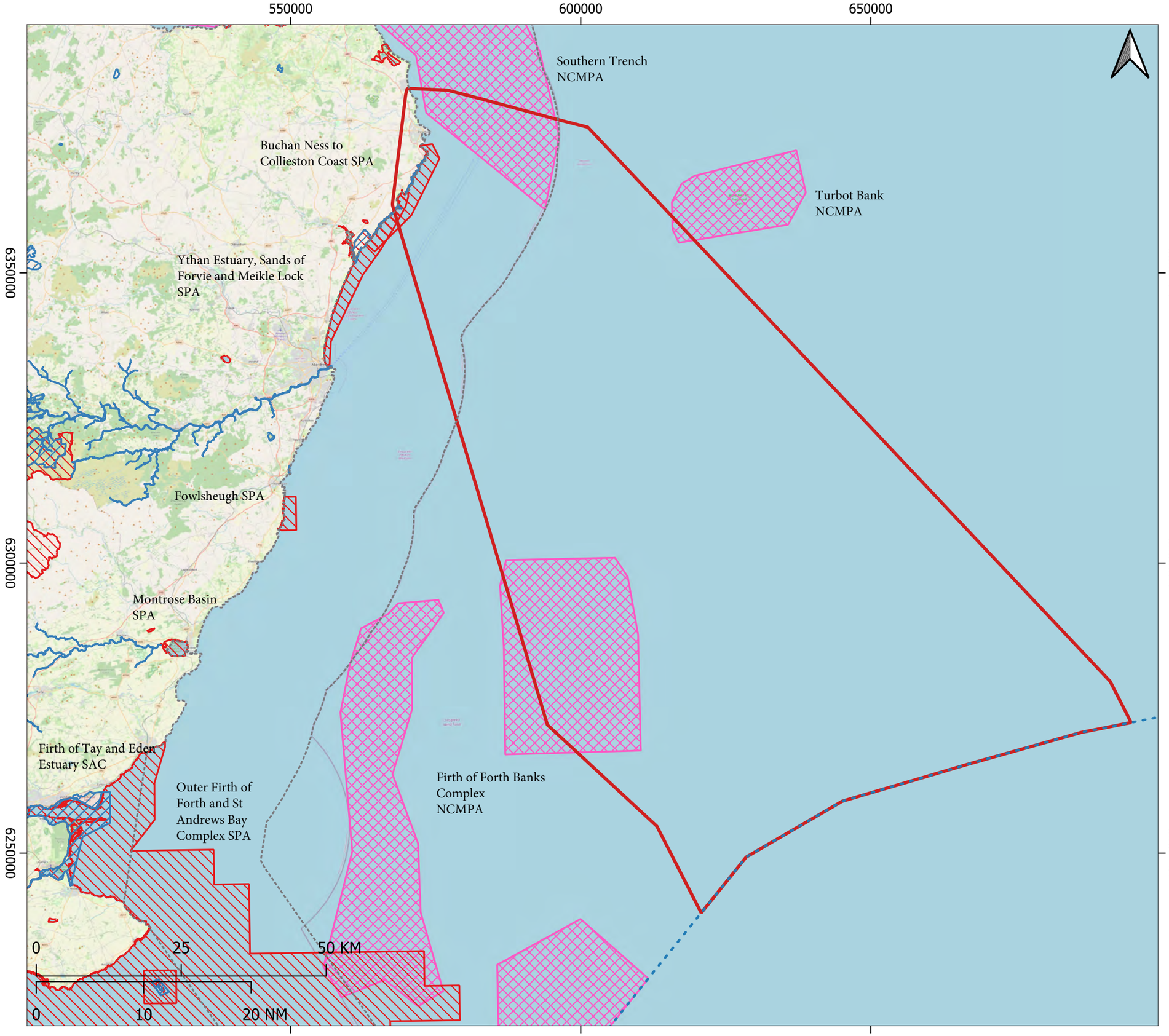
12NM Limit

Open Street Map

Note: All landfall segments are connected to the relevant Offshore Route segment. Due to several segments taking a common route at points not all coloured lines may be visible if several are overlain.

Date	04/05/2023
Coordinate System	WGS 84 / UTM zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	meters
Scale at A3	1:650,000
Created	J Cunningham
Reviewed	K Kean
Authorised	A Farley

Document Path: X:\GIS\GIS_PROJECTS\C01494_EAGL3&4\Project\QGS\EPS_EGL3\C01494_EGL3_EPS_LOC_001.qgz
Export Date: 04/05/2023



collaborative environmental advisers

Protected Sites

C01494-EPS-EGL3-LOC-007-A

EGL 3 Scottish Waters

Scottish Adjacent Waters

12NM Limit

EGL3 Application Area

Protected Sites

Special Area of Conservation (SAC) Scotland

Special Area of Conservation (SAC) with marine componants

Special Protection Area (SPA) Scotland

Nature Conservation Marine Protected Area (NCMPA) -- Scotland

Open Street Map

Note: All landfall segments are connected to the relevant Offshore Route segment. Due to several segments taking a common route at points not all coloured lines may be visible if several are overlain.

Date	13/04/2023
Coordinate System	WGS 84 / UTM zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	meters
Scale at A3	1:650,000
Created	J Cunningham
Reviewed	K Kean
Authorised	A Farley

Document Path: X:\GIS\GIS_PROJECTS\C01494_EAGL3&4\Project\QGS\EGL4\01_LOC\C01494_EGL4_EPS_LOC_001.qgz
Export Date: 13/04/2023

1.2. Scope

This Protected Species Risk Assessment seeks to determine whether the proposed marine cable route surveys either alone, or in combination with other plans and projects, are likely to lead to physical injury or non-trivial disturbance of individuals or species populations of European and nationally protected marine species. This assessment relates specifically to Scottish inshore and offshore waters. A separate Protected Sites and Species Assessment has been undertaken for English waters (inshore and offshore) (Document reference - C01494_NGET_REP_D0122), which also includes an assessment of potential impacts on Scottish marine conservation designations (Marine Protected Areas, Special Areas of Conservation and Special Protection Areas).

The protected species included in this report are listed in Table 1-1.

Table 1-1 : Relevant Protected Species

Species	Protection Level	Relevant Legislation Scotland
All cetaceans (whales, porpoises, dolphins)	European Protected Species (EPS)	The Conservation (Natural Habitats, &c) Regulations 1994 (as amended) The Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended)
All chelonians (marine turtles)	European Protected Species (EPS)	The Conservation (Natural Habitats, &c) Regulations 1994 (as amended) The Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended)
Eurasian Otter	European Protected Species (EPS)	The Conservation (Natural Habitats, &c) Regulations 1994 (as amended)
Pinnipeds	Nationally Protected	Marine (Scotland) Act 2010 (as amended) and Protection of Seals (Designated Sea Haul-out Sites) (Scotland) Order 2014
Basking shark	Nationally Protected	Nature Conservation (Scotland) Act 2004 The Wildlife and Countryside Act 1981 (as amended)

This protected species assessment has been prepared with consideration of the following guidance:

- The protection of Marine European Protected Species from injury and disturbance. Guidance for Scottish Inshore Waters (Marine Scotland 2020).
- Guidance on noise management in harbour porpoise SACs (JNCC 2020).
- JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys (JNCC 2017).
- Guidance on the Offence of Harassment at Seal Haul-out Site (Marine Scotland 2014).
- 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 *et al.* 2010).

1.3. Structure of the Report

This report is structured into the following chapters to include information relating to the proposed marine cable route surveys, the protected species that can potentially occur in the Application Area, the potential impacts to protected species, and measures to ensure species are protected. Specifically, the chapters describe or comprise the following elements:

- Section 1: Legislation and regulatory background
- Section 2: Description of the proposed marine cable route surveys
- Section 3: Identification of the protected species that may be found in or near the Application Area
- Section 4: Identification of potential impacts
- Section 5: Risk assessment and proposed mitigation
- Section 6: Presents the conclusions from this report
- Appendix 1: Marine Mammal Mitigation Plan (MMMP)

1.4. Legislative Context

1.4.1. Cetaceans

Cetaceans (whales, dolphins, porpoise) are designated as EPS in Scotland (see Table 1-1 for relevant legislation). The legislation applies to inshore waters (0-12 nautical miles (NM) under The Conservation (Natural Habitats, &c) Regulations 1994 (as amended) (Scotland) and offshore waters 12-200 NM under The Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) (UK wide). The legislation prohibits the "deliberate and reckless capture, injury, killing and disturbance of marine EPS" (Marine Scotland, 2020). It is important to note, that JNCC *et al.* (2010) guidance also considers that the potential for disturbance from some activities can be considered "trivial". Activities which might be considered trivial include those that lead to "sporadic disturbances without any likely negative impact on the species". For an activity to be considered "non-trivial", the JNCC *et al.* (2010) guidance states that "*the disturbance to marine EPS would need to be likely to at least increase the risk of a certain negative impact on the species' [Favourable Conservation Status] (FCS)".*

However, further to this, cetaceans are offered additional protection on an individual level in Scottish inshore waters with the specific inclusion of Regulation 39(2) which states that "*it is an offence to deliberately or recklessly disturb any dolphin, porpoise or whale (cetacean)".* In Scotland, the licensing authority is Marine Scotland on behalf of the Scottish Ministers.

The onus is on the Applicant to determine whether the proposed activity has the potential to result in an offence under the Regulations and whether an EPS Licence is required in order to carry out the activity. Guidance states that "*It is expected that many activities at sea will not require a licence to exempt them from regulations 39(1) and (2) of the Habitat Regulations since there may be suitable mitigation to reduce the potential for injury and/or disturbance."* (Marine Scotland 2020). However, if despite the implementation of mitigation measures there remains the potential risk of an offence, then an EPS licence can be granted if the application passes the following three tests:

- There must be a licensable purpose;
- There must be no satisfactory alternative; and
- The activity must not be detrimental to the maintenance of the population of the species concerned at favourable conservation status in their natural range.

UK guidance (Marine Scotland 2020, JNCC 2020, JNCC et al. 2010) notes that certain activities, such as geophysical survey, which produce underwater noise in areas where EPS are present, have the potential to result in a disturbance or injury offence, unless appropriate mitigation measures are implemented. The risk of an offence being committed, and therefore the potential need for an EPS Licence, is dependent on a range of factors, including:

- Presence/absence of EPS.
- Frequency of occurrence and density of EPS.
- Noise associated with the activity and resulting impacts on EPS.
- Length of exposure of EPS to noise associated with proposed activities.
- 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).
- The motivation of the animal to remain within the areas (e.g., food availability).
- The potential for combination effects with other activities in the region.
- Whether mitigation can remove the risk of an offence being committed.

1.4.2. Marine Turtles

All marine turtles (chelonians) are designated as EPS in Scotland (see Table 1-1 for relevant legislation). The legislation applies to inshore and offshore waters and prohibits the "*deliberate and reckless capture, injury, killing and disturbance of marine EPS*" (Marine Scotland, 2020). In Scotland the licensing authority is Marine Scotland on behalf of the Scottish Ministers.

The onus is on the Applicant to determine whether the proposed activity has the potential to result in an offence under the Regulations and whether an EPS Licence is required in order to carry out the activity. Guidance states that "*It is expected that many activities at sea will not require a licence to exempt them from regulations 39(1) and (2) of the Habitat Regulations since there may be suitable mitigation to reduce the potential for injury and/or disturbance."* (Marine Scotland 2020). However, if despite the implementation of

mitigation measures there remains the potential risk of an offence then an EPS licence can be granted if the application passes the following three tests:

- There must be a licensable purpose;
- There must be no satisfactory alternative; and
- The activity must not be detrimental to the maintenance of the population of the species concerned at favourable conservation status in their natural range.

1.4.3. Eurasian Otter

As an EPS, the Eurasian otter (*Lutra lutra*) is fully protected under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). The legislation applies to inshore waters <12 NM.

Otters are also classified as Near Threatened on the International Union for Conservation of Nature (IUCN) Red List, are listed under CITES Appendix 1, protected in the UK under the Wildlife and Countryside Act, 1981, and classified as a Priority Species in the UK Biodiversity Action Plan.

It is therefore an offence to deliberately or recklessly:

- kill, injure, capture or harass an otter;
- disturb an otter whilst it is occupying a holt (underground den) or other place it uses for shelter or protection, or while it is rearing or otherwise caring for its young, or in any way that impairs its ability to survive or breed, or significantly affects the local distribution or abundance of otters;
- obstruct access to an otter breeding site or resting place, or otherwise prevent their use.

And whether or not deliberate or reckless:

- to damage or destroy an otter breeding site or resting place.

The onus is on the Applicant to determine if the proposed activity has the potential to result in an offence under the legislation, and the responsible licensing authority is Marine Scotland.

1.4.4. Pinnipeds

The UK is home to two species of native seal – the grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*). Both species, as well as others, are protected in the UK.

Under UK and Scottish legislation (see Table 1-1), it is an offence to intentionally kill or injure a seal or intentionally or recklessly harass a seal at a haul-out site. Haul-out sites are designated under the Protection of Seals (Designated Sea Haul-out Sites) (Scotland) Order 2014. Marine Scotland are the licensing authority for commercial activities such as geophysical surveying in Scotland.

1.4.5. Basking Shark

Basking shark are listed as endangered on the IUCN Red List and are protected within inshore Scottish waters under the Nature Conservation (Scotland) Act 2004 (NatureScot, 2020a). Under these regulations it is an offence to intentionally or recklessly kill, injure, take, possess, disturb or harass any basking shark.

In Scotland, basking shark are provided full protection under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and are priority marine features in Scottish seas (NatureScot, 2020a).

Like for EPS, the onus is on the Applicant to determine if the proposed activity has the potential to result in an offence under the legislation and whether a Basking Shark Licence is required in order to carry out the activity. The responsible licensing authority is Marine Scotland.

2. Survey Description

2.1. Summary of Survey Activities

Table 2-1 outlines the survey data acquisition types to be used during the proposed marine cable route survey campaign for EGL 3.

The geophysical survey corridor will be at least 500 m wide to provide adequate coverage of the seabed and to allow future micro-routeing and refinement of the cable route where required. In places the survey corridor may be expanded to 1 km to aid route development if observed seabed features prove detrimental to installation.

The maximum number of sampling stations has been indicated in Table 2-1.

Table 2-1 : Summary of proposed site investigation methodologies

Survey Type	Methods	Description
Geophysical Survey	Multi Beam Echo Sounder (MBES), Side Scan Sonar (SSS), magnetometer, Sub-Bottom Profiling (SBP), Autonomous Underwater Vehicle (AUV), Remotely Operated Vehicle (ROV), and Ultra-Short Baseline (USBL) positioning system.	The objectives of the proposed geophysical survey are to: ▪ Map the intertidal area, seabed and sub-surface to optimise cable routeing within the application area and to enable assessment of cable burial depth. ▪ Plan the scope and position of the geotechnical sampling programme in the application area. ▪ Identify marine habitat areas from which the benthic survey can be undertaken. ▪ Identify sensitive marine habitats which will need to be avoided during geotechnical and environmental sampling and cable installation. ▪ Provide the geophysical data from which a marine archaeological assessment can be undertaken as part of the consenting process. To meet these objectives, the geophysical survey will undertake the following tasks: ▪ Measure intertidal topography and seabed bathymetry, surface morphology and identify the nature of the seabed sediments - in particular the height, length and slopes of bedforms (UAV, MBES, SSS). ▪ Identify the distribution and thickness of superficial sediments and rock head where possible (SBP). ▪ Identify the distribution of subsea geological features such as areas of exposed bedrock (MBES, SSS). ▪ Identify the location, extent and nature of any impediments to laying or burial of the cables such as wrecks, debris on seafloor, rock outcrop, other cables, pipelines etc. (magnetometer, MBES, SSS). ▪ A remotely operated vehicle (ROV) will be used at third-party crossings (e.g., existing in-service cables) to survey 200 m either side of the proposed crossing location to confirm the location of the asset and its depth of burial. The survey will provide accurate information that can be used when designing cable crossings (if applicable). The interpretation of the geophysical survey forms the basis of the scope of work for geotechnical and benthic surveys. USBL systems are used to determine the position of subsea survey items, including ROVs, towed sensors, etc. This involves the emission of sound from a vessel-mounted transducer to a subsea transponder.
Geotechnical Survey	Vibrocore (VC), Cone Penetrometer Tests (CPT) and boreholes.	The purpose of the geotechnical survey is to evaluate the nature and mechanical properties of the superficial intertidal and seabed sediments within the proposed cable corridor. All sample volumes will be less than 1 m^3. The techniques to be used include: 1. Vibrocores - core samples of sediments down to 3-6 m depth, acquired to allow ground truthing of the geophysical interpretation. 2. Cone penetrometer tests - measure the resistance of sediments, allowing determination of the types of sediments present and their structure. 3. Boreholes - typically used at the chosen cable landfall if horizontal directional drilling (HDD) is being considered as a technique to enable the shore crossing. Boreholes acquire deep core samples of sediments (typically 20-30 m). Boreholes will be positioned within 1 km of the shore and spaced equidistant.

Survey Type	Methods	Description
		VCs and CPTs are typically acquired at the same sample station and will be positioned along the proposed centreline of the cable within the proposed cable corridor. The exact location, quantity and penetration depth of the geotechnical samples will be determined following interpretation of geophysical survey. However, it has been assumed that they will be spaced every 2 km and therefore shall comprise nominally of the following: ▪ 267 VCs (176 within English waters, 91 within Scottish waters) ▪ 267 CPTs (176 within English waters, 91 within Scottish waters) ▪ Option for up to 3 boreholes at selected landfalls If the seabed is found to be broadly similar then distance between sampling stations will increase, and conversely if the seabed is found to be more varied spacing will decrease.
Benthic Ecology	Subtidal benthic survey and Intertidal walkover survey	This survey is designed to identify the benthic communities and habitats present within the proposed cable corridor and at the selected landfalls. A Phase 1 habitat survey consisting of an intertidal walkover survey to include a biotope mapping exercise of the intertidal part of the proposed landfalls with identification of the existing habitats will be undertaken. The survey shall cover an area of -/+250 m to either side of the landfall site and route across the beach, and map the biotopes present between mean high water springs (MHWS) and mean low water springs (MLWS). Where sediments are present in the Application Area, additional Phase 2 core sampling will be undertaken. Subtidal sampling locations will be identified based on review of geophysical data. Locations may be subject to drop down video in advance of sampling and to ground truth the SSS interpretation. At each sample station 4 Grab samples will be undertaken to acquire samples for faunal analysis (3 samples) and one for physio-chemical testing. In the subtidal area, features of conservation importance such as reefs will be identified by means of visual inspection. All sample volumes will be less than 1m^3. Sampling will indicatively consist of the following using Van Veen, Day or box corer: ▪ 10 intertidal grab stations (4 samples at each) ▪ 7 nearshore grab stations (4 samples at each) ▪ 154 offshore grab stations (102 within English waters, 52 within Scottish waters - 4 samples at each)

The Application Area coordinates shown in Figure 1-1 are listed in Table 2-3.

Table 2-2 : EGL 3 Application Area Coordinates – Scotland

Coordinate Point	Latitude	Longitude	Location
1	56° 17.20681050' N	001° 02.95004964' W	Outside 12NM
2	56° 25.36719839' N	001° 09.96327032' W	Outside 12NM
3	56° 35.03339208' N	001° 27.93595255' W	Outside 12NM
4	57° 03.49148670' N	001° 42.24961190' W	On 12NM Boundary
5	57° 23.53333111' N	001° 52.55677266' W	Inside 12NM
6	57° 23.70170055' N	001° 52.57376376' W	Inside 12NM
7	57° 33.83239697' N	001° 49.97042061' W	Inside 12NM
8	57° 34.36140469' N	001° 49.70813198' W	Inside 12NM

Coordinate Point	Latitude	Longitude	Location
9	57° 34.36340560' N	001° 48.87240948' W	Inside 12NM
10	57° 34.15785681' N	001° 42.75911423' W	Inside 12NM
11	57° 33.28142844' N	001° 36.92564034' W	Inside 12NM
12	57° 31.19009659' N	001° 23.67131155' W	On 12NM Boundary
13	57° 30.43805541' N	001° 18.64714871' W	Outside 12NM
14	56° 37.28896918' N	000° 07.04052163' E	Outside 12NM
15	56° 33.38997012' N	000° 10.24964646' E	Outside 12NM

2.2. Acoustic Characteristics of Survey Activities

The specific equipment to be used during the proposed marine cable route surveys is currently unknown. Table 2-4 presents the characteristic acoustic parameters for a reasonable range of geophysical and geotechnical equipment that could potentially be used.

The Sound Pressure Level (SPL) characterises the amplitude of a sound. Sound Exposure Level (SEL) is a measure of energy that considers both received level and duration of exposure. In the table below, peak pressure is used indicated by dB peak and, in the case of underwater sound, the reference unit is taken as 1 µPa.

Table 2-3 : Typical acoustic parameters for a range of geophysical and geotechnical equipment

Equipment Type	Frequency (kHz)	Sound Pressure Level SPL (peak) in dB re 1 µPa	Sound Exposure Level **SEL (dB re1 µP a2s)**	Source
MBES	200 - 500	210 - 245	169.5	Danson (2005), Hopkins (2007), Lurton and DeRuiter (2011), BEIS (2020a)
SSS	300 - 900	200 - 240	163	BOEM (2019), BEIS (2020a), DAHG (2014)
SBP	Pinger: 2 - 12 Boomer: 0.5 - 5 Chirp: 2 - 40 Sparker: 1 - 2	178 - 225	174 - 241	Danson (2005), BEIS (2020a) BOEM (2016), BEIS (2020b)
Ultrashort baseline (USBL)	14-50	194 - 207	200	IOOA (2020)
Vibrocore	<1	Up to 180-190	N/A	BOEM (2019)
Cone Penetration Test	No sound emitted	No sound emitted	N/A	BOEM (2019)
Borehole	0.002 – 50	142-190	N/A	BEIS (2020a), DAHG (2014), Erbe and McPherson (2017)
Magnetometer	No sound emitted	No sound emitted	N/A	Magnetometers do not emit an acoustic signal.

2.3. Vessels

Two types of vessels will be deployed to undertake the surveys: an offshore vessel (>10-15 m water depth), and a nearshore vessel (10-15 m to MHWS). The offshore vessel will have dynamic positioning 2 (DP2) capabilities and will perform 24-hour operations.

The nearshore vessel is not required to have dynamic positioning capabilities and may work 12- or 24-hours operations. The nearshore vessel will also have the option for Autonomous Underwater Vehicle (AUV) or Autonomous Surface Vehicle (ASV) in shallow areas. To drill the optional landfall boreholes, either a jack-up barge, multi-cat or anchored barge will be required. If there is an intertidal area with suitable access, then a cable-percussive mobile drilling rig with mud mats to stabilise the drilling rig may be used.

2.4. Programme

The survey has a proposed start date of 01 July 2023.

Table 2-5 below shows the offshore scope is estimated to take a minimum of 41 days in Scottish waters and 80 days in English waters (excluding weather downtime and port calls).

Table 2-4 : EGL 3 estimated survey duration by type and jurisdiction.

Survey Type	km	No. of Survey Days	Inc. weather + port calls
Scotland			
Geophysical	170	23	29
Geotechnical	170	14	16
Benthic	170	4	5
England			
Geophysical	330	44	57
Geotechnical	330	28	32
Benthic	330	8	10

3. Identification of the protected species that may be found in or near the Application Area

This section identifies the EPS and nationally protected species likely to be present in the Application Area. Density estimates and the seasonality of species presence have been provided.

3.1. Application Area and Key Data Sources

The Application Area for the baseline encompasses the Greater North Sea Ecoregion (North Sea, English Channel, Skagerrak and Kattegat) (ICES, 2016), with a focus on the western North Sea along the east coast of Scotland. The baseline takes into consideration where available, species-specific data based on Management Units (MU) published by the Inter-Agency Marine Mammal Working Group (IAMMWG). Abundance estimates for MUs were first produced in 2015 (IAMMWG, 2015) and updated in 2022 (IAMMWG, 2022).

Delineation of MUs for cetaceans are aligned as far as practically possible with Assessment Units (AU) as defined by OSPAR for reporting under the Marine Strategy Framework Directive (ICES, 2014). The Application Area falls within the North Sea AU for harbour porpoise and the east coast of Scotland AU for common bottlenose dolphin. The Application Area also falls within the single assessment units for common minke whale, white-beaked dolphin and common dolphin (ICES, 2014).

The key data source for abundance and density estimates for this baseline is the Small Cetaceans in European Atlantic waters and the North Sea (SCANS) Project surveys that have been undertaken to estimate the abundance of small cetaceans within the region. The first survey was undertaken in 1994, with repeats in 2005 (SCANS II) and 2016 (SCANS III), with the most up to date estimates revised in 2021 (Hammond *et al*., 2021).

SCANS surveys were only conducted in summer and are therefore representative of summer distributions only. However, it is likely that cetacean densities around the UK are highest during the summer season (Waggitt *et al*., 2019). Therefore, the abundances presented are considered to represent the highest likely abundances to be encountered within the Application Area.

The Application Area passes through survey Blocks R (including Scottish and English waters) and O (English waters) (Figure 3-1). This baseline is focused on the species present and their abundance in the Scottish inshore (<12 NM) and offshore (>12 NM) of the UK EGL 3 survey area i.e., within the Application Area.
Other key data sources for cetaceans include.

- Waggitt *et al.* (2020) which collated data across the northeast Atlantic from 1980 and 2018 and provided distribution models for 12 species of cetacean.
- Hague *et al*. (2020) provides a review of abundance estimates and distribution of marine mammals across the North Sea and Atlantic areas of Scottish waters.
- Heinänen & Skov (2015) developed distribution models for harbour porpoise within the UK Exclusive Economic Zone.

For pinnipeds, Seal Management Units (SMUs) are provided by the Special Committee on Seals (SCOS) with abundance estimates provided for each based on haul-out and pup counts (SCOS, 2021). At-sea distribution is derived from multiple telemetry data sets used to build regional habitat preference models. These models are combined with spatially resolved abundance data (haul-out counts) to predict at-sea distribution (Carter *et al.,* 2020; Carter *et al*., 2022).

For turtles, Reeds (2004) provides a summary of distribution data supplied by the Ocean Biodiversity Information Systems (OBIS), while sightings around the UK for basking shark are summarised by Witt *et al*. (2012) with habitat suitability modelling and associated maps produced by Austin *et al*. (2019).

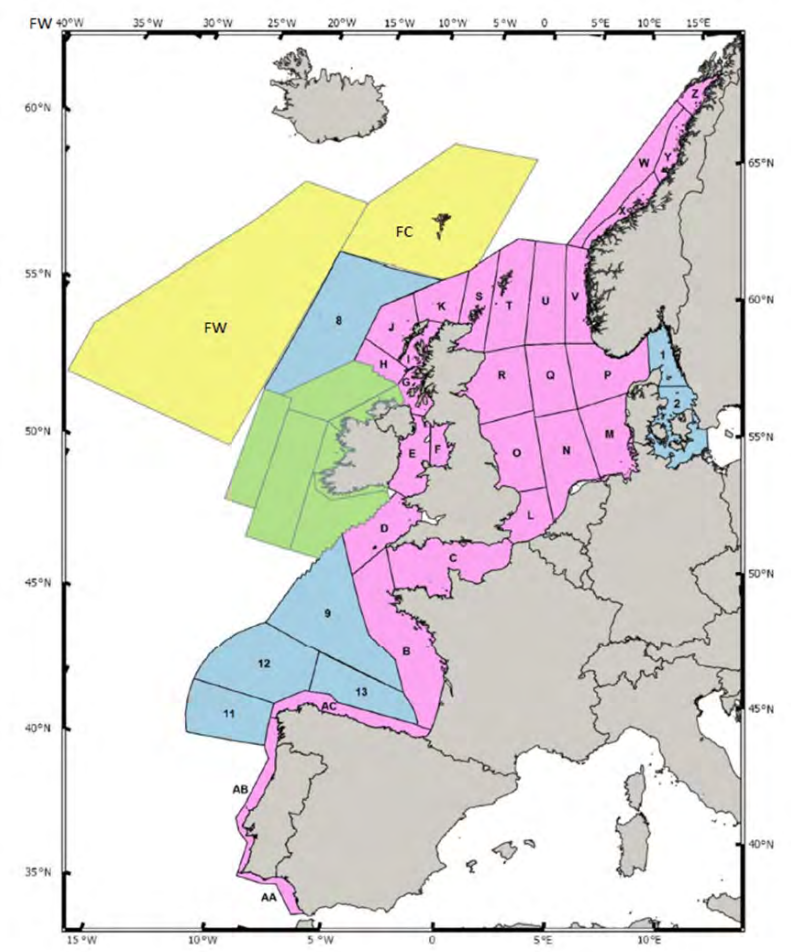


Figure 3-1 : SCANS III survey blocks – blue areas surveyed by vessel and pink areas surveyed by air (from Hammond et al., 2021).

3.2. Cetaceans

All cetaceans (whales, dolphins and porpoises) are listed as EPS. There are four species of cetacean known to regularly occur over wide areas of the North Sea off Northeast Scotland, with a further five species considered regular but less common (ICES, 2016; Hammond *et al.*, 2004; Reid *et al.*, 2003). Table 3-1 summarises these species and includes their status on the IUCN Red List (IUCN, 2023).

Table 3-1 : Cetaceans recorded in the northern North Sea

Common Name	Scientific Name	Occurrence	IUCN Status
Fin whale	*Balaenoptera physalus*	Rare	Vulnerable
Humpback whale	*Megaptera novaeangliae*	Occasional	Least Concern
Common minke whale	*Balaenoptera acutorostrata*	Regular	Least Concern
Sperm whale	*Physeter macrocephalus*	Rare	Vulnerable
Northern bottlenose whale	*Hyperoodon ampullatus*	Rare	Near Threatened
Orca (killer whale)	*Orcinus orca*	Regular, less common	Data Deficient
Long-finned pilot whale	*Globicephala melas*	Regular, less common	Least Concern
Risso's dolphin	*Grampus griseus*	Regular, less common	Least Concern

Common Name	Scientific Name	Occurrence	IUCN Status
Common bottlenose dolphin	*Tursiops truncatus*	Regular	Least Concern
White-beaked dolphin	*Lagenorhynchus albirostris*	Regular	Least Concern
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Regular, less common	Least Concern
Common dolphin	*Delphinus delphis*	Regular, less common	Least Concern
Harbour porpoise	*Phocoena phocoena*	Regular	Least Concern

Within Scottish inshore waters of the Application Area (<12 NM) four species are regularly recorded, the harbour porpoise (*Phocoena phocoena*), white-beaked dolphin (*Lagenorhynchus albirostris*), common bottlenose dolphin (*Tursiops truncatus*) and common minke whale (*Balaenoptera acutorostrata*) (Hammond *et al*., 2004; Reid *et al*., 2003; Hague *et al*., 2020).

Within offshore (> 12 NM) waters of the Application Area, three species are regularly recorded, the harbour porpoise, white-beaked dolphin and common minke whale (Hammond *et al*., 2004; Reid *et al*., 2003; Hague *et al*., 2020). In addition, there are occasional records of a further 10 species. Most of these occasional species are recorded further north of the Application Area, although there are records of offshore common bottlenose dolphins and orca, within the Application Area (Hague *et al*., 2020).

3.2.1. Harbour Porpoise (*Phocoena phocoena*)

The harbour porpoise is considered Least Concern globally on the IUCN Red List, although the current population trend is unknown globally (Braulik *et al*., 2020). In Europe, the North Atlantic population is considered Least Concern with no evidence of any significant declines (IUCN SSC Cetacean Specialist Group, 2007a). In UK waters the overall trend in Conservation Status is unknown with insufficient data to establish a trend for the population size or future prospects for the UK population (JNCC, 2019a).

The harbour porpoise within the eastern North Atlantic is generally considered to behave as one continuous population, although there is some evidence of genetic variation (Tolley & Rosel, 2006; Anderson *et al*., 2001). For conservation and management purposes the population is divided into smaller units termed MUs that reflect spatial differences in human activities and their management. Harbour porpoise within the Application Area, are considered part of the North Sea MU. The current estimate of abundance for the North Sea MU is 346,601 (Coefficient of Variation (CV) 0.09; 95% Confidence Interval (CI) 289,498 – 419,967), of which 159,632 are considered as the UK portion (IAMMWG, 2022).

Abundance estimates for survey block R, from SCANS III survey was 38,646 (CV 0.287, CI 20,584 – 66,524) with density estimated at 0.599 animals per km^2 (Hammond *et al*., 2021).

Harbour porpoises are frequently encountered in shallower shelf waters (Hammond *et al*., 2013) with preference for waters between 50 m and 150 m deep (Isojunno *et al*., 2012; Booth *et al*., 2013). Within the North Sea, water depth, hydrodynamic variables, and coarseness of surface sediments, are the most important factors affecting presence and density of harbour porpoise (Heinänen & Skov, 2015). Studies indicate that the relationship between particular hydrodynamic variables and porpoise distribution are often inconsistent between sites and that associations and interactions may vary between regions and between individuals (De Boer *et al*., 2014; Johnston *et al*., 2005).

Such static (e.g., depth and slope) and dynamic (e.g., tidal flow, mixing) habitat features are associated with increased productivity and prey aggregations. Harbour porpoise diet consists of a wide variety of fish and cephalopod species and varies regionally with only a few prey types dominating in one area (Santos & Pierce, 2003; Santos *et al*., 2004). In Scottish waters whiting (*Merlangius merlangus*) and sandeel (Ammodytidae) dominate porpoise diet, with these species preferring fine and coarse sands and sandy sediments (Holland *et al*., 2005; Atkinson *et al*., 2004). Due to its small size and high metabolism harbour porpoise need a constant supply of high energy prey to meet its energy requirements, and are considered to feed at high rates, consuming up to 10% of their body weight per day (Kastelein *et al*., 1997; Lockyer *et al*., 2003; Wisniewska *et al*., 2016). This may mean that porpoise distribution is more closely linked to higher prey abundance or prey quality compared to other marine mammals (Santos & Pierce, 2003).

3.2.1.1. Inshore (<12 NM) Area

In coastal areas, harbour porpoise tend to prefer areas with a high degree of water mixing such as headlands, bays and estuaries (Booth et al., 2013; Benjamins et al., 2016; Baxter et al., 2011). On the west coast of Scotland, depth, seabed slope and tidal features were determined to influence porpoise distribution (Booth et al., 2013; Embling et al., 2010). Modelling of harbour porpoise distribution in the Moray Firth revealed depth and availability of sand and gravelly sand as key variables predicting spatial variation in relative abundance (Brookes et al., 2013; Clark et al., 2006). Off the northeast coast of Scotland harbour porpoise tend to prefer relatively deeper areas, of 20 m, adjacent to the coast (Weir et al., 2007).

While harbour porpoise are present year round, movements and seasonal changes in distribution and abundance have been recorded. In the inshore waters of northeast Scotland sightings show a seasonal increase between July and October, with a peak occurrence in August and September (Weir et al., 2007). Distribution maps produced by Waggitt et al. (2020) show densities of harbour porpoise are greater in summer months, July to September, within inshore waters.

Seasonal shifts in harbour porpoise distribution have been recorded in inshore Scottish waters in relation to changes in prey availability, including in the Moray Firth (Williamson *et al.*, 2022; Robinson *et al*., 2007) and The Minch (Dolman *et al*., 2013), as well as in other inshore areas of the North Sea (Gilles *et al.,* 2009; Sveegaard *et al*., 2012; Bouveroux *et al*., 2020). Off the northeast coast of Scotland, Weir *et al*. (2007) suggested an inshore movement of mackerel (*Scomber scombrus*) during summer, particularly July, may be an important factor in the increase in porpoise sightings at that time of year.

Inshore movements of females and calves has also been recorded in Scottish waters (Robinson *et al*., 2007). In Scottish waters mating and calving occurs between May and July (Learmonth *et al*., 2014). Harbour porpoise calves were only recorded in inshore waters off the northeast of Scotland by Weir *et al.* (2007) between June and August, and they suggest porpoises increase in porpoises during summer months may be the result of a combination of factors including the distribution of prey, utilisation of sheltered waters during the calving season and a seasonal increase in energetic demands associated with calving and lactation.

Fine scale distribution of harbour porpoise is likely to be linked to environmental variables (van Beest *et al*., 2018; Benjamins *et al*., 2017), but also the presence of aggressors such as bottlenose dolphins in coastal areas (Williamson *et al*., 2022).

Collation of survey data from the offshore wind farm sites on the east coast of Scotland confirms the presence of harbour porpoise throughout inshore waters (Hague *et al.,* 2020) (Sparling, 2012; Grellier & Lacey, 2012; Mackenzie *et al*., 2012). Surveys indicate that while harbour porpoise are present throughout the area, sightings tend to concentrate around shallow sandy banks (Sparling, 2012).

3.2.1.2. Offshore (>12 NM) Area

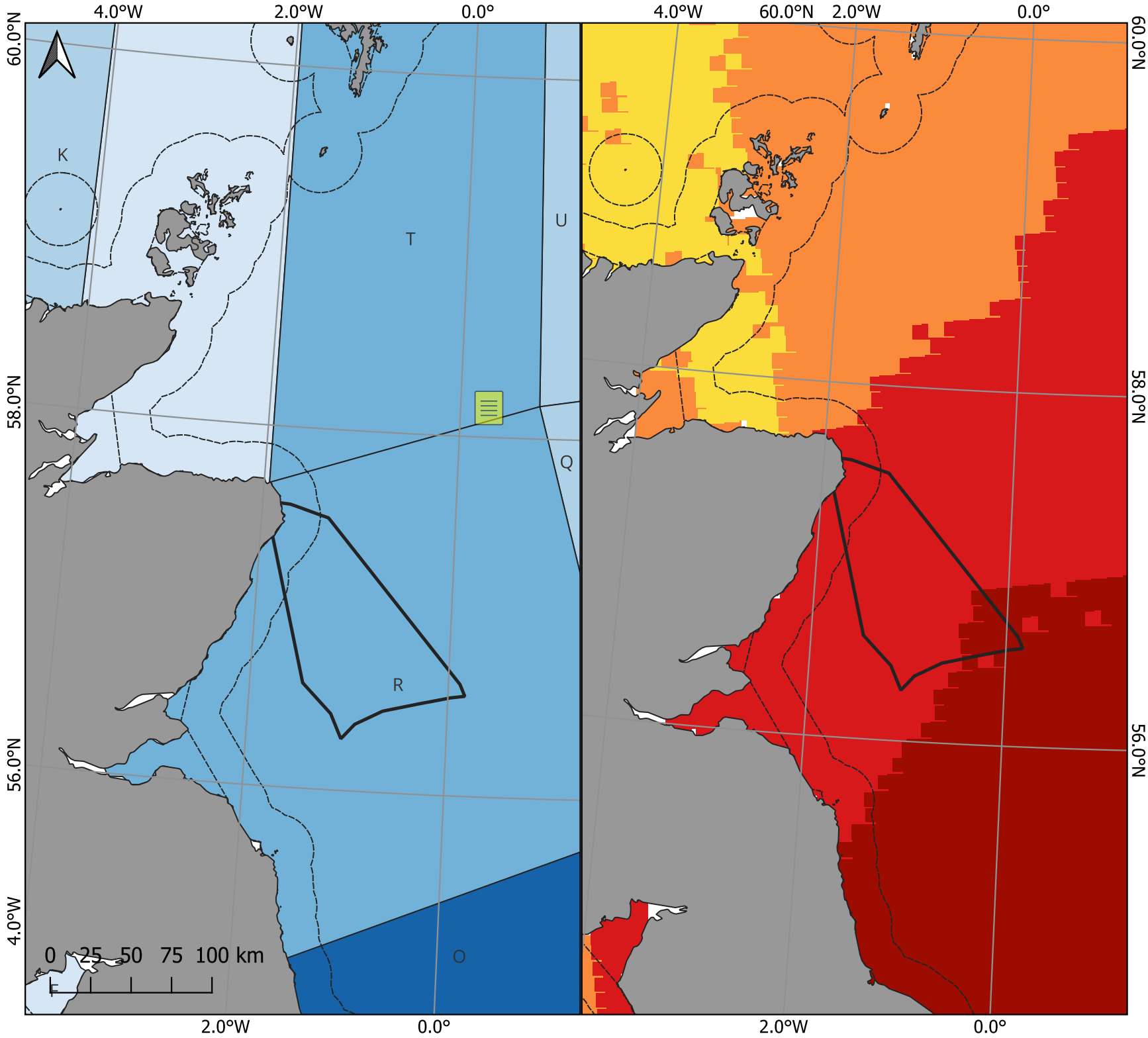
Surveys conducted off the east coast of Scotland highlight the presence of harbour porpoise in offshore waters particularly during summer months (Hague *et al*., 2020; Baxter *et al*., 2011; Waggitt *et al*., 2020). In offshore waters of the North Sea, Heinänen & Skov (2015) indicate depth and hydrodynamic variables such as surface salinity, eddy potential and vertical temperature gradient influence presence and density of harbour porpoise. Coarseness of sediments, current speed and slope of the seafloor also influence density in summer. During summer, harbour porpoise appear to avoid well mixed areas, preferring more stable areas and avoiding high current speeds. Peaks in occurrence occur in summer over water depths of 30 m to 50 m and in areas approximately 200 m deep, while in winter a peak at water depths between 30 m and 40 m is seen. Analysis also indicates that muddy areas and hard bottoms are avoided. Nielsen *et al*. (2021) also showed preferences for stratified waters in the North Sea in contrast to coastal areas which may suggest distinct foraging behaviours.

Seasonal movements of harbour porpoise are also recorded in offshore areas. Distribution maps produced by Waggitt *et al*. (2020) show densities of harbour porpoise in Scottish waters are greater in summer months. Predictive modelling also indicates a summer shift from spring hotspots in the southern and southeastern North Sea towards offshore and western areas in summer (Gilles *et al*., 2016). Gilles *et al*. (2016) also predicted density in autumn was lower, although the distribution was spatially heterogenous with areas of relatively higher densities predicted in the northwest. Heinänen & Skov (2015) indicates a southerly shift in porpoise distribution during winter months.

Such seasonal movements are likely to be in relation to variation in the distribution of prey (Gilles *et al*., 2016; Gilles *et al*., 2009).

Figure 3-2 shows Harbour Porpoise, Phocoena phocoena, estimated densities (Scans-lll, Hammond et al, 2021) and modelled densities (Scans-lll, Lacey et al, 2022) within the EGL 3 Application Area.

Figure 3-3 shows Harbour Porpoise, Phocoena phocoena, seasonal distribution (Waggit, 2019) within the EGL 3 Application Area.



EGL3 Protected Species Baseline Harbour Porpoise Densities

Seiche Reference: P1779
Scale: 1:3,021,573
Reference System: WGS84 UTM 31N
Initials: RB
Date: 20/04/2023

12 nm Limit

EGL3 Application Area

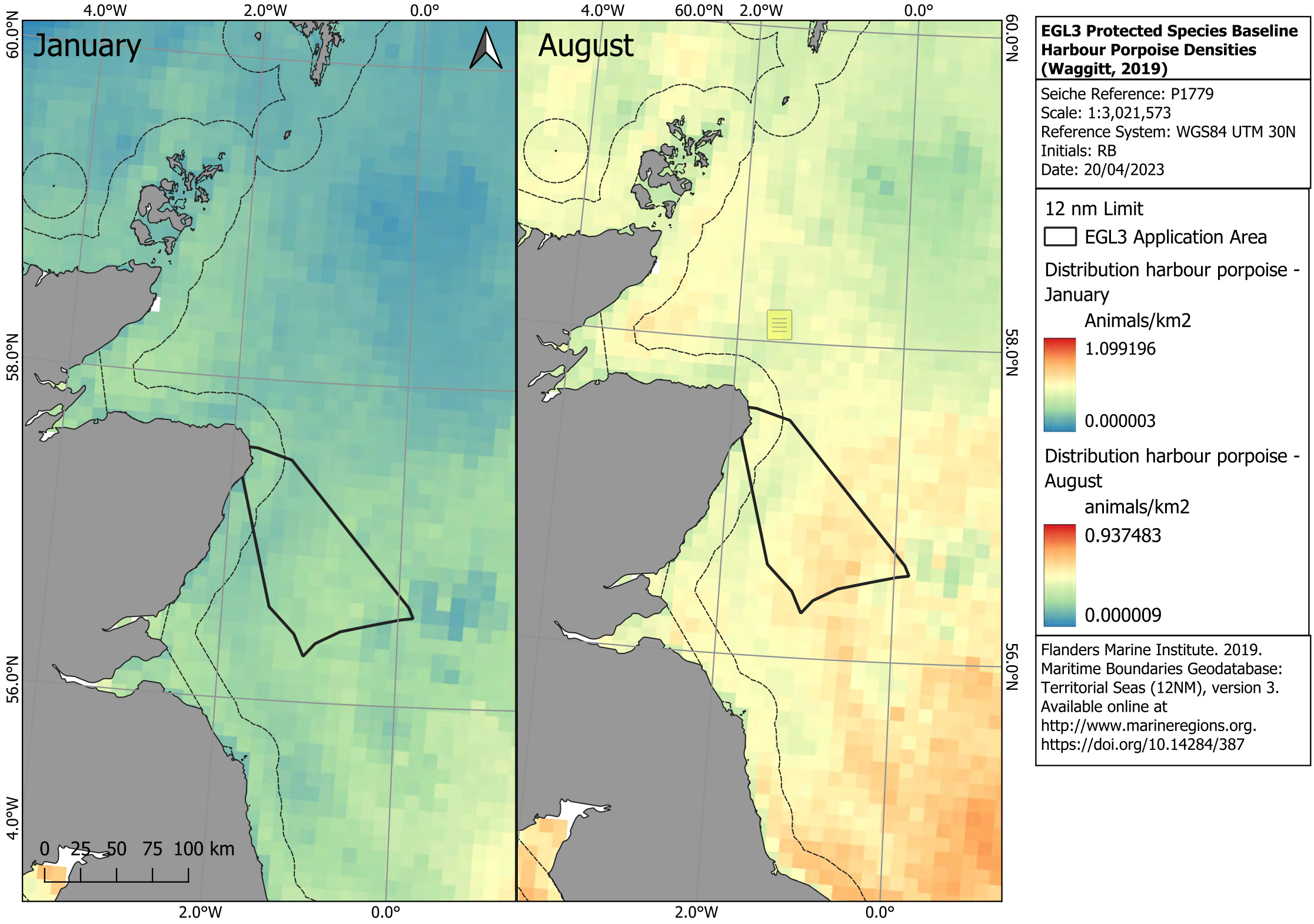
SCANS-III Estimated Density - animals/km2
(Hammond et al. 2021)

- 0 - 0.025
- 0.025 - 0.05
- 0.05 - 0.075
- 0.075 - 0.1
- 0.1 - 0.125

SCANS-III Modelled Density - animals/km2
(Lacey et al. 2022)

- 0 - 0.107
- 0.107 - 0.215
- 0.215 - 0.303
- 0.303 - 0.459
- 0.459 - 0.787
- 0.787 - 5.818

Flanders Marine Institute. 2019. Maritime Boundaries Geodatabase: Territorial Seas (12NM), version 3. Available online at http://www.marineregions.org. https://doi.org/10.14284/387



EGL3 Protected Species Baseline Harbour Porpoise Densities (Waggitt, 2019)

Seiche Reference: P1779
Scale: 1:3,021,573
Reference System: WGS84 UTM 30N
Initials: RB
Date: 20/04/2023

12 nm Limit

EGL3 Application Area

Distribution harbour porpoise - January

Animals/km2

1.099196

0.000003

Distribution harbour porpoise - August

animals/km2

0.937483

0.000009

Flanders Marine Institute. 2019. Maritime Boundaries Geodatabase: Territorial Seas (12NM), version 3. Available online at http://www.marineregions.org. https://doi.org/10.14284/387

3.2.2. Common bottlenose dolphin (*Tursiops truncatus*)

The common bottlenose dolphin is listed as Least Concern globally on the IUCN Red List, although the current population trend is unknown (Wells *et al*., 2019). In Europe the species has been assessed as Data Deficient, with the current population trend decreasing (IUCN SSC Cetacean Specialist Group, 2007b). In the UK the overall trend in Conservation Status is Unknown, and although the population appears stable there are too few data points to confidently conclude the current and future population trends (JNCC, 2019b).

Two distinct ecotypes of common bottlenose dolphin are recognised in UK waters, a wide-ranging offshore type and a more philopatric inshore type (Louis *et al*., 2014). A number of coastal groups are recognised with limited interchange between (Cheney *et al*., 2013; IAMMWG, 2015). On the east coast of Scotland two MUs have been identified, the Coastal East Scotland (CES) (to 12 NM) and the Greater North Sea (GNS).

3.2.2.1. Inshore (<12 NM) Area

Since the mid-1990s the resident population of common bottlenose dolphin in the Moray Firth has expanded its range south to the waters off Aberdeen, St Andrews Bay and the Firth of Forth where they are encountered year-round (Wilson *et al*., 2004; Arso Civil *et al*., 2019). Abundance estimates of bottlenose dolphins within the CES is 224 (CV 0.02; CI 214-234) (IAMMWG, 2022).

Bottlenose dolphins are known to regularly inhabit the waters off the Aberdeenshire coast, with over half of the known population of dolphins utilising this region (Weir *et al*., 2008). Here, occurrence peaks between April and June (Weir *et al*., 2008).

Increasing abundance of dolphins is also seen in the Tay estuary and adjacent areas, with numbers increasing from 91 (95% CI 78 - 106) in 2009 to 114 (95% CI 88 - 149) in 2019, with this area used by more than half the estimated population during summer (Arso Civil *et al*., 2021).

Results presented by Arso Civil *et al.* (2021) suggest movement between the sites is infrequent but that there is a consistent, seasonal and directional movement pattern. This is characterised by higher intensity of movement from the Tay estuary and adjacent waters to the Moray Firth in early summer, and from the Moray Firth to the Tay estuary in late summer. However, this pattern is not followed consistently every year by all individuals. Differences in individual ranging behaviour is well-known for this species (Wilson *et al*., 2004; Arso Civil *et al*., 2019) but it is not clear what is driving individual movements. The seasonal pattern of movement observed overall is suggested to be driven by seasonal changes in prey, but also that social connections may influence how animals move between locations (Arso Civil *et al*., 2021).

Most encounters with bottlenose dolphin along the east coast are within a water depth of less than 30 m and within 2 km of the coastline except in St Andrews Bay and the entrance to the Tay Estuary. Most encounters in the Tay Estuary are of dolphins following the sand bar exposed at low tide (Quick *et al*., 2014). This is in contrast to the Inner Moray Firth where highest abundance of dolphins is found in depths of more than 50 m, with steep gradients where strong currents and tidal fronts occur within deep constricted channels which concentrates prey species (Hastie *et al*., 2003; Hastie *et al.,* 2004; Wilson *et al*., 1997). However, Culloch & Robinson (2008) showed bottlenose dolphins utilising the southern outer Moray Firth preferred shallower, coastal water depths of less than 25 m also, suggesting that where such deep water areas are not as prominent, dolphins may use the coastline to aid foraging. In river mouths and estuaries tidal dynamics are likely to have an influence on dolphin occurrence and distribution (Arso Civil *et al*., 2019; Sini *et al*., 2005)

An east coast wide acoustic survey of bottlenose dolphin revealed dolphins were more likely to be observed within 5 km of the shore, with waters between Stonehaven and Aberdeen a potential area of high occupancy. Models also predicted dolphins were more likely to be detected in deeper waters (Palmer *et al*., 2019)

Scottish bottlenose dolphin are known to prey mainly on cod (*Gadhus morhua*), saithe (*Pollachius virens*) and whiting, with other species including salmon (*Salmo salar*) and haddock (*Melanogrammus aeglefinus*) and cephalopods also taken (Santos *et al*., 2001). The rivers Tay, North Esk and South Esk are known to be important for migrating salmon and sea trout (*Salmo trutta*), with these species likely to be important prey species for bottlenose dolphin in the area particularly during summer (Arso Civil *et al*., 2019; Palmer *et al*., 2019).

Aberdeen harbour has also been shown to be an important foraging area for dolphins off the east coast, where they have been recorded throwing large fish in the air. It is suggested that the occurrence and abundance of dolphins utilising the harbour is related to the up-estuary movement of salmon prior to river entry during the summer months (Sini *et al*., 2005). A wide variety of feeding techniques were recorded by Sini *et al.* (2005) indicating the dolphins may be taking a diverse variety of prey (Sini *et al*., 2005).

Female bottlenose dolphins are known to calve off the east coast throughout May to October with a peak in summer months between July and September associated with an annual peak in regional sea temperature (Robinson *et al*., 2017). Analysis of bottlenose dolphin movements suggests females are more site faithful to the Moray Firth SAC compared with males, with males exhibiting wider movements and moving more frequently to sites on the east coast (Quick *et al*., 2014; Arso Civil *et al*., 2021). However, the movement patterns of these individuals are not fully understood, especially during winter months, and mother calf pairs are known to regularly use east coast waters (Stockin *et al*., 2006; Quick *et al*., 2014; Arso Civil *et al*., 2021).

3.2.2.2. Offshore (>12 NM) Area

A review of recent strandings and sightings indicate bottlenose dolphins are present in both offshore waters as well as throughout most inshore Scottish waters (Cheney *et al*., 2013). Abundance estimates of common bottlenose dolphins within the GNS MU are 2,022 (CV 0.75; CI 548 – 7,453) of these an estimated 1,885 (CV 0.88; CI 476 - 7,461) occur in the UK portion of the MU (IAMMWG, 2022).

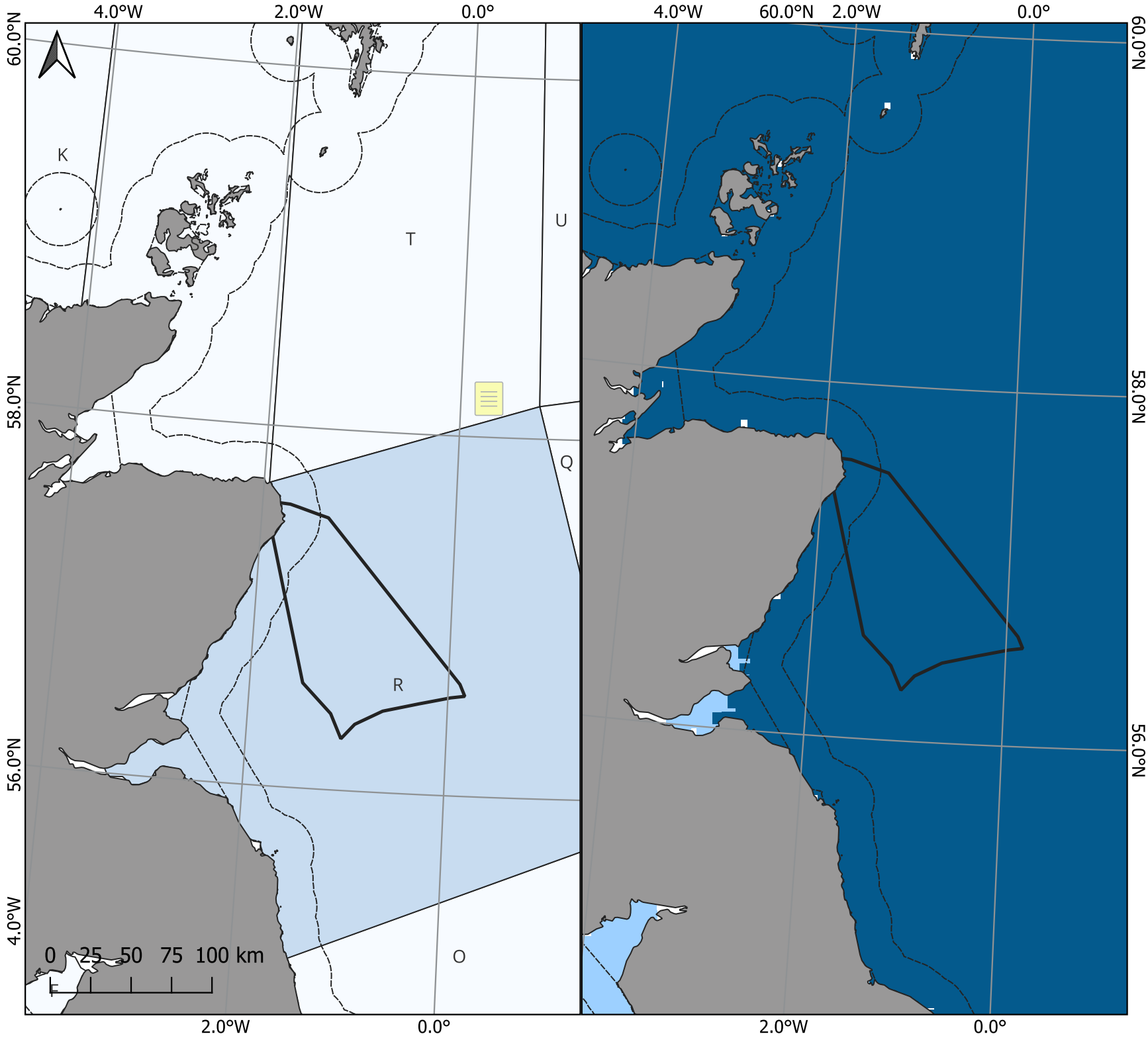
Comparatively little is known about offshore common bottlenose dolphins in the GNS. Offshore bottlenose dolphins tend to occur in larger groups, with low site-fidelity and extensive movement patterns (Silva *et al*., 2008; Oudejans *et al*., 2015; Oviedo Correa *et al*., 2019).

As with inshore bottlenose dolphins, distribution of offshore bottlenose dolphins is likely linked to distribution of prey species (Hastie *et al*., 2004). While inshore and coastal bottlenose dolphins feed mainly on benthic and demersal fish species, offshore bottlenose dolphins have been recorded foraging on a wide variety of prey relying on epipelagic and mesopelagic schooling fish and cephalopods (Pate & McFee, 2012; Spitz *et al*., 2006; Barros & Odell, 1990; Barros *et al*., 2000). Analysis of bottlenose dolphin stomach contents reveal preference for demersal species such as cod and saithe, but also pelagic species such as salmon and cephalopods (Santos *et al*., 2001).

Offshore bottlenose dolphins are known to associate with features associated with increased primary production and prey aggregation such as areas with steeply sloping topography such as shelf breaks and seamounts (Dinis *et al*., 2016; Oudejans *et al*., 2015; Waggit *et al*., 2020). Distribution maps produced by Waggitt *et al*. (2020) did not include sightings of bottlenose dolphins within 30 km of the coastline, with the assumption that these are the offshore ecotype. The models predict a year-round but low abundance to the north-west of Scotland.

Figure 3-4 shows Bottlenose Dolphin, Tursiops truncates, estimated densities (Scans-lll, Hammond et al, 2021) and modelled densities (Scans-lll, Lacey et al, 2022) within the EGL 3 Application Area.

Figure 3-5 shows Bottlenose Dolphin, Tursiops truncates, seasonal distribution (Waggit, 2019) within the EGL 3 Application Area.



EGL3 Protected Species Baseline Bottlenose Dolphin Densities

Seiche Reference: P1779
Scale: 1:3,021,573
Reference System: WGS84 UTM 31N
Initials: RB
Date: 20/04/2023

12 nm Limit

EGL3 Application Area

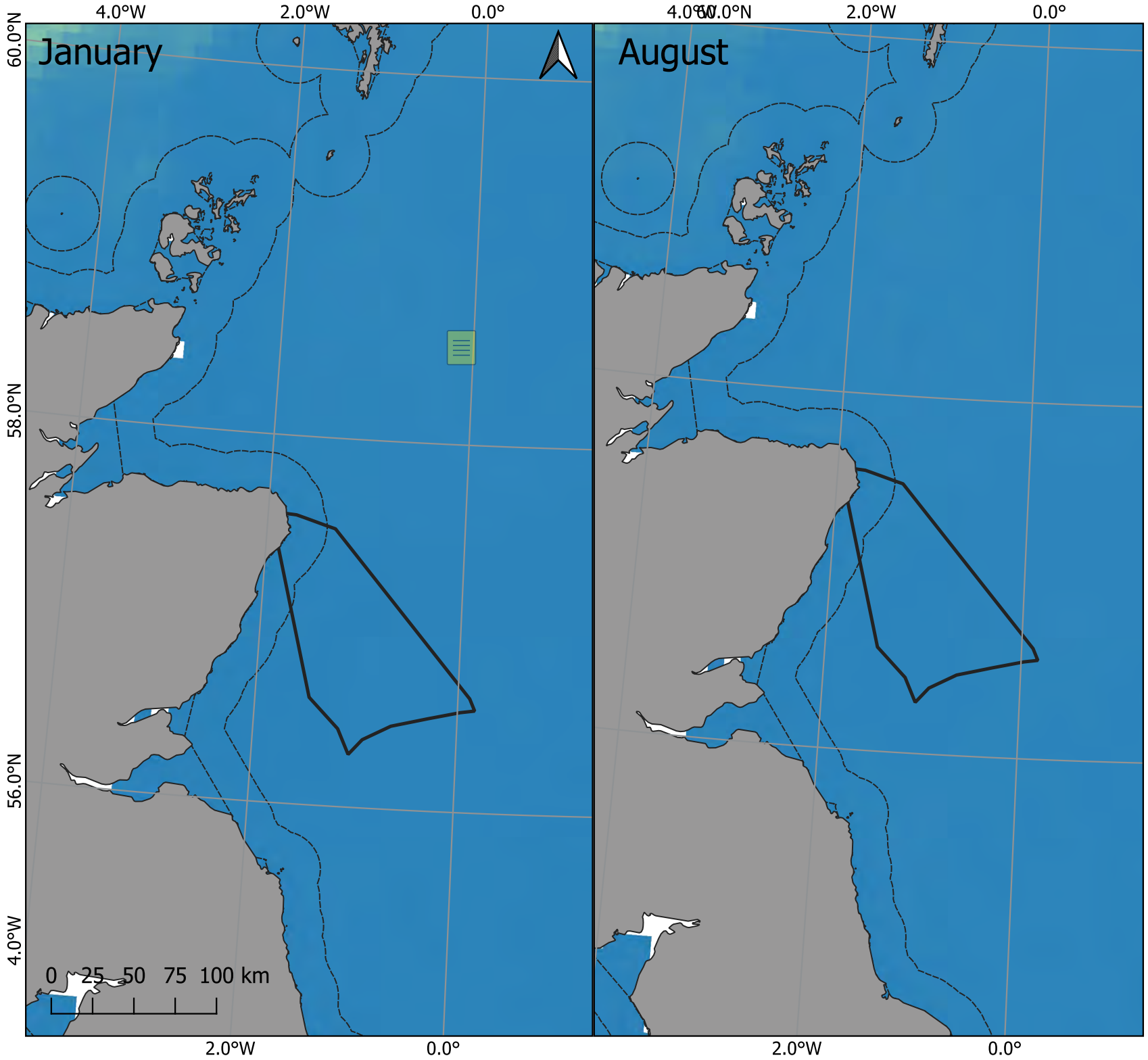
SCANS-III Estimated Density-animals/km2
(Hammond et al. 2021)

- 0 - 0.025
- 0.025 - 0.05
- 0.05 - 0.075
- 0.075 - 0.1
- 0.1 - 0.125

SCANS-III Modelled Density - animals/km2
(Lacey et al. 2022)

- 0 - 0.012
- 0.012 - 0.032
- 0.032 - 0.052
- 0.052 - 0.077
- 0.077 - 0.127
- 0.127 - 0.424

Flanders Marine Institute. 2019. Maritime Boundaries Geodatabase: Territorial Seas (12NM), version 3. Available online at http://www.marineregions.org. https://doi.org/10.14284/387



EGL3 Protected Species Baseline Bottlenose Dolphin Densities (Waggitt, 2019)

Seiche Reference: P1779
Scale: 1:3,021,573
Reference System: WGS84 UTM 30N
Initials: RB
Date: 20/04/2023

12 nm Limit

EGL3 Application Area

Distribution bottlenose dolphin - January

animals/km2

0.494948

0.000015

Distribution bottlenose dolphin - August

animals/km2

0.370727

0.00005

Flanders Marine Institute. 2019. Maritime Boundaries Geodatabase: Territorial Seas (12NM), version 3. Available online at http://www.marineregions.org. https://doi.org/10.14284/387

3.2.3. Common minke whale (*Balaenoptera acutorostrata*)

The common minke whale is listed as Least Concern globally on the IUCN Red List, although the current population trend is unknown (Cooke, 2018a). The species is also listed as Least Concern in European waters, but again the population trend is unknown (IUCN SSC Cetacean Specialist Group, 2007c). In the UK the overall trend in Conservation Status is Unknown, with insufficient data to establish trends for population size or potential future prospects for the population (JNCC, 2019c).

Common minke whales off the east coast of Scotland are considered part of the Celtic and Greater North Sea (CGNS) MU. The current estimate of abundance is 20,118 (CV 0.18; CI 14,061 - 28,786), of which 10,288 (CV 0.26, CI 6,210 - 17,042) are considered as the UK portion (IAMMWG, 2022).

Abundance estimates for survey block R from the SCANS III survey is 2,498 (CL 604 - 6,791) with a density of 0.0387 animals per km^2 (Hammond *et al*., 2021).

Common minke whales are regularly recorded throughout coastal areas as well as further offshore, where they are typically recorded in water depths of less than 200 m (Hammond *et al*., 2021; Weir *et al*., 2001; Macleod *et al*., 2004). Common minke whales are present year-round in Scottish waters, with a peak in occurrence between April and October (MacLeod *et al*., 2007a; Evans *et al*., 2011; Weir *et al*., 2007). Density estimates produced by Waggitt *et al.* (2020) show a seasonal peak during summer months. Evidence from the wider Atlantic indicates common minke whales perform seasonal migrations between high latitude summer feeding grounds and low latitude winter breeding grounds (Risch *et al*., 2014). From monitoring stations along the east coast of Scotland minke whales have been detected acoustically between May and November, with a main peak in June and July and a second peak in October (Risch *et al*., 2019).

In summer feeding areas common minke whale distribution is related to prey distribution (Macleod *et al*., 2004; Robinson *et al*., 2009). Minke whales in Scottish waters predominantly prey on sandeels and clupeids (herring *Clupea harengus* and sprat *Sprattus sprattus*) (Pierce *et al*., 2004).

While there is evidence minke whales migrate to breeding grounds in lower latitudes in winter months (Risch *et al*., 2014), individuals have been recorded remaining in higher latitude areas during winter and have been recorded year-round off the Scottish coast (Evans *et al*., 2011). There are also reports of unweaned calves in spring and winter in offshore waters around Britain and Ireland indicating offshore movements and potentially calving and weaning in more northerly latitudes (Kavanagh *et al.,* 2018).

3.2.3.1. Inshore (<12 NM) Area

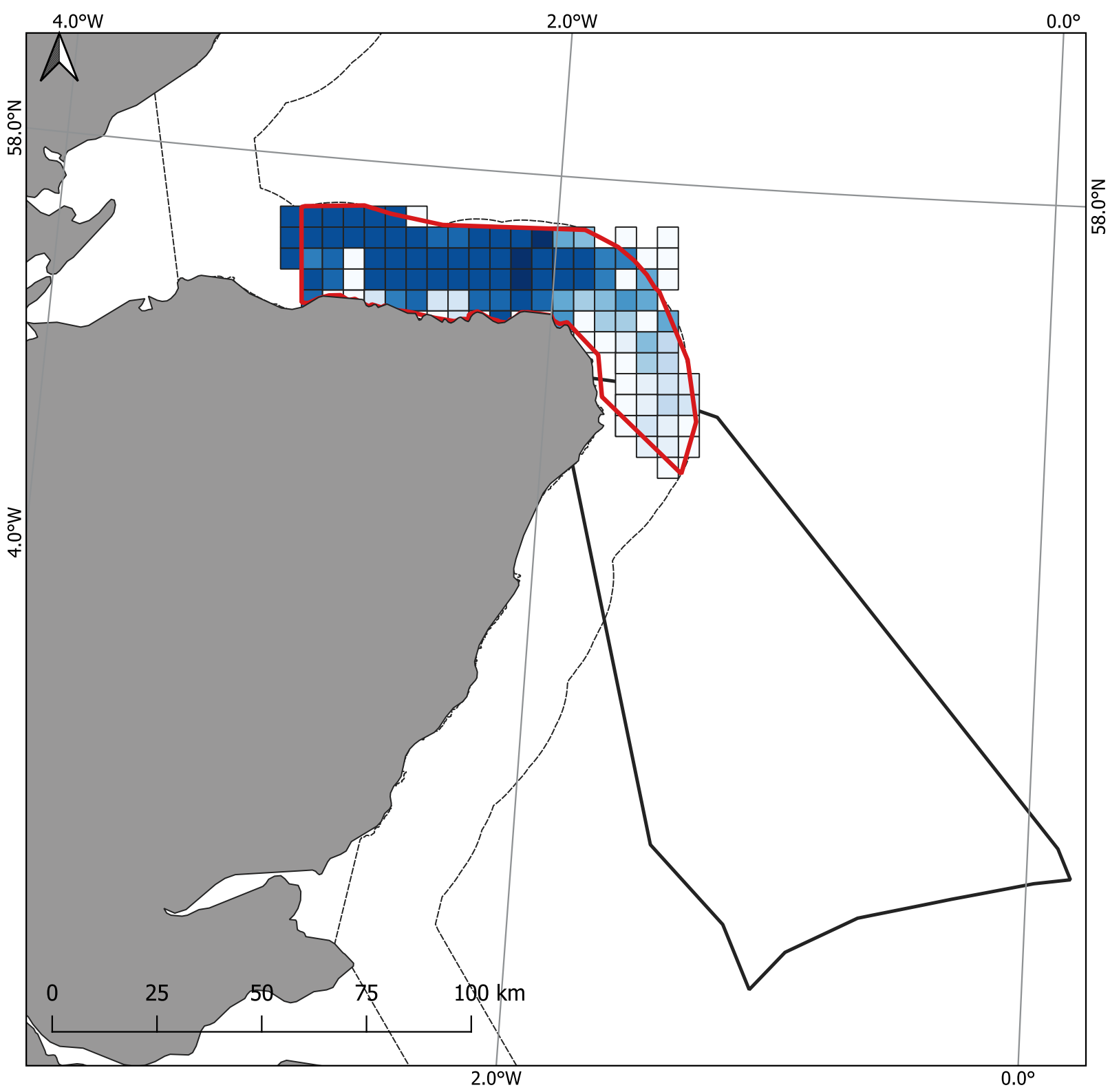
Common minke whale distribution in inshore, coastal areas, during summer is predominantly driven by the distribution of prey. On the west coast of Scotland, the distribution of minke whales changes during the season in response to shift in prey preference. In spring sediment type is the most significant predictor of minke whale presence with most sightings over mixtures of gravel/sand seabed, corresponding with sandeel habitat (Macleod *et al*., 2004; Anderwald *et al*., 2012). Through summer distribution changes to predicted pre-spawning herring habitat, corresponding to deeper waters with high topographic relief (Macleod *et al*., 2004). Alternatively, minke whales in autumn may be targeting aggregations of sprat (Anderwald *et al*., 2012; Anderwald *et al*., 2011). At a fine-scale Anderwald *et al*. (2012) indicate foraging behaviour is influenced by tidal currents.

On the east coast of Scotland, Robinson *et al*. (2009) indicated minke whales show a strong preference for water depths between 20 m and 50 m, with steep slopes and sandy gravelly sediment, which are all important for distribution and aggregation of prey species. In addition, mesoscale oceanographic features, which have an influence on levels of phytoplankton biomass which in turn draws sandeel prey out of the sediments, also have an influence on the distribution of minke whales (Tetley *et al*., 2008).

Further work reveals spatial segregation of the area by adult and juvenile whales, with juveniles preferring shallower, inshore waters with sandy-gravel sediments and adults preferring deeper waters with steep benthic slopes and muddy sand, further from the coast (Robinson *et al*., in press). Juvenile whales were also shown to target sandeels exclusively, with adults showing seasonal flexibility switching between sandeels, herring and sprat (Robinson *et al*., in press).

In 2020 the Southern Trench Marine Protected Area (MPA) was designated to protect four biodiversity features including the common minke whale. The area was selected due to persistently above average densities of minke whale, with both adult and juvenile whales regularly observed feeding (NatureScot, 2020d). The southern boundary of the MPA overlaps the EGL3 Application Area. Mapping of adjusted densities of minke whales between 2000 and 2012 and modelled persistence above mean density between 2001 and 2012 indicates high density areas in the section of the MPA along the southern Moray Firth, with lower densities found between Fraserburgh and Peterhead where the MPA overlaps the ELG3 Application Area (NatureScot, 2020).

Figure 3-6 shows the location of the EGL3 Application Area and the Southern Trench MPA and highlights the modelled persistence of above mean density of minke whales between 2000 and 2012 from Paxton et al. (2014).



EGL3 Protected Species Baseline Minke Whale in the Southern Trench MPA

Seiche Reference: P1779
Scale: 1:1,242,023
Reference System: WGS84 UTM 31N
Initials: RB
Date: 04/05/2023

12 nm Limit

EGL3 Application Area

Southern Trench MPA

Modelled persistence of above mean density of minke whale (July, August & September 2001-2012) Persistence-certainty score, between 0-6000 (Paxton et al. 2014).

- 0 - 500
- 500 - 1000
- 1000 - 1500
- 1500 - 2000
- 2000 - 2500
- 2500 - 3000
- 3000 - 3500
- 3500 - 4000
- 4000 - 4500
- 4500 - 5000
- 5000 - 5500
- 5500 - 6000

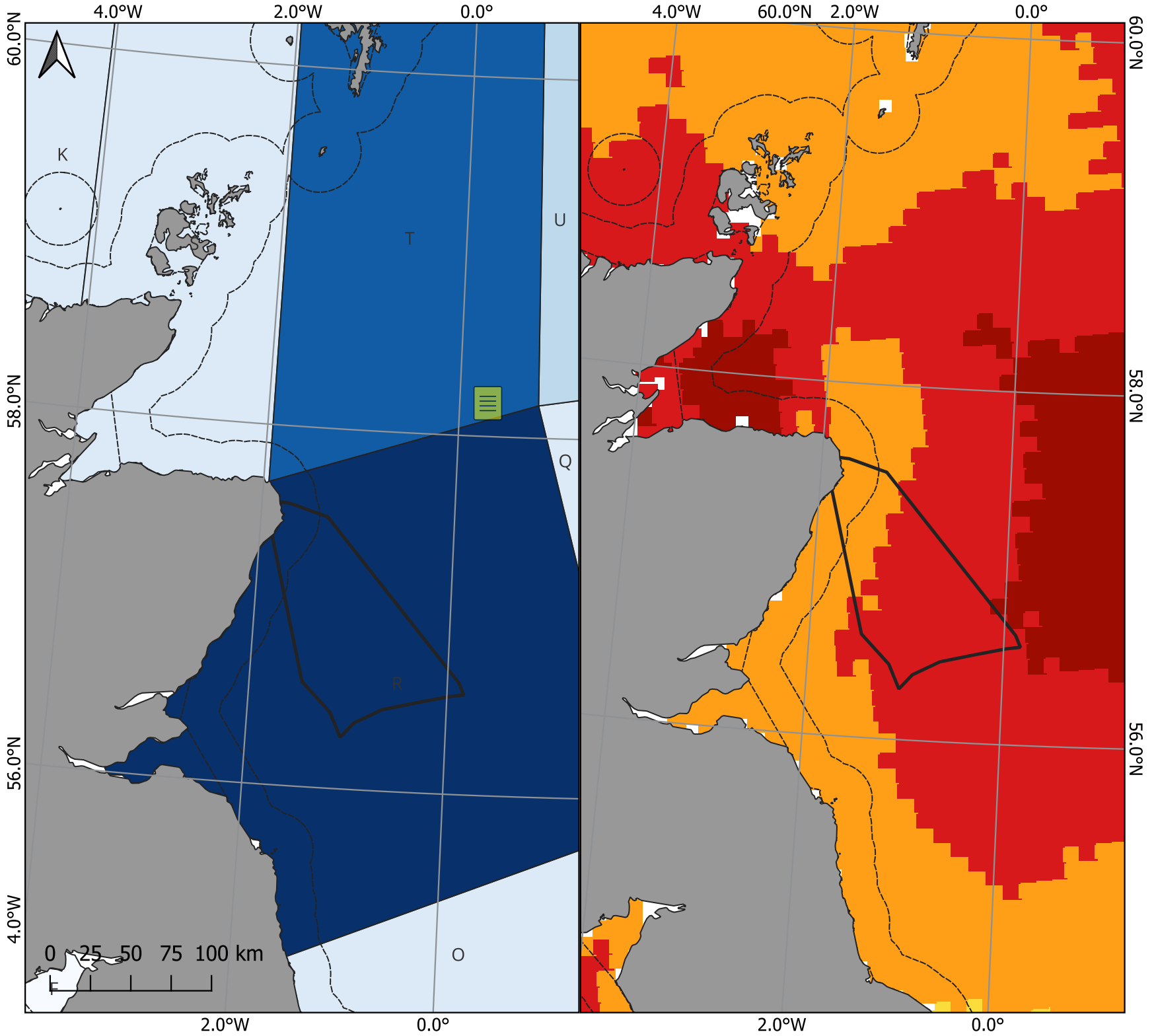
3.2.3.2. Offshore (>12 NM) Area

Comparatively, little is known about the habitat preferences of minke whales further offshore, although it is likely to be driven by features affecting prey distribution and abundance as with inshore areas (Macleod *et al*., 2004; Robinson *et al*., 2009). Offshore areas characterised by frontal features and high productivity such as sand banks and the shelf edge are likely to provide important foraging sites for minke whales (de Boer, 2010; Heide-Jørgensen *et al*., 2001).

In the wider North Sea minke whales are known to feed on pelagic species such as sandeel, mackerel, herring, whiting and Norway pout (*Trisopterus esmarkii*) (Olsen & Holst, 2001) indicating pelagic foraging is important in continental shelf waters. The presence of haddock suggests demersal foraging may also occur (Olsen & Holst, 2001). Herring spawning grounds and sandeel foraging habitats within the offshore North Sea are likely to provide important foraging areas for minke whales (Jensen *et al*., 2011; Frost & Diele, 2022).

Figure 3-7 shows Minke whale, Balaenoptera acutorostrata, estimated densities (Scans-lll, Hammond et al, 2021) and modelled densities (Scans-lll, Lacey et al, 2022) within the EGL 3 Application Area.

Figure 3-8 shows Minke whale, Balaenoptera acutorostrata, seasonal distribution (Waggit, 2019) within the EGL 3 Application Area.



EGL3 Protected Species Baseline Minke Whale Densities

Seiche Reference: P1779
Scale: 1:3,021,573
Reference System: WGS84 UTM 31N
Initials: RB
Date: 20/04/2023

12 nm Limit

EGL3 Application Area

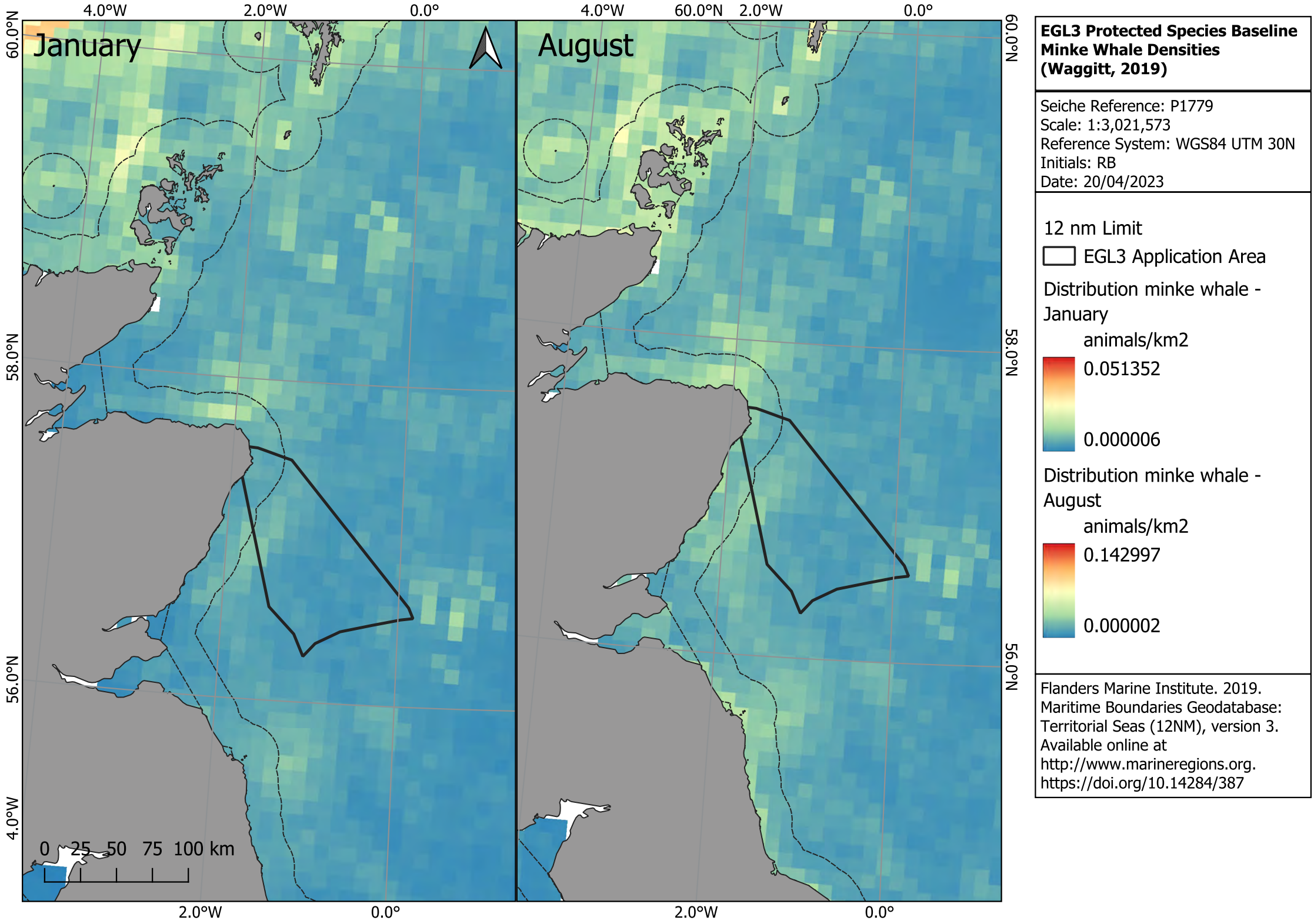
SCANS-III Estimated Density-animals/km2
(Hammond et al. 2021)

- 0 - 0.005
- 0.005 - 0.01
- 0.01 - 0.015
- 0.015 - 0.02
- 0.02 - 0.025
- 0.025 - 0.03
- 0.03 - 0.035
- 0.035 - 0.04

SCANS-III Modelled Density-animals/km2
(Lacey et al. 2022)

- 0 - 0.0033
- 0.0033 - 0.0083
- 0.0083 - 0.0148
- 0.0148 - 0.0229
- 0.0229 - 0.0332
- 0.0332 - 0.0695

Flanders Marine Institute. 2019. Maritime Boundaries Geodatabase: Territorial Seas (12NM), version 3. Available online at http://www.marineregions.org. https://doi.org/10.14284/387



EGL3 Protected Species Baseline Minke Whale Densities (Waggitt, 2019)

Seiche Reference: P1779
Scale: 1:3,021,573
Reference System: WGS84 UTM 30N
Initials: RB
Date: 20/04/2023

12 nm Limit

EGL3 Application Area

Distribution minke whale - January

animals/km2

0.051352

0.000006

Distribution minke whale - August

animals/km2

0.142997

0.000002

Flanders Marine Institute. 2019. Maritime Boundaries Geodatabase: Territorial Seas (12NM), version 3. Available online at http://www.marineregions.org. https://doi.org/10.14284/387

3.2.4. White-beaked dolphin (*Lagenorhynchus albirostris*)

The white-beaked dolphin is listed as Least Concern globally on the IUCN Red List, although its population trend is unknown (Kiszka & Braulik, 2018a). In Europe the species is also listed as Least Concern with a stable population trend (IUCN SSC Cetacean Specialist Group, 2007d). In the UK the overall trend in Conservation Status is Unknown, with insufficient data to establish a trend for the population size nor potential future prospects for the population (JNCC, 2019d).

A single MU is defined for white-beaked dolphin, within which the abundance is estimated to be 43,951 (CV 0.22, CI 28,439 - 67,924). Of this 34,025 (CV 0.28, CI 20,026 - 57,807) are estimated to occur within UK waters of the MU (IAMMWG, 2022).

Abundance estimates for survey block R from the SCANS III survey is 15,694 (CV 0.484, CI 3,022 - 33,340) with a density of 0.243 animals per km^2 (Hammond *et al*., 2021).

White-beaked dolphins are found within the continental shelf, shelf edge and slope waters, with their primary habitat in water depths less than 200 m (Kinze, 2018; Reid *et al*., 2003; MacLeod *et al*., 2007b). Studies indicate that water temperature is a key variable in defining preferred habitat, with white-beaked dolphins preferring cooler waters (MacLeod *et al*., 2008; Canning *et al*., 2008). Within cooler, shallower waters, higher chlorophyll-a concentrations are also important predictors for white-beaked dolphin presence (MacLeod *et al*., 2007b).

White-beaked dolphin are present year-round in Scottish waters, although densities tend to be higher in summer months (Waggitt *et al*., 2020).

White-beaked dolphins in Scottish waters feed on a variety of fish species. Haddock and whiting were the most important prey species, with cod, herring and mackerel also eaten (Canning *et al*., 2008).

3.2.4.1. Inshore (<12 NM) Area

Peak sightings of white-beaked dolphin in inshore waters tend to occur in summer (Weir *et al*., 2007; Canning *et al*., 2008). Inshore movements may be associated with calving, which occurs between June and September (Canning *et al*., 2008). Haddock and whiting do not exhibit an inshore/offshore migration suggesting that white-beaked dolphins are not following prey into coastal waters, but rather for calving (Canning *et al*., 2008). Females tend to move into inshore waters first for calving, with coastal waters providing greater protection with still plenty of prey. Males then follow females to mate following calving (Canning *et al*., 2008).

Within coastal areas white-beaked dolphins are sighted more often in waters where the relatively deeper 20 m isobath occurred adjacent to the coast (Weir *et al*., 2007). Canning *et al*. (2008) found slope and aspect to be more important, with east facing slopes having a positive effect on sightings. Where prey species are widespread it is suggested that dolphins follow the prey rather than targeting specific habitats (Canning *et al*., 2008).

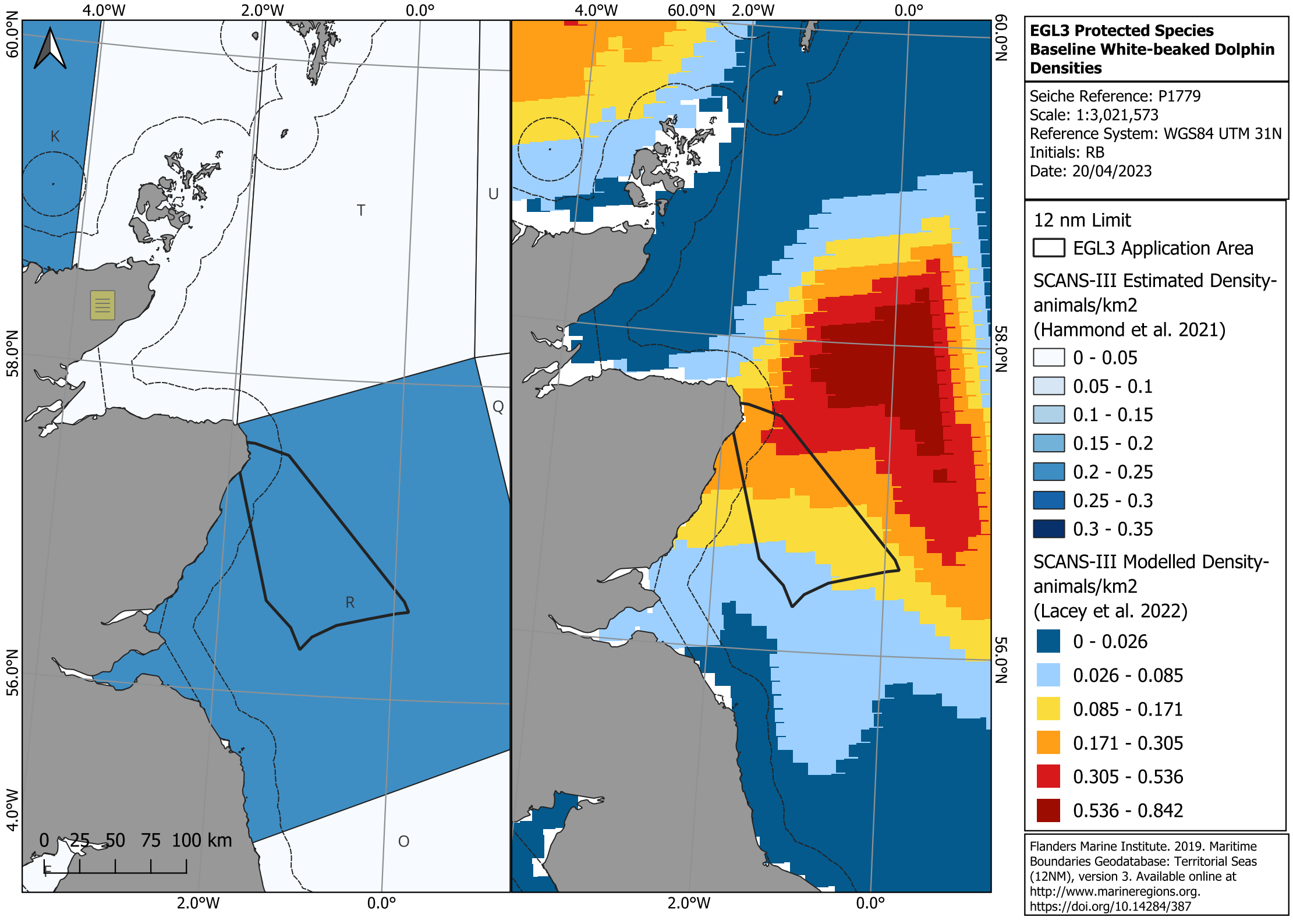
3.2.4.2. Offshore (>12 NM) Area

White-beaked dolphins are regularly recorded within offshore areas of the North Sea during seismic surveys (Hague *et al*., 2020) and from offshore installations (Delefosse *et al*., 2018).

Distribution of dolphins is likely to be driven by that of their main prey as in inshore waters (Fall & Skern-Mauritzen, 2014). White-beaked dolphins are known to inhabit large ranges, are highly mobile and transient in nature due to patchy resources (Bertulli *et al*., 2015).

Figure 3-9 shows White-beaked dolphin, Lagenorhynchus albirostris, estimated densities (Scans-lll, Hammond et al, 2021) and modelled densities (Scans-lll, Lacey et al, 2022) within the EGL 3 Application Area.

Figure 3-10 shows White-beaked dolphin, Lagenorhynchus albirostris, seasonal distribution (Waggit, 2019) within the EGL 3 Application Area.



EGL3 Protected Species Baseline White-beaked Dolphin Densities

Seiche Reference: P1779
Scale: 1:3,021,573
Reference System: WGS84 UTM 31N
Initials: RB
Date: 20/04/2023

12 nm Limit

EGL3 Application Area

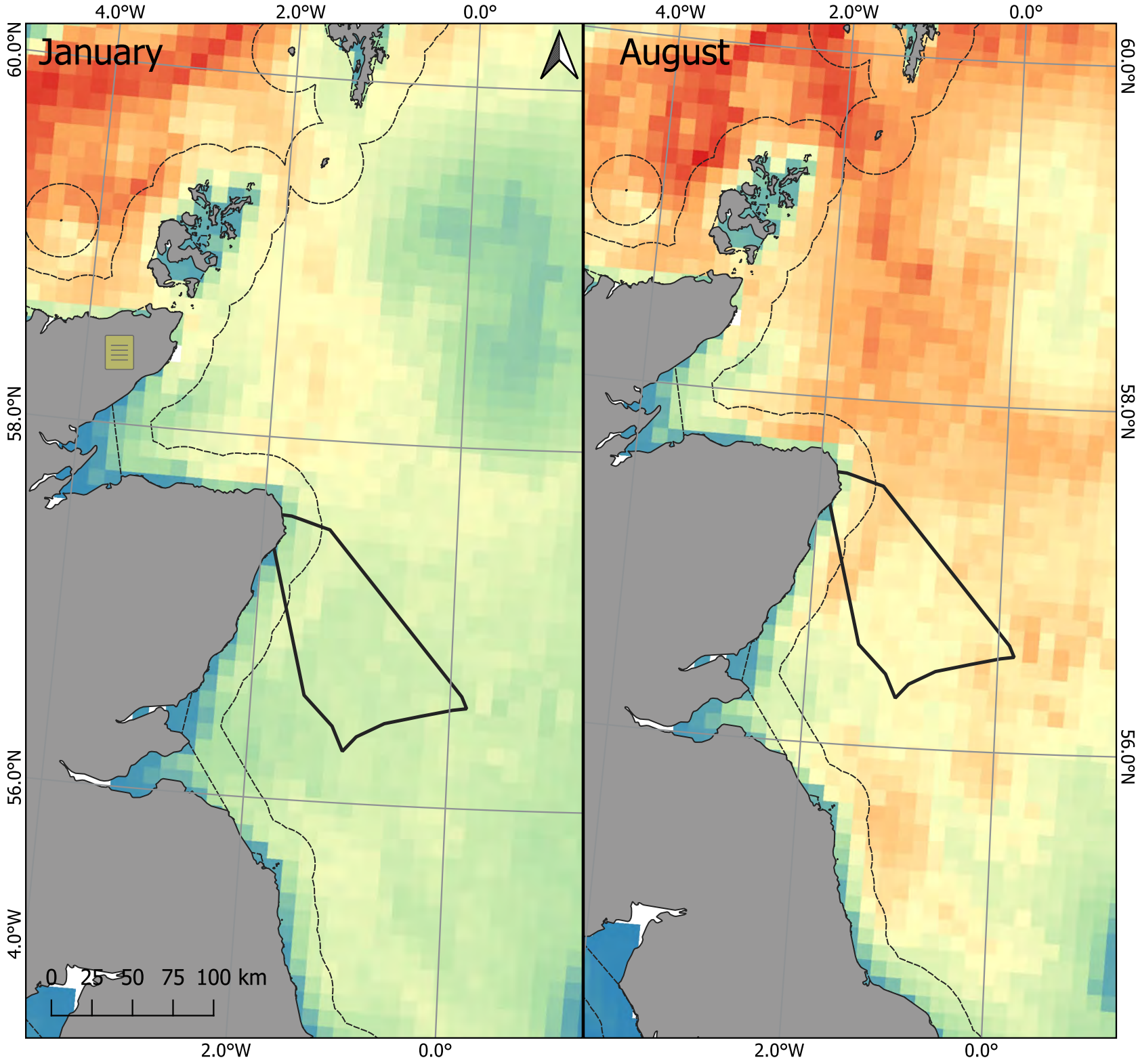
SCANS-III Estimated Density-animals/km2
(Hammond et al. 2021)

- 0 - 0.05
- 0.05 - 0.1
- 0.1 - 0.15
- 0.15 - 0.2
- 0.2 - 0.25
- 0.25 - 0.3
- 0.3 - 0.35

SCANS-III Modelled Density-animals/km2
(Lacey et al. 2022)

- 0 - 0.026
- 0.026 - 0.085
- 0.085 - 0.171
- 0.171 - 0.305
- 0.305 - 0.536
- 0.536 - 0.842

Flanders Marine Institute. 2019. Maritime Boundaries Geodatabase: Territorial Seas (12NM), version 3. Available online at http://www.marineregions.org. https://doi.org/10.14284/387



EGL3 Protected Species Baseline White-beaked Dolphin Densities (Waggitt, 2019)

Seiche Reference: P1779
Scale: 1:3,021,573
Reference System: WGS84 UTM 30N
Initials: RB
Date: 20/04/2023

12 nm Limit

EGL3 Application Area

Distribution white-beaked dolphin-January

animals/km2

0.1249

0

Distribution white-beaked dolphin-August

animal/km2

0.241666

0

Flanders Marine Institute. 2019. Maritime Boundaries Geodatabase: Territorial Seas (12NM), version 3. Available online at http://www.marineregions.org. https://doi.org/10.14284/387

3.2.5. Other Cetaceans

A further five species of cetacean are considered regular but less common within the North Sea, with most sightings of these species recorded further north of the Application Area. In addition, although only incidental records of humpback whale were recorded by Hammond *et al*. (2004) and Reid *et al*. (2003) sightings across the North Sea have been increasing in recent years (Leopold *et al*., 2018).

Atlantic White-sided Dolphin (*Lagenorhynchus acutus*)

The Atlantic white-sided dolphin is listed globally as Least Concern on the IUCN Red List although its current population trend is unknown (Braulik, 2019). In Europe the species is also listed as Least Concern with a stable population trend (IUCN SSC Cetacean Specialist Group, 2007e).

A single MU is defined for the Atlantic white-sided dolphin, within which the abundance is estimated to be 18,128 (CV 0.61, CI 6,049 - 54,323). Of this 12,293 (CV 0.64, CI 3,891 - 38,841) are estimated to occur within UK waters of the MU (IAMMWG, 2022). Abundance estimates for survey block R from the SCANS III survey is 644 (CV 0.994, CI 0 - 2,069) with a density of 0.0100 animals per km^2 (Hammond *et al*., 2021).

Atlantic white-sided dolphins are predominantly distributed within continental shelf and slope waters in waters between 5°C and 16°C (Cipriano, 2018). Around the UK its distribution is concentrated in offshore waters beyond the continental shelf edge off the west coast (Macleod, 2004; Weir *et al*., 2001), although it does occur in small numbers in the North Sea (Hammond *et al*., 2021).

Within the Grampian region there have been sporadic sightings, predominantly in offshore areas, with the majority occurring in July and August (Anderwald & Evans, 2010; Weir & Stockin, 2001).

Waggitt *et al*. (2020) highlighted an increase in density in offshore waters west of Scotland during summer months, with low densities in coastal areas and the North Sea throughout the year. Sightings in UK waters follow a seasonal variation in distribution, with more sightings in spring and summer along the continental shelf and slope, with movement further offshore in winter months (Ó Cahdla *et al*., 2004). Such movement may be associated with prey movement and distribution. In the eastern North Atlantic, Atlantic white-sided dolphin diet is dominated by blue whiting (*Micromesistius poutassou*), *Trisopterus* species and whiting. Atlantic mackerel and a number of mesopelagic fish including myctophids and silvery pout (*Gadiculus argenteus thori*) are also important (Hernandez-Milian *et al*., 2016). Blue whiting is known to undertaken seasonal movements from offshore areas towards the continental shelf for spawning (Hátún *et al*., 2007). Research by Hernandez-Milian *et al*. (2016) also indicates that the diet of Atlantic white-sided dolphins varies between juveniles and adults.

Common Dolphin (*Delphinus delphis*)

The common dolphin is listed as Least Concern globally on the IUCN Red List with an unknown population trend (Braulik *et al*., 2021). In Europe the species is listed as Data Deficient, with a varying status throughout its European range although this assessment is in need of updating. Although abundant, its population status in Europe is unknown (IUCN SSC Cetacean Specialist Group, 2007e).

Common dolphins are widely distributed in pelagic and shelf waters of the Atlantic (Murphy *et al*., 2013). In the UK their distribution is predominantly concentrated in the west, in waters above 14°C (MacLeod *et al*., 2008; MacLeod *et al*., 2007b). Common dolphins are much rarer on the east coast of Scotland and northern North Sea, although sustained occurrence has been recorded in for example the Moray Firth (Robinson *et al*., 2010) and there are sightings recorded offshore in the northern North Sea (Hague *et al*., 2020) as well as along the East Grampian coast (Anderwald & Evans, 2010).

Sightings in Scottish waters show large seasonal variations with low densities in winter and higher densities in summer months (Waggitt *et al*., 2020). Such seasonal movements may be related to prey availability and distribution (Murphy *et al*., 2013) and to changes in sea surface temperature (Neumann, 2001; MacLeod *et al*., 2008).

Common dolphins tend to feed on small, pelagic fish (Santos *et al*., 2013; Spitz *et al*., 2010) and occasionally cephalopods (Marçalo *et al*., 2018). In Scottish waters mackerel, haddock, sandeel, sprat and whiting are the main prey items for common dolphins (Kessler, 2021).

A single MU is defined for common dolphins, within which abundance is estimated at 102,656 (CV 0.29, CI 58,932 - 178,822). Of this 57,417 (CV 0.32, CI 30,850 - 106,863) are estimated to occur within UK waters of the MU (IAMMWG, 2022). No common dolphins were recorded in the North Sea during the SCANS III survey.

Orca (*Orcinus orca*)

Orca are listed as Data Deficient globally on the IUCN Red List, with an unknown population trend (Reeves *et al*., 2017). In Europe the species is also listed as Data Deficient with an unknown population trend (IUCN SSC Cetacean Specialist Group, 2007f).

Orca are widely distributed in coastal and oceanic waters of the North Atlantic and occur throughout the year in British waters (Jourdain *et al*., 2019). In the Eastern North Atlantic two ecotypes are present, initially described as Type 1, generalist feeders showing heaving tooth wear associated with fish consumption but known to predate marine mammals, and Type 2's, specialist marine mammal feeding orcas (Foote *et al*., 2009). More recent work has shown Type 1 Atlantic orca have a long-term preference for marine mammals, with many individuals switching prey (Vongraven & Bisther, 2013; Foote *et al*., 2010; Deecke *et al*., 2011) calling into question the designation of ecotypes based on prey preference (Foote, 2022).

Around Scottish waters Type 2 orca are found off the west coast, known as the West Coast Community with only two individuals suspected to remain (Sanders, 2023). The majority of orca sighted in Scottish waters form part of the Northern Isles community found off the coast of Shetland, Orkney and the north Scottish mainland as well as further offshore (Jourdain *et al*., 2019). Here orcas are present year-round but with increase in sightings in coastal areas during summer months (Jourdain *et al*., 2019). Evidence shows movements of at least some individuals from the Northern Isles to Icelandic summer-spawning grounds (Foote *et al*., 2010). During winter an increase in sightings offshore in the northern North Sea associated with mackerel fisheries (Luque *et al*., 2006). Occasional records are reported along the East Grampian coast (Anderwald & Evans, 2010; Weir & Stockin, 2001).

Waggitt *et al.* (2020) suggest orca tend to move into the area during summer, although for Scottish waters the distribution remains similar throughout the year.

No abundance or density estimates were calculated for orca through SCANS III. Estimates of abundance for North Atlantic orca is 15,014 (CV 0.42, CI 6,637 - 33,964) (Jourdain *et al*., 2019). To date 187 individuals have been catalogued off the northern coasts of Scotland (Scullion *et al*., 2021).

Risso's Dolphin (*Grampus griseus*)

The Risso's dolphin is listed globally as Least Concern on the IUCN Red List, although its population trend is unknown (Kiszka & Braulik, 2018b). In Europe the species is listed as Data Deficient, with an unknown population trend (IUCN SSC Cetacean Specialist Group, 2007g).

A single MU is defined for Risso's dolphin within the region, within which the abundance is estimated to be 12,262 (CV 0.46, CI 5,227 - 28,764). Of this 8,687 (CV 0.63, CI 2,810 - 26,852) are estimated to occur within the UK waters of the MU (IAMMWG, 2022). No Risso's dolphin were sighted in survey block R during the SCANS III survey.

Risso's dolphins are generally distributed along the continental shelf and slope areas, in warmer mid-temperate waters (Jefferson *et al*., 2014). In Scottish waters they generally occur along the continental shelf rather than coastal waters (Waggitt *et al*., 2020). Despite this, notable concentrations of Risso's dolphin occur in the coastal waters along the west coast of Scotland (Weir *et al*., 2019) and they are regular around Shetland and Orkney (Hague *et al*., 2020).

An increasing number of reports have also been recorded in the northern North Sea in recent years (Paxton *et al*., 2014) and the species has been increasing recorded from the East Grampian coastline (Anderwald & Evans, 2010).

Risso's dolphin are present in Scottish waters year-round, with a seasonal increase between May and October in inshore areas (Hague *et al*., 2020; Weir *et al*., 2019; Anderwald & Evans, 2010). Sightings suggest that deeper waters closer to shore may be important calving and feeding habitats (Hague *et al*., 2020). Around the UK Risso's dolphins tend to prefer water depths of 50 to 100 m (Evans *et al*., 2003) although sightings coastally also occur in waters 30 to 40 m in depth (Weir *et al*., 2019; de Boer *et al*., 2012).

Risso's dolphin predominantly prey on cephalopods, with the octopus *Eledone cirrhosa* its main prey in Scottish waters (MacLeod *et al*., 2014).

Long-finned Pilot Whale (*Globicephala melas*)

The long-finned pilot whale is globally listed as Least Concern on the IUCN Red List, although its population trend is unknown (Minton *et al*., 2018). In Europe, although widespread and abundant, the species is listed as Data Deficient with an unknown population trend (IUCN SSC Cetacean Specialist Group, 2007h).

No MU is defined for this species in UK waters. All sightings in Scottish waters during the SCANS III survey occurred in the north and west of Scotland, blocks J and K where abundance was 87 (CI 11 - 713) and 1,745 (CI 273 - 11,160) respectively (Hammond *et al*., 2021). No pilot whales were detected in block R.

Data from Waggitt *et al.* (2020) indicate pilot whales occur in the region year-round but move into deeper waters during the summer months. Pilot whales are widely distributed along the continental shelf edge and oceanic waters of the Northeast Atlantic, and are strongly associated with waters 2000 m deep, with steep slopes (Rogan *et al*., 2017). There were no sightings recorded in the North Sea (Rogan *et al*., 2017) although some records are presented in the Moray Firth (Hague *et al*., 2020).

Long-finned pilot whale are known to feed on cephalopods, with the squid family Ommastrephidae forming the most important prey component in Scottish whales (Santos *et al*., 2014).

There have been only a few reports of this species from the East Grampian coastline (Anderwald & Evans, 2010; Weir & Stockin, 2001).

Humpback Whale (*Megaptera novaeangliae*)

The humpback whale is listed globally as Least Concern on the IUCN Red List, with an increasing population trend (Cooke, 2018b). In Europe the species is also listed as Least Concern with an increasing population trend (IUCN SSC Cetacean Specialist Group, 2007i).

Humpback whales are known to undertake seasonal migrations between high latitude, summer, feeding grounds and tropical coastal waters in winter for breeding (Fleming & Jackson, 2011). In the Northeast, Atlantic humpback whales are known to migrate to breeding grounds in the West Indies or Cape Verde Islands (Mackay, 2015; Jones *et al*., 2017; Kettemer *et al*., 2022).

Over the past 20 years the number of humpback whales recorded in UK waters has increased (Snell *et al*., 2023). This includes an increase in the number of whales sighted in the North Sea (Leopold *et al*., 2018; Berrow & Whooley, 2022). Whales have been recorded in all months of the year in the southern North Sea, with no apparent seasonality (Berrow & Whooley, 2022). However, an increase in the occurrence of humpback whales in the Firth of Forth in winter has been suggested to be a migratory stopover during the southbound migration (O'Neil *et al*., 2019). Humpback whales recorded in Scottish and Irish waters have been recorded migrating to breeding grounds off Cape Verde (Berrow *et al*., 2021; McNeil, 2023).

There is no MU for humpback whale in UK waters, with no individuals recorded during the SCANS III survey.

Humpback whales feed on a variety of pelagic fish with species such as sprat, herring and sandeel being important in around the UK coast (Berrow & Whooley, 2022).

3.2.6. Summary of Cetacean Abundance and Density Estimates

A summary of the abundance and density estimates of the four most encountered species of cetaceans is provided in Table 3-2. The estimated number of individuals within the Application Area is calculated using the density estimates from SCANS III multiplied by the area of the survey corridor of 1 km plus an Effective Deterrence Range (EDR) of 5 km as recommended by JNCC for geophysical survey equipment (JNCC, 2020). Based on an 11 km stretch multiplied by a total estimated distance of 239 km of the survey corridor, gives an area of 2,629 km2.

Table 3-2 : Summary of abundance and density estimates for the four key cetacean species per MU and for SCANS III block R

Species	MU	Total Abundance MU*	Total Abundance UK portion of MU*	Abundance in SCANS III Block R^	Density SCANS III Block R (individuals/km^2)^	Estimated Number Individuals within Application Area
Harbour porpoise	North Sea	346,601 (CV 0.09) (CI 289,498-419,967)	159,632 (CV 0.12) (CI 127,442-199,954)	38,646 (CV 0.287) (CI 20,584-66,524)	0.599	1575
Bottlenose dolphin	Coastal East Scotland	224 (CV 0.02) (CI 214-234)	224 (CV 0.02) (CI 214-234)	-	-	224
	Greater North Sea	2,022 (CV 0.75) (CI 548-7,453)	1,885 (CV 0.8) (CI 476-7,461)	1,924 (CV 0.861) (CI 0-5,048)	0.0298	78
White-beaked dolphin	Celtic and Greater North Sea	43,951 (CV 0.22) (CI 28,439-67,924)	34,025 (CV 0.28) (CI 20,026-57,807)	15,691 (CV 0.484) (CI 3,022-33,340)	0.243	639
Common minke whale	Celtic and Greater North Sea	20,118 (CV 0.18)	10,288 (CV 0.26)	2,498 (CV 0.614) (CI 604-6,791)	0.0387	102

		(CI 14,061-28,786)	(CI 6,210-17,042)			

*IAMMWG (2022)

^Hammond *et al*. (2021)

3.3. Marine Turtles

All species of marine turtles are listed as EPS.

There have been records of four species of marine turtle in the North Sea, the leatherback (*Dermocheylys coriacea*), loggerhead turtle (*Caretta caretta*), green turtle (*Chelonia mydas*) and Kemp's ridley (*Lepidochelys kempii*) (Goverse *et al*., 2014; Botterell *et al*. 2020). Of these the most commonly recorded is the leatherback turtle which are regularly recorded along the north-western part of the European Continental Shelf (Godley *et al*., 1998; Doyle *et al*., 2008; Botterell *et al*. 2020). Records within the North Sea tend to be more occasional (Botterell *et al*., 2020; Goverse *et al*., 2014; Reeds, 2004)

The leatherback turtle is listed as Vulnerable globally on the IUCN Red List, with a decreasing population trend (Wallace *et al*., 2013).

Leatherback turtles' nest on tropical and subtropical beaches with adults undertaking extensive migrations across the oceans before returning to nesting beaches every two to four years (Fossette *et al*., 2010). The species seasonally frequents waters around the UK and Ireland during the boreal summer and autumn, utilising these waters as a foraging ground for gelatinous prey (Godley *et al*., 1998; Witt *et al*., 2007). Turtles foraging in UK waters are likely to breed in the Caribbean (Hays *et al*., 2004a; Eckert, 2006). There is also increasing evidence that individuals maintain a broad level of fidelity to different foraging ranges e.g., western Atlantic or eastern Atlantic (Hays *et al*., 2006).

Unlike the majority of marine turtles, leatherback turtles do not have a hard shell but leathery skin with distinct ridges running the length of the animal. It is also the largest of all marine reptiles (Girondot *et al*., 2021). Leatherback turtles are known to have an endothermic capacity therefore can remain active in cool prey-rich waters (McMahon & Hays, 2006). The northerly distribution of the species is essentially encapsulated by the position of the 15°C isotherm which has moved north by 330 km in the last 17 years (McMahon & Hays, 2006).

The majority of leatherback turtles recorded off the UK are adults or subadults nearing sexual maturity (Godley *et al*., 1998) with smaller individuals excluded from higher latitude cooler water habitats, likely driven by gigantothermy whereby large, bulky ecothermic animals are more easily able to maintain a constant body temperature due to their smaller surface area to volume ratio (Witt *et al*., 2007).

Leatherback turtles feed on gelatinous organisms such as coelenterates (class Scyphozoa) including *Aurelia*, *Chrysaoara, Cyanea* and *Rhizostoma* (Davenport, 1998). Such species have been recorded in the North Atlantic and North Sea (Richardson *et al*., 2006) and consistent aggregations of *Rhizostoma octopus* in distinct coastal hotpots may account for nearly a quarter of variance in leatherback turtle sightings of the west coast of the UK (Houghton *et al*., 2006). The distribution of this prey around the UK is predominantly concentrated on the west coast (Witt *et al*., 2007).

Leatherback turtles tend to inhabit shallower habitats by night and deeper areas by day, likely in response to vertical tracking of diel migrating prey (Eckert *et al*., 1989). The species is predominantly an epipelagic forager (0-200 m) (Hays *et al*., 2004b). Hays *et al*. (2006) indicated that leatherbacks are constantly fine-tuning foraging behaviour and diel activity in association with local conditions, with shorter shallower dives at higher latitudes.

The majority of leatherback sightings and strandings in the UK occur on western coasts, with a peak in occurrence between June and October (Botterell *et al*., 2020).

Records of the other, hard shelled species of turtle are sparse. As with leatherback turtles most occur on the western side of the UK although most tend to occur during the winter months and are of juvenile individuals. It is likely that these individuals are arriving via North Atlantic current systems (Botterell *et al*., 2020).

3.4. Eurasian Otter (*Lutra Lutra*)

Eurasian otter are largely solitary, semi-aquatic mammals that obtain most of their food from lochs, rivers, or the sea. The Scottish population unusually comprises a particularly high proportion (perhaps 50% or more) of coastal-dwelling individuals that feed almost exclusively in the sea. The coast and islands of western Scotland are particularly important for this species and coastal otters are occasionally referred to as 'sea otters' despite the fact that they are exactly the same species as the animals which inhabit freshwaters further inland. Coastal dwelling populations use shallow, inshore marine areas for feeding but they also require access to fresh water for bathing and terrestrial areas for resting and breeding, therefore their foraging range in the marine environment is limited to coastal areas.

In freshwaters, otters feed mainly on fish such as trout, salmon and eels. In the spring spawning frogs and toads become important prey. Mammals and birds are also taken occasionally. In these habitats, otters are largely (but not exclusively) nocturnal and occupy very large home ranges (around 32 km for males and 20 km for females). In contrast, their coastal counterparts are mainly active during the day and, because these productive inshore waters provide many fish and crustacean prey, they need much smaller home ranges. These can be as little as 4-5 km of coastline. Coastal-dwelling otters require a ready supply of fresh water to wash the salt out of their fur, which would otherwise rapidly lose its insulative properties (SNH 2015).

Otters are mostly solitary except when they come together to breed. They mate year-round, though most cubs, also known as pups, are born between May and August. An otter usually maintains numerous couches and holts within its territory. Couches are aboveground resting places, often on islands, or hidden in extensive reed beds, or in dense scrub, brambles or nettles. Holts are underground and can take many forms – among falls of rocks, in caves, excavated tunnels in peat banks, or within root systems of mature bank-side trees. Along coasts holts are often found adjacent to freshwater streams or springs, as otters need to wash the salt from their fur.

The National Biodiversity Network (NBN) Trust Atlas (Scotland) is an online tool combining multiple sources of information about UK species and habitats. The NBN Atlas Scotland allows users to interrogate species records, habitat, climate and soil information, geographical boundaries and to use extremely powerful mapping tools through a single portal.

The atlas provides occurrence records for otter using an online interactive map facility. A 32 km circle was drawn centred on the Application Area landfall near Peterhead. The number of otter records within this area was 572.

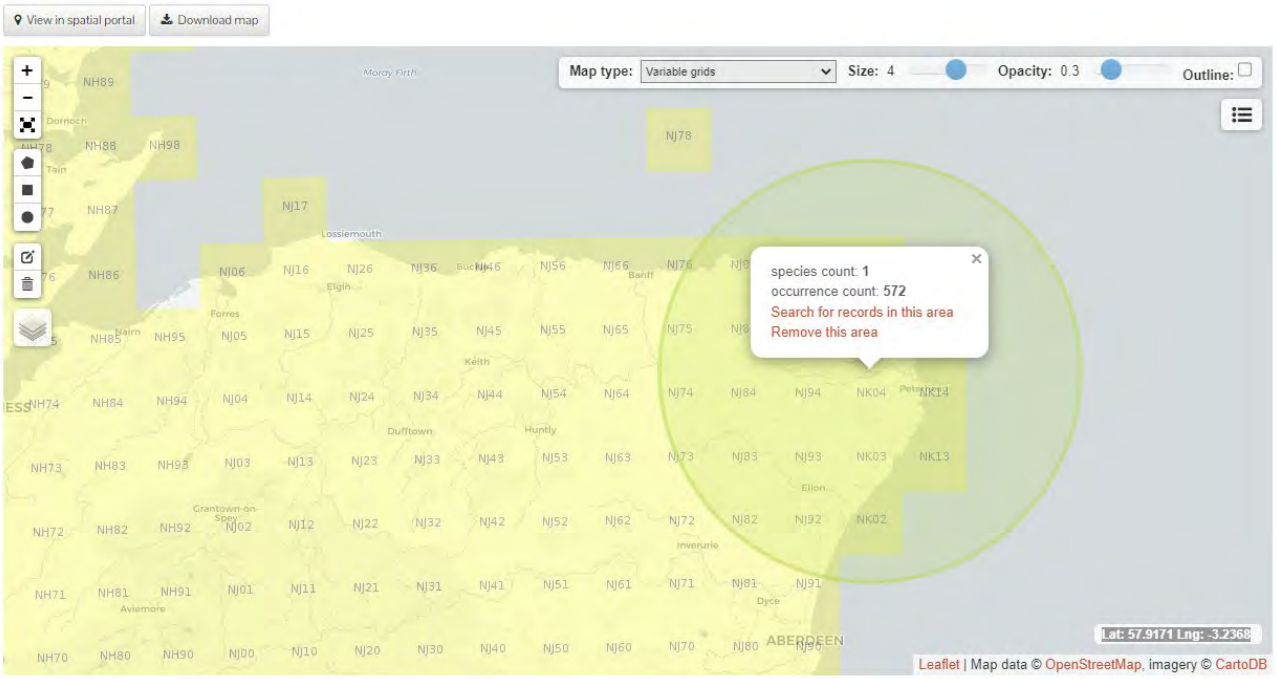


Figure 3-10 : Occurrence Records of Otter shown on the NBN Atlas interactive map near the landfall Application Area

Classification of these records by month is shown below in Table 3-3. Sightings for the Eurasian otter peak in May-June and September although they are seen all year round.

Table 3-3 : Eurasian otter records classified by month

Month	Count
January	35
February	43
March	9
April	29
May	176

Month	Count
June	51
July	17
August	16
September	95
October	14
November	19
December	15

There are no SACs designated for Otter within the foraging range.

3.5. Other (non-EPS) Species

3.5.1. Pinnipeds

Whilst not EPS, pinnipeds are protected as Annex II species under the EU Habitats Directive and are subject to national legislation, with haul-out sites protected by The Protection of Seals (Designated Sea Haul-out Sites) (Scotland) Order 2014. The two most regularly occurring species in UK waters are the harbour seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*) (Hammond *et al*., 2004).

Harbour Seal (*Phoca vitulina*)

The harbour seal is listed globally as Least Concern on the IUCN Red List, with an unknown population trend (Lowry, 2016). The species is also listed as Least Concern within European waters, with an unknown population trend (European Mammal Assessment Team, 2007a). In the UK the overall trend in Conservation Status is Unfavourable – Inadequate due to declines still observed in some areas, leading to the current population size being less than the favourable reference population and future prospects of the population being poor (JNCC, 2019e).

Approximately 32% of European harbour seals are found in the UK (SCOS, 2021). SCOS defines seven SMU in Scottish waters, of which the project route falls within the East Scotland SMU.

Harbour seals come ashore in sheltered waters, often on sandbanks and in estuaries, but also in rocky areas (SCOS, 2021). Harbour seals haul out on land to rest, moult and breed (Thompson *et al*., 1997) dispersing from these sites to forage at sea (Thompson *et al*., 1994; Bailey *et al*., 2014). In June and July female seals haul out to give birth (SCOS, 2021). Females lactate and care for pups for 21 days before weaning (Thompson & Wheeler, 2008), during which time the female continues to forage at sea, returning regularly to the pup and therefore limiting at sea distribution (Thompson *et al*., 1994; Bailey *et al*., 2014).

Since seals spend a higher proportion of time on land during moult in late summer (August to September) (Wilson, 2001) counts during moult are considered to represent the highest proportion of the population (SCOS, 2021). The best estimate of the UK harbour seal population in 2020 is 43,750 (approximate CI 35,800 - 58,300). This is derived by scaling the most recent counts from surveys between 2016 and 2019, and including 2021 counts in the southeast of England, by the estimated proportion hauled out during surveys (0.72 CI 0.54 - 0.88). For the East Coast SMU, the estimated population is 476 (CI 389 - 635) (SCOS, 2021).

The most recent August counts of harbour seals for the UK was 31,486 (SCOS, 2021). Of this 85% are recorded in Scottish waters, with 343 recorded in the East Scotland SMU (SCOS, 2021). While count data suggests the East Scotland SMU is stablising, there has been a drastic decline in the Firth of Tay and Eden Estuary SAC population (1990 - 2002 count of 641, 2016 count of 51) (Hanson *et al*., 2015).

Harbour seals feed on a wide variety of prey including sandeels, gadoids, herring, sprat, flatfish, octopus and squid, with diet varying seasonally and between regions (SCOS, 2021). The diet of seals off the east coast of Scotland is dominated by sandeels particularly during winter and spring. Gadoids (whiting, cod) and flatfish (dab *Limanda limanda*, plaice *Pleuronectes platessa*, flounder *Platichthys flesus*) are the other main prey (Sharples *et al*., 2009).

3.5.1.1. Inshore (<12 NM) Area

Studies indicate that harbour seals tend to forage within 30 km to 50 km of the coastline in waters less than 50 m in depth (Thompson *et al*., 1994; Bailey *et al*., 2014) and within 60 km of haul-out sites (Thompson *et al*., 1996; Cordes *et al*., 2011).

At-sea density is predominantly driven by a negative association with increasing distance from haul-out and water depth. As such predicted density is concentrated in coastal and inshore waters (Carter *et al*., 2022). To the south of the project route the Firth of Tay and Eden Estuary SAC has been designated for harbour seals utilising the sandbanks for breeding (JNCC, 2015).

Under the Marine (Scotland) Act a Sea Conservation Area has been designated on the east coast of Scotland, to the south of the Application Area (Scottish Government, 2011). There are no designated haul-out sites for harbour seals near to the landfalls within the Application Area.

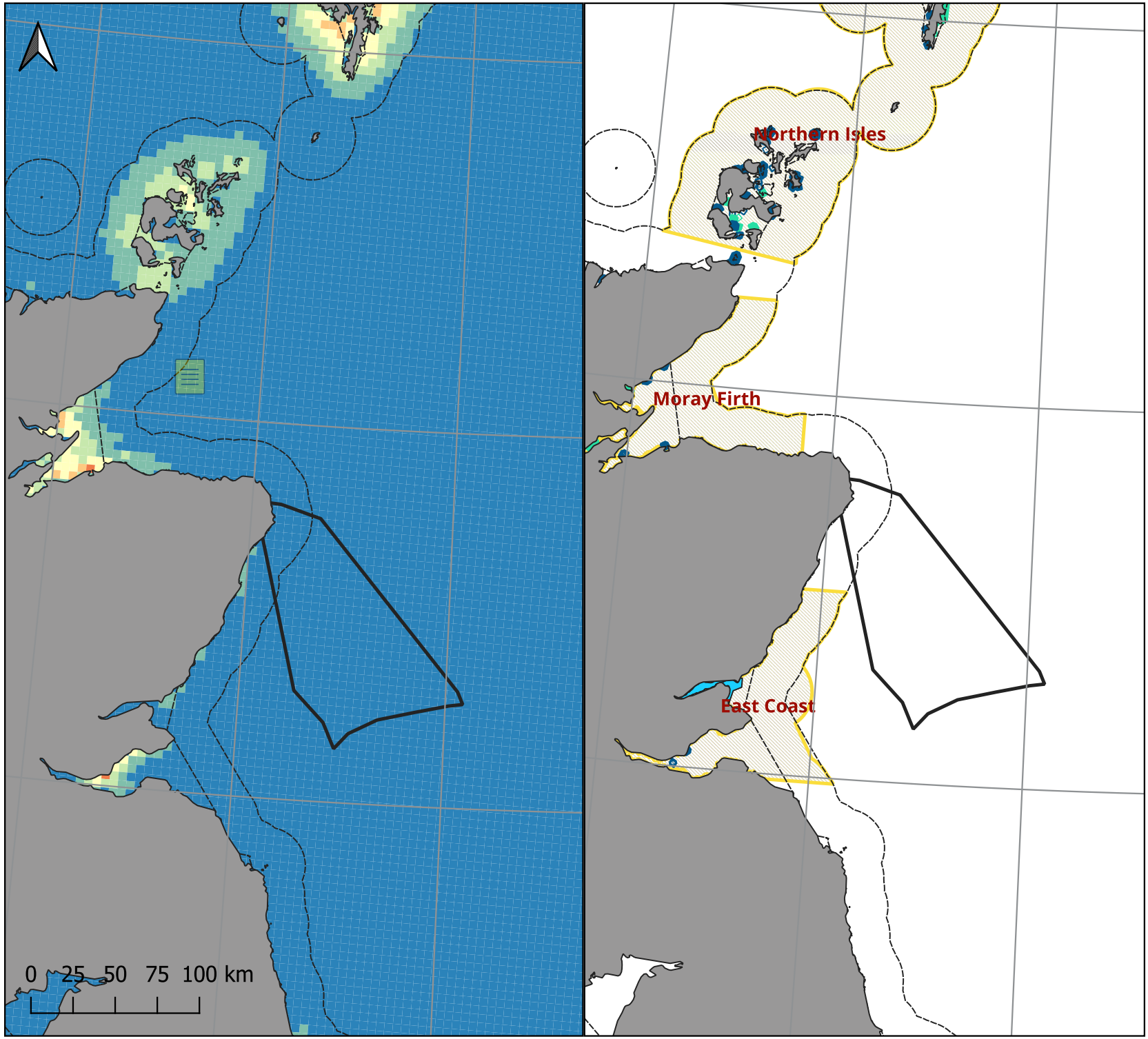
3.5.1.2. Offshore (>12 NM) Area

While the majority of harbour seals forage within 50 km of the coastline, it is noted that harbour seal movements are highly variable among individuals (Sharples *et al*., 2012) and that some individuals undertake longer distance journeys of more than 100 km (Cunningham *et al*., 2009). Sharples *et al.* (2012) noted that harbour seal movement was not restricted to near-shore waters with seals often undertaking lengthy trips to offshore locations. Seals on the east coast of Scotland made some of the most wide-ranging trips (Sharples *et al*., 2012). Jones *et al*. (2015) show harbour seals utilise offshore sandbanks as foraging areas.

Such movements are likely to be due to distribution of prey, with suggestion that seals hauled out on intertidal sandbanks bordering shallow and gently sloping sedimentary may have further to travel to find sufficient productive foraging areas (Sharples *et al*., 2012). Differences in between sexes and body size in foraging distance have been observed in the Moray Firth, with males and larger animals undertaking longer trips of greater distance (Thompson *et al*., 1998).

Research from the wider North Sea indicates offshore foraging trips may reflect avoidance of intra-specific competition rather than the presence of offshore hotspots (Vance *et al*., 2021).

Figure 3-12 shows Harbour Seal, Phoca vitulina, at sea usage and haul sites in the vicinity of the EGL 3 Application Area (Carter et al, 2020).



EGL3 Protected Species Baseline
Harbour Seal Densities

Seiche Reference: P1779
Scale: 1:3,021,573
Reference System: WGS84 UTM 30N
Initials: RB
Date 20/04/2023

12 nm Limit

EGL3 Application Area

Harbour Seal Meat At Sea Usage (Carter et al 2020)

- 0 - 0.0047
- 0.0047 - 0.017
- 0.017 - 0.0355
- 0.0355 - 0.0615
- 0.0615 - 0.1024
- 0.1024 - 0.1933
- 0.1933 - 0.4451

Haulout Sites

- Harbour seal/grey seal
- Harbour seal

SACs

- Firth of Tay and Eden Estuary
- Seal Conservation Areas

Grey Seal (*Halichoerus grypus*)

The grey seal is listed as Least Concern globally on the IUCN Red List, with an increasing population trend (Bowen, 2016). In Europe the species is also listed as Least Concern with an increasing population trend (European Mammal Assessment team, 2007b). In the UK the overall trend in Conservation Status is Favourable and Improving (JNCC, 2019f).

Approximately 38% of the world's grey seal population breed in UK waters, with 88% of colonies in Scotland (SCOS, 2021). SCOS defines seven SMU in Scottish waters, of which the project route falls within the East Scotland SMU.

Grey seals haul out on land to rest, moult and breed, before dispersing to the open sea where they predominantly forage along the seabed at depths of 100 m within 100 km of haul-out sites (SCOS, 2021). In the UK grey seals typically breed on remote, uninhabited islands or coasts (SCOS, 2021). UK grey seals breed in autumn, with a clockwise cline in the pupping season. In Scotland pupping occurs between October and December, with moult from January to April (SCOS, 2021). Females give birth and suckle a single pup for 17 to 23 days (SCOS, 2021) during which time they remain onshore (Bowen *et al*., 2006).

Grey seal population trends are assessed from counts of pups born during autumn when females congregate on land to give birth. Outside the breeding season animals redistribute themselves and therefore regional differences in population estimates do not necessarily reflect abundance of animals at other times of year. The estimated population size is calculated using a model including pup production estimates, knowledge of life history parameters and independent estimates of population derived from August counts. The most recent estimate is 140,700 (CI 129,300 - 153,500) (SCOS, 2021).

The main regional groups of breeding colonies in Scotland are the Inner Hebrides, Outer Hebrides, Orkney and the Firth of Forth, to the south of the Application Area. Pup production in 2019 for the Firth of Forth colonies was 7,261, an increase of 4.2% compared with 2016 (SCOS, 2021).

For the east coast of Scotland, August count for grey seals was 3782 in 2016 with an estimated population of the North Sea (including the east coast SMU) 76,183 (CI 65,910-89,324) in 2017 (Russell et al., 2021 in SCOS, 2021).

High usage areas at sea have been demonstrated along the east coast of Scotland (Carter *et al*., 2022). While the SACs in the east coast account for the majority of pup production (SCOS, 2021), summer haul-out counts and at sea distribution reveals only a small percentage of seals utilise SACs during the summer foraging season (Carter *et al*., 2022). Carter *et al.* (2022) analysis indicates between 21 and 58% of breeding females use different regions for breeding and foraging, suggesting at least some partial migration.

Grey seals feed on a wide variety of prey including sandeel and gadids including cod, saithe and ling (Hammond & Wilson, 2016). In southeastern Scotland, the grey seal diet is dominated by sandeel in spring and summer, and to lesser extent in autumn and winter when other important prey includes large gadids and flatfish (Wilson & Hammond, 2019).

3.5.1.3. Inshore (<12 NM) Area

At-sea distribution of grey seals is often characterised by gravel or sandy sediments, the ideal burrowing habitat of sandeel (McConnell *et al*., 1999). Models of at-sea density revealed distance was the primary driver of distribution, with predicted density declining within increasing distance from haul-outs. In addition, for the east coast of Scotland, substrate type, water depth and stratification were shown to be important factors in grey seal distribution (Carter *et al*., 2022). On the east coast water depth selection decreases to 100 m (Huon *et al*., 2021) with usual dive depths between 10 m and 80 m (Aarts *et al*., 2008).

A designated haul-out site for grey seals (under the Protection of Seals (Designation of Haul-Out Sites) (Scotland) Amendment Order 2017) is located at Ythan River mouth (site code EC-003). This is approximately 9 km from the Application Area. Here approximately 2,197 seals were recorded in August counts in 2016, with the site rapidly expanding since 2010 (Morris et al., 2021). Modelling of shows mean at sea usage is high around the Ythan River mouth (Carter et al., 2020).

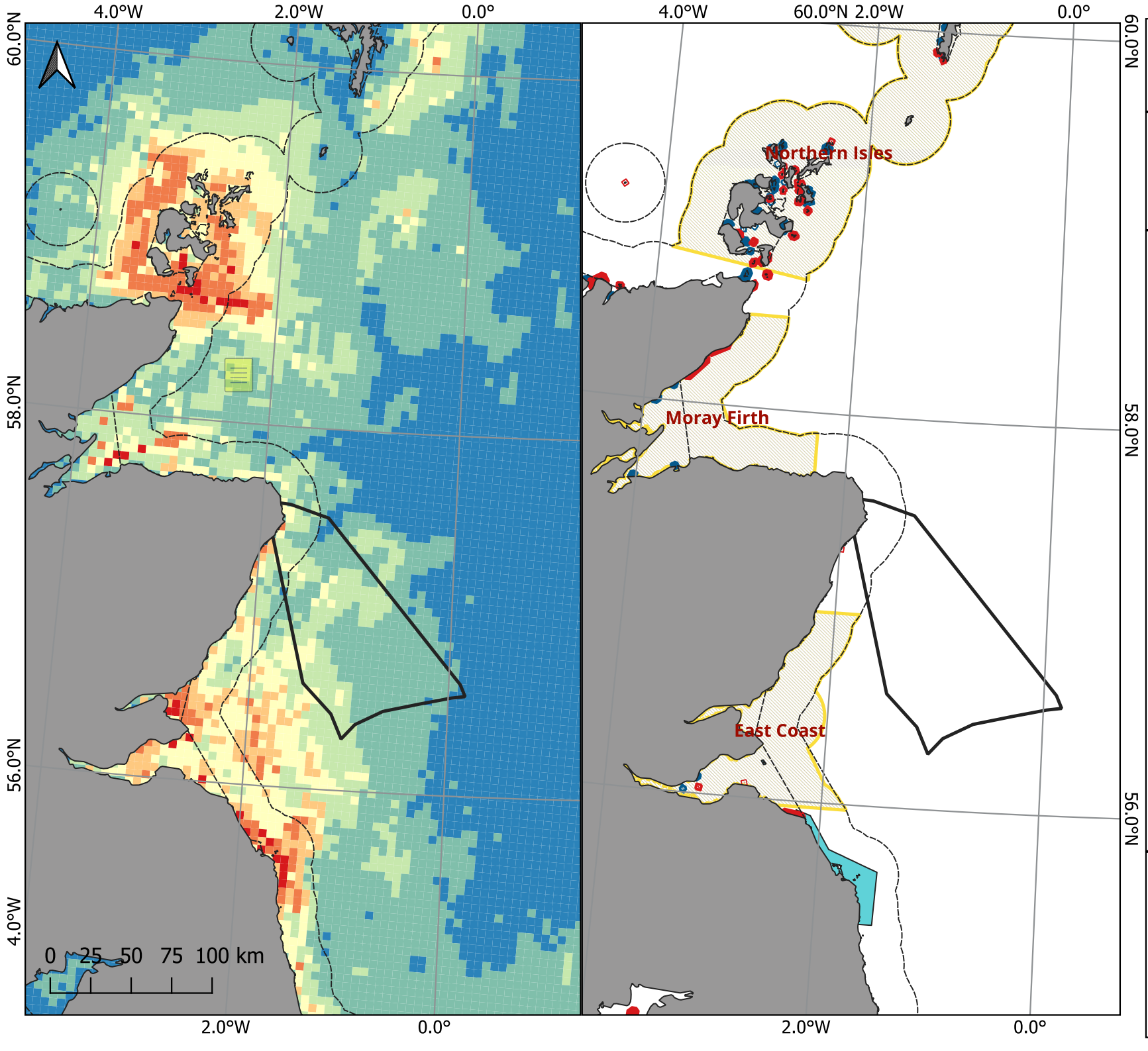
To the south of the Application Area, two SACs have been designated for the main grey seals breeding colonies, the Isle of May within the entrance to the Firth of Forth and Berwickshire and North Northumberland Coast SACs. The Isle of May breeding colony is the largest east coast colony in Scotland, contributing approximately 4.5% of the annual UK pup production (JNCC, 2023).

While grey seals are known to travel longer distances foraging offshore, in the North Sea they spend 43% of their time within 10 km of haul-out sites (McConnell *et al*., 1999) and to preferentially select habitat closer to haul-out sites (Aarts *et al*., 2008; Huon *et al*., 2021; Carter *et al*., 2022).

3.5.1.4. Offshore (>12 NM) Area

Grey seals are known to travel longer distances offshore for foraging and will frequently travel over 100 km between haul out sites (SCOS, 2021; McConnell *et al*., 1999; Thompson *et al*., 1996). In the North Sea grey seals have been shown to travel long distances to offshore areas on specific sandbanks where sandeel availability is high (McConnell *et al*., 1999; Huon *et al*., 2021). Jones *et al*. (2015) highlighted grey seal distribution is characterised by a series of highly utilised offshore foraging areas (up to 100 km offshore), linked via corridors to high usage coastal areas with grey seals spending up to 12% of their time at distances of more than 50 km from the coast (Jones *et al*., 2015).

Figure 3-13 shows Grey Seal, Halichoerus grypus, at sea usage and haul sites in the vicinity of the EGL 3 Application Area (Carter et al, 2020).



EGL3 Protected Species Baseline
Grey Seal Densities

Seiche Reference: P1779
Scale: 1:3,021,573
Reference System: WGS84 UTM 30N
Initials: RB
Date 20/04/2023

12 nm Limit
EGL3 Application Area

Grey Seal Mean At Sea Usage
(Carter et al. 2020)
- 0 - 0.0015
- 0.0015 - 0.0055
- 0.0055 - 0.0118
- 0.0118 - 0.0213
- 0.0213 - 0.0371
- 0.0371 - 0.0709
- 0.0709 - 0.2614

Haulout Sites
- Grey seal
- Grey seal/harbour seal

SACs
- Isle of May
- Berwickshire and North Northumberland Coast
- Seal Conservation Area

Summary of Pinniped Abundance Estimates

Table 3-4 provides a summary of the abundance estimates for East Scotland SMU for harbour seal, based on SCOS (2021), and grey seal, based on SCOS (2021) and Lonergan *et al*. (2011). Abundance estimate for grey seals on the east coast are for the North Sea region which includes the East Scotland SMU (SCOS, 2021). The number of seals within the Application Area was taken from estimates of seal distribution in a 5 km x 5 km grid covering the maximum foraging range of seals from haul outs in the British Isles. These represent the percentage of the population estimated to be present at any one time during the main foraging season (grey seals: summer, harbour seals: spring) (Carter et al., 2022). The number in the Application Area is based on the summed mean, which gives the % of the at-sea population predicted within the area, with the estimated number based on that percentage of the east coast abundance. To estimate the number of seals within the survey corridor, the survey corridor area was calculated based on 1 km plus a 5 km EDR as recommended by JNCC for geophysical survey equipment (JNCC, 2020) giving a total of 11 km. This was multiplied by the total estimated distance of 239 km of the survey corridor, giving an area of 2,629 km2. This is 30.8 % of the total Application Area (8,545.5 km2). As such the number of seals within the survey area was calculated as 30.8 % of the total abundance estimated within the Application Area, based on the mean at-sea usage.

Table 3-4 : Summary of abundance and estimates for grey and harbour seals

Species	Abundance UK	Abundance East Coast	August Counts East Coast SMU	2019 pup production estimate	% of population predicted within Application Area	Estimated abundance within Application Area	Estimated abundance within the Survey Corridor Area
Harbour seal	43,750 (CI 35,800-58,300)	476 (CI 389-635)	343	-	0.01	1	1
Grey seal	140,700 (CI 129,300-153,500)	76,183* (CI 65,910-89,324)	3782	7,261*	2.25	1714	528

*Estimated abundance for North Sea, including the East Scotland SMU

3.5.2. Basking Shark

Although not an EPS, the basking shark (*Cetorhinus maximus*) is protected in inshore Scottish waters under the Nature Conservation (Scotland) Act 2004 and is protected under the Wildlife and Countryside Act 1981.

The basking shark is listed as Endangered globally on the IUCN Red List, with a decreasing population trend (Rigby *et al*., 2021). The basking shark is a planktivorous coastal-pelagic species that feeds by swimming slowly at the surface, but also undertakes vertical migrations to water depths of more than 1000 m (Gore *et al*., 2008).

Around the UK basking sharks are predominantly sighted around the southwest coast of England, west coast of Scotland and the Isle of Man, during the summer months utilising coastal and shelf habitats for foraging on dense patches of zooplankton associated with persistent fronts (Witt *et al*., 2012; Southall *et al.,* 2005). Sightings tend to peak between May and September coinciding with a seasonal increase in zooplankton abundance (Witt *et al*., 2012). Basking sharks appear to prefer calanoid copepod zooplankton such as *Calanus helgolandicus* and *C. finmarchicus* (Sims & Merrett, 1997).

Sightings on the east coast and the North Sea are rarer although are recorded (Witt *et al*., 2012).

Studies also indicate the region may be critical habitat supporting courtship and reproductive behaviours (Sims *et al.,* 2000; Sims *et al*., 2022).

In winter sharks undertake extensive horizontal (up to 3400 km) and vertical (>750 m) movements to utilise productive continental shelf and shelf-edge habitats (Sims *et al*., 2003). While some individuals make extensive migrations across the Atlantic (Gore *et al*., 2008) many either remain in UK waters, migrate south to the Bay of Biscay or further south to the waters off the Iberian Peninsula and North Africa (Doherty *et al*., 2017). Sharks were recorded using both continental shelf waters and oceanic habitats between 50 and 200 m (Doherty *et al*., 2017).

The distribution of basking sharks is known to be influenced by a range of environmental conditions, including water depth, sea surface temperature and the presence of frontal systems, all of which are likely to influence the distribution of prey (Austin *et al*., 2019). Models

predicting habitat suitability for basking sharks around the UK indicate areas of high relative habitat suitability off the east coast of Scotland in the northern North Sea (Austin *et al*., 2019). Data listed in the NBN Atlas contains 3 records of basking shark in the EGL3 Application Area. All sightings are unconfirmed and occurred in the following years, 1988, 2005 and 2012 (NBN Atlas, 2021).

4. Potential Environmental Impacts

Table 4-1 below summarises the potential impacts that could have an adverse effect on protected species and therefore require consideration by the risk assessment.

Table 4-1 Potential pressures identified as requiring consideration in the risk assessment.

Impact	Impact Description	Impacts requiring further assessment				
		EPS			Nationally Protected Species	
		Cetaceans	Marine Turtles	Otter	Pinnipeds	Basking shark
Injury due to physical collision with vessel(s)	There are known incidents of marine mammals colliding with fast moving vessels. Collisions can cause injuries and fatalities.	✓	✓	✓	✓	✓
Risk of injury or disturbance from underwater noise changes	There is potential for noise emissions from geophysical survey equipment and vessels to affect species either through disturbance or in extreme cases by causing auditory injury. Where effects occur, this could lead to a reduction in foraging effectiveness where individuals are displaced to less productive foraging areas. Otter under water, hearing sensitivity is significantly reduced when compared to sea lions and other pinniped species, demonstrating that otter hearing is primarily adapted to receive airborne sounds (Ghoul et al., 2014).	✓	✓	X	✓	✓
Cumulative Effects	Due to the location and geographical extent of the survey it is likely that there could be other surveys or other activities occurring at the same time as the proposed surveys that have the potential to generate underwater noise or vessel traffic.	✓	✓	✓	✓	✓
Pollution event (Accidental Hydrocarbon & PAH contamination)	There is the potential that an accidental spill of oil from equipment, fuel tanks etc from the survey vessel could contaminate the environment and endanger marine mammals. However, survey vessels will comply with the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78 which relate to pollution from oil from equipment, fuel tanks etc and release of sewage (black and grey waters). Compliance with International and National Regulations will be sufficient to minimise the risk to the environment and this impact has been screened out of the assessment.	X	X	X	X	X
Visual /physical disturbance or displacement	Pinniped are more sensitive to anthropogenic disturbance when hauled out. Wilson (2013) presents a review of such studies, and concludes that as an	X	X	✓	✓	X

Impact	Impact Description	Impacts requiring further assessment				
		EPS			Nationally Protected Species	
		Cetaceans	Marine Turtles	Otter	Pinnipeds	Basking shark
	overall generalisation, unless habituation has been established by frequent non-intrusive visits, a safe boat distance for harbour and grey seals (i.e., one at which there is a low risk of significant numbers of seals flushing) is about 200 m. The physical presence of the survey vessel/vessels offshore and of humans onshore, may cause some temporary disturbance to otters should they be in the immediate vicinity of the survey activities. This may result in otters temporarily avoiding their chosen feeding/resting location.					

5. Risk Assessment

The purpose of this section is to examine the possible impacts of the proposed site investigations on those protected species identified as having the potential to be present in the area, and address protective measures aimed at reducing any impact to these species.

5.1. Identification of Relevant Protected Species

In Table 5-1 below is a summary table of the numbers of EPS likely to be affected.

Table 5-1 : Summary of EPS likely to be present close to or within the Application Area.

Species	Estimated Number Individuals within Application Area	Abundance East Coast
Harbour porpoise	1575	-
Bottlenose dolphin	302	-
White-beaked dolphin	639	-
Common minke whale	102	-
Harbour seal	1	476 (CI 389-635)
Grey seal	1714	76,183 (CI 65,910-89,324)
Basking Shark	-	3
Eurasian Otter	572 within 32 km of Application Area	-

5.2. Impact Assessment

5.2.1. Injury Due to Collision with Survey Vessel(s)

There is a risk of collision between protected species considered in this assessment and survey vessels. However, it is largely recognised that the key factors contributing to collision between marine mammals and slow-moving species and vessels is speed (see Schoeman et al., 2020 for review). Injuries to marine mammals from vessel strikes are species-dependent but are generally more severe at higher impact speeds, with ships travelling at 14 knots or faster being the most likely to cause lethal or serious injuries (Wang

et al., 2007). The vessels undertaking these surveys are likely to be either stationary or travelling considerably slower (5 knots) than this while engaged in the proposed survey activities. They will also be moving in a predefined trajectory (straight lines), allowing for animals to predict the movement of the vessels, thus allowing both the vessel and any animal in the area time to avoid collision.

Basking sharks are found in Scottish coastal waters in the summer, following thermal fronts in order to feed. Basking sharks are most at risk from collisions with fishing vessels during the summer months when greater numbers of animals are at the surface feeding and engaged in courtship-like behaviour at the surface. There is evidence of basking sharks with injuries that could have been caused by collision with boat propellers (NatureScot 2019).

During transit times, the survey vessels will be travelling at speeds greater than 5 knots. However, these movements are not considered to deviate from normal vessel traffic in the Application Area. Vessel density data for the landfall area near Peterhead has been reviewed using EMODnet (View Data | EMODnet Human Activities (emodnet-humanactivities.eu)). Density is expressed as h/km^2 per month.

A cargo vessel transit route is shown between Aberdeen and Peterhead running parallel to the coastline. There is also moderate fishing vessel density. There appears to be no marked seasonality to the vessel density pattern.

Figure 5-1 below shows all types of vessel density (annual averages 2017-2021) from EMODnet.

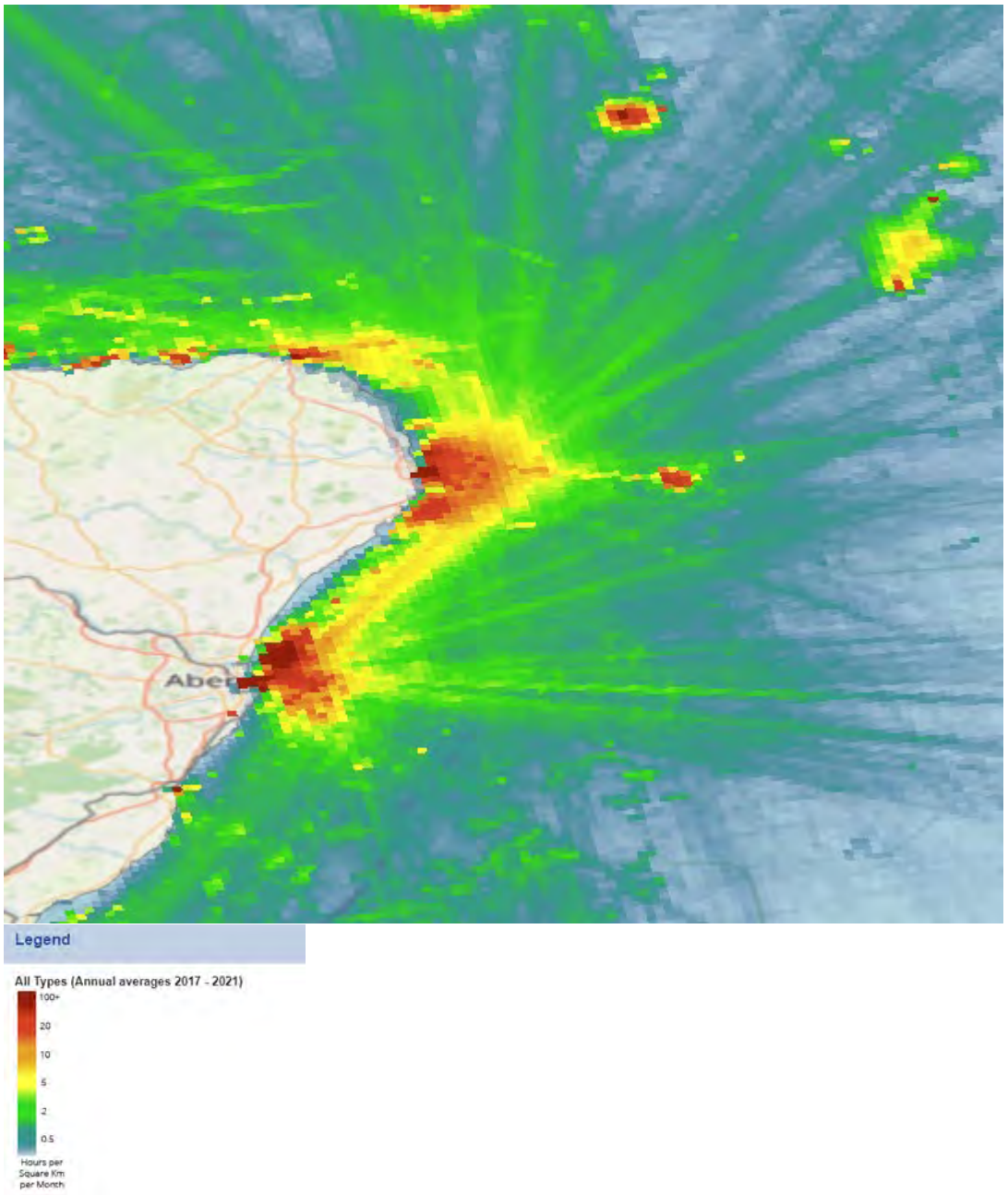


Figure 5-1 : All Types Vessel density heat map

In conclusion, the protected species in the area are exposed to marine traffic on a regular basis and should therefore become accustomed to vessel movements. The small number of vessels (1-2) that will be required for these surveys will not significantly increase vessel traffic in the area. Accordingly, it is predicted that collisions between survey vessels and protected species are extremely unlikely and there is no risk of significant effects to any of the species considered. As such, potential effects are concluded to be negligible.

5.2.2. Risk of Injury or Disturbance from Underwater Noise Changes

5.2.2.1. Sensitivity to underwater noise changes

Cetaceans have evolved to use sound as an important aid in navigation, communication and hunting. It is generally accepted that exposure to anthropogenic sound can induce a range of behavioural effects, and in extreme circumstances, lead to permanent injury in marine mammals. There is no direct evidence to link physical injury in cetaceans and geophysical surveys, however there is evidence that cetaceans exhibit short-term behavioural responses to geophysical survey e.g., Gordon et al. (2004), Southall et al. (2007), Thompson et al. (2013), and Sarnocińska et al. (2020).

The risk assessment therefore considers the potential for lethal / physical injury, auditory injury and behavioural disturbance.

Marine mammals are not equally sensitive to noise at all frequencies and have different hearing sensitivity thresholds. Parvin et al. (2007) noted that lethal effects may occur where peak to peak levels exceed 240 dB re 1 µPa, and physical injury may occur where peak to peak levels exceed 220 dB re 1 µPa (Parvin et al., 2007). The latest peer-reviewed thresholds for the onset of a permanent threshold shift (PTS) or a temporary threshold shift (TTS) in hearing, published by Southall et al. (2019) are used to assess the impacts of noise on marine mammals. These are provided in Table 5-2.

Table 5-2 : Injury thresholds for cetaceans for impulsive noise (Southall et al. 2019)

Marine mammal hearing group	Estimated auditory bandwidth (kHz) [peak sensitivity]	Species potentially present in Application Area	SPL (unweighted) – dB re 1µPa (peak)	
			PTS onset	TTS onset
Low-frequency cetaceans (LF)	0.007-35* [0.2 – 19]	Minke whale Fin whale Humpback whale	219	213
High-frequency cetaceans (HF)	0.15-160 [8.8 – 110]	Risso's dolphin Bottlenose dolphin Common dolphin Atlantic white-sided dolphin Orca White-beaked dolphin	230	224
Very high-frequency cetaceans (VHF)	0.2-180 [12 – 140]	Harbour porpoise	202	196
Phocid carnivores in water (PCW)	0.075-100 [1.9-30]	Grey seal Harbour seal	218	212
Other carnivores in Water (OCW)	0.60 – 39	European Otter	232	226
Marine Turtles	0.03 – 1.2	Leatherback Turtle	210	158

Behavioural disturbance from underwater sound sources is more difficult to assess than injury as it depends on other factors such as the animal's habituation to anthropogenic noise, the level of natural background noise, the direction of the sound, the extent of exposure and cumulative impacts. For the purposes of this assessment, the UK Joint Nature Conservation Committee (JNCC) (2020) precautionary Effective Deterrence Range (EDR) for geophysical surveys of 5 km has been used to assess the potential effects of disturbance from underwater noise. Although the EDR is for harbour porpoise, as these animals are very high frequency cetaceans, the thresholds for the onset of auditory injury and disturbance are lower than for other cetaceans. The EDR has therefore been used as a conservative proxy for other species.

5.2.2.2. Risk of Physical / Auditory Injury

The proposed survey will generate underwater noise from the vessel thrusters, geophysical and geotechnical survey equipment. Of the sources present, the geophysical survey equipment has the highest potential to cause auditory injury and therefore the assessment focuses on this activity.

The MBES and SSS to be used have operating frequencies above 200 kHz. The JNCC (2017) advises that mitigation is not required for MBES in shallow waters (<200 m) as the higher frequencies used fall outside the hearing frequencies of cetaceans and the sounds produced attenuate quicker than the frequencies used in deeper waters. Bathymetry across the Application Area is less than 200 m.

The SBPs (pinger, boomer, chirp and sparker) operate at frequencies between 0.5 – 40 kHz, which will be within the hearing range of the protected species. They typically have a sound pressure level (SPL) in the range of 178 – 225 dB re 1µPa (peak) (see Table 2-3).

The sound pressure levels exceed the Southall et al. (2019) auditory injury thresholds for impulsive noise presented for Low Frequency, Very High Frequency cetaceans, Phocid carnivores in water and marine turtles in Table 5-2, indicating that animals may experience noise levels sufficient to cause auditory injury if within close proximity of the SBP equipment. High Frequency cetaceans may experience noise levels sufficient to cause TTS if within close proximity of the SBP equipment.

The USBL will be operating at an SPL of 194 – 207 dB re 1µPa @1m (assumed to be 0-pk) in the frequency range 14-50 kHz. The transmitter characteristics are within the range of echo sounders used on a variety of vessels (including pleasure crafts and fishing vessels). This source level is below the thresholds for onset of PTS or TTS in low, high frequency cetaceans, phocid carnivores in water and European otter. However, as it exceeds the threshold for very high frequency cetaceans and marine turtles, there is the potential that animals may experience noise levels sufficient to cause auditory injury if within close proximity of the USBL equipment.

The most likely response of a marine mammal to noise levels that could induce auditory injury (PTS or TTS) is to flee from the ensonified area (Southall et al., 2007) and subsequently the onset of TTS can be referred to as the fleeing response. This is therefore a behavioural response that overlaps with disturbance ranges and animals exposed to these noise levels are likely to actively avoid hearing damage by moving away from the area. Therefore, the risk of auditory injury to cetaceans from use of geophysical survey and positioning equipment has been assessed as negligible.

The geotechnical survey equipment (Vibcrocore & Borehole) operates at an SPL of 142 – 190 dB re 1µPa @1m. The source level is below the thresholds for onset of PTS or TTS all cetacean species, phocid carnivores in water and European otter. The source level is above the threshold for TTS in marine turtles, but due to the rarity of the animals in the Application Area the risk of auditory injury has been assessed as negligible.

Basking sharks do not have a swim bladder or any other air-filled cavity, therefore they are incapable of detecting sound pressure and are not as vulnerable to trauma from extreme sound pressure changes as fish with swim bladders (Popper et al., 2014). The most appropriate guideline thresholds currently available are those for mortality and recoverable injury presented in Popper et al., (2014) for "Fish: no swim bladder", both of which are SPL peak >213 dB re 1 µPa.

The expected source level from a SBP could be above 213 dB re 1 µPa, therefore it can be concluded that there is a small risk of injury to basking shark from the surveys.

While research on the behavioural responses of low frequency sounds is lacking, studies of the responses of more acoustically sensitive fish species to airguns have generally shown startle responses and short-term changes in vertical position in the water column (Carroll et al., 2017).

Popper et al., (2014) present a qualitative scale for the relative risk of behavioural responses to sound. For fish with no swim bladder, the relative risk of response is high for near distances, moderate for intermediate distances and low for far distances, from the sound source (no assumptions are made on source or received level due to insufficient data).

Given the low numbers of basking shark likely to be present and the transient nature of the offshore survey the risk of auditory injury to Basking Shark from use of geophysical survey and positioning equipment has been assessed as negligible.

5.2.2.3. Risk of Disturbance

The 5 km EDR proposed by JNCC (2020) represents the limit range at which disturbance effects have been detected specifically for harbour porpoise. Evidence suggests that avoidance behaviour will be temporary, with individuals returning to the area affected once the sound has ceased (Stone and Tasker 2006, Thompson et al., 2013, Stone et al., 2017). The geophysical survey will be temporary, with the presence of the offshore survey vessel transient in any one location as it moves along the lines of survey. Therefore, any individuals that are disturbed will be able to return to the Application Area (noting that only a 500 m – 1000 m wide corridor within the Application Area will be surveyed) as soon as the vessel has passed through. Disturbance will therefore fit under the JNCC et al., (2010) classification of trivial as it will only lead to "sporadic disturbances without any likely negative impact on the species".

The geotechnical survey equipment operates at a source level below the threshold for auditory injury in cetacean species, phocid carnivores in water and European otter. The threshold for disturbance is lower than for injury, and the activity will be short in duration at each location (<24 hours for geotechnical boreholes and <1 hour for vibrocores). Protected species are therefore unlikely to be disturbed by noise from the geotechnical survey, unless they are in close proximity (<100 m) to the work. This is unlikely given the presence of the survey vessel which will lead to small-scale temporary displacement of animals.

Implementation of industry standard best practice mitigation, combined with the temporary nature of the proposed site investigations, will mean that disturbance effects to protected species will be temporary and not significant.

5.2.3. Visual / Physical Disturbance or Displacement

5.2.3.1. Visual disturbance to the Eurasian otter (*Lutra lutra*)

The landfall section of the Application Area falls within the habitat and foraging range of the Eurasian otter (*Lutra lutra*), however there are no SACs designated for otter on the east coast of Scotland.

The physical presence of the survey vessel/vessels offshore and of humans onshore, may cause some temporary disturbance to otters should they be in the immediate vicinity of the survey activities. This may result in otters temporarily avoiding their chosen feeding/resting location; however, they are likely to willingly move to another nearby location. The presence of one or two extra vessels in the area is not deemed a significant increase in vessel activity. Similarly, the presence of 2-3 people in the intertidal area is also not a significant increase in human activity on the shore, as they will be limited to 1-2 days duration.

Otters are subject to pressures on land and in water (freshwater and marine). Impacts that reduce the availability or quality of, or cause disturbance to, their terrestrial or aquatic habitats are likely to affect otters. Scotland's otters are most at risk from road accidents, the single biggest source of otter mortality (excluding natural causes). Other threats to otters include commercial eel fishing and 'creeling' for crustaceans (NatureScot 2020b).

The proposed surveys will not cause any permanent physical obstructions, there is no potential to alter the natural circulation of sediment and organic matter, or to cause changes to the existing sediment transport processes. The volume of sediment removed by the benthic and geotechnical surveys from the nearshore area is considered insignificant, and therefore there is no impact pathway identified that could cause any habitat destruction or alteration for the habitat of the otter.

In conclusion, it is deemed that the proposed surveys will not impact on the otter, directly or indirectly, due to the nature of the surveys, their short duration, their temporary and very localised effects, and limited emissions. Therefore, it is considered unlikely that there will be any significant effects either directly or indirectly on the otter or their habitat.

5.2.3.2. Visual disturbance to pinnipeds

Multiple studies have investigated the responses of hauled-out seals to the presence/approach of vessels. Wilson (2013) presents a review of such studies, and concludes that as an overall generalisation, unless habituation has been established by frequent non-intrusive visits, a safe boat distance for harbour and grey seals (i.e., one at which there is a low risk of significant numbers of seals flushing) is about 200 m. There is a designated haul-out site for grey seal (Ythan River mouth) that lies approximately 9 km away from the Application Area. This is located further than 200 m distance suggested by Wilson (2013) as a safe boat distance. The presence of the offshore survey vessel will be transient in any one location, as it moves through the Application Area (noting that the survey corridor within the Application Area is only 500 m to 1000 m wide). Therefore, any individuals that are disturbed will be able to return to the Application Area as soon as the vessel has passed through.

In conclusion, individual animals may experience short-term disturbance, but this will not lead to long-term displacement of animals and there will be no impact on the species population. Therefore, the risk from disturbance on pinnipeds has been assessed as negligible.

5.2.4. Cumulative Effects

Cumulative impacts arise when localised disturbance occurs from more than one activity occurring simultaneously but in proximity resulting in a wider zone of disturbance or exacerbating a barrier effect; or if surveys were to occur consecutively, lengthening the period of disturbance.

A search of marine licence and Section 36 consent applications processed by Marine Scotland identified projects which could potentially interact with the proposed cable route survey. These have been listed below in Table 5-3.

Table 5-3 : Marine licence and Section 36 consent applications

Applicant Name	License Ref	Type of Activity	Licence Period	License Status	Application Area
Scottish Hydro Electric Power Distribution Plc	EPS/BS-00010172	▪ USBL & SBP Geophysical Surveys	01/04/2023-31/03/2024	Granted	Moray Firth, Tay and Forth Marine Regions
Buchan Offshore Wind	EPS/BS-00010207	▪ Geophysical, Geotechnical and Benthic Survey	01/04/2023-30/09/2023	Granted	North of Peterhead to Buchan OWF
Scottish Hydro Electric	EPS/BS-00010242	▪ UXO Geophysical Survey	01/04/2023 – 31/03/2024	Submitted 07/03/2023	Peterhead to Drax

Applicant Name	License Ref	Type of Activity	Licence Period	License Status	Application Area
Transmission Plc					
Caledonia Offshore Wind Limited	EPS/BS-00010182	▪ Geophysical Survey	01/03/2023-29/02/2024	Granted	Moray Firth
MarramWind Limited	EPS/BS-00010197	▪ Geophysical, Geotechnical and Benthic Survey	01/03/2023-30/09/2023	Granted	North-east of Peterhead
Beatrice Offshore Windfarm	MS EPS 09 2020 0	▪ Geophysical and Benthic survey including inspection operations	07/07/2020-31/12/2023	Granted	Moray Firth
Aberdeen Offshore Windfarm	EPS/BS-00009123	▪ Geophysical Survey	10/04/2021-09/04/2026	Granted	Aberdeen Bay
Salamander Offshore Wind Farm	EPS/BS00010272	▪ Geophysical Survey	31/05/2023-31/07/2023	Granted	East of Peterhead

For the purposes of the assessment, it has been assumed that one or more surveys could be undertaken in proximity to the Application Area simultaneously or consecutively. Given the potential for additional surveys in the area, the proposed cable route surveys could have a significant cumulative impact in combination with other projects. Customer based discussions will be undertaken with other projects in proximity regarding co-location and co-existence.

Surveys within close proximity are unlikely to take place concurrently as data acquisition can be impaired if two or more geophysical surveys occur at the same time. It is therefore most likely that surveys would occur consecutively, resulting in an extension of the time period over which protected species are disturbed. They will not permanently exclude EPS or nationally protected species from part of their range, nor will they permanently prevent access for the species to suitable habitat therein. Widespread or prolonged disturbance is not predicted.

A study in the UK Southern North Sea SAC on the potential cumulative effects from a number of nearby windfarms on harbour porpoise (BEIS 2020a), concluded that seismic surveys did not have an adverse effect upon the integrity of the SAC. Harbour porpoise relocated and displacement was temporary. It is expected that the same behavioural response will be observed as the Application Area lies in open coastal waters where protected species have the ability to temporarily avoid the transient surveys.

The risk to protected species is negligible.

5.3. Proposed Mitigation Measures

The proposed surveys will be undertaken with relevant best practice guidelines in place. These are currently as follows:

- JNCC (2017) Guidelines for minimising the risk to injury to marine mammals from geophysical surveys.
- SNH (2017) Scottish Marine Wildlife Watching Code.

JNCC guidelines will be applied to reduce the risk of injury occurring from the SBP systems. No mitigation is required for the MBES. It is noted that adherence to the JNCC guidelines is considered by Statutory Nature Conservation Bodies to reduce the risk of injury to marine mammals from geophysical survey activities to negligible. The survey equipment and activities proposed here are well-within the envelope of those for which the guidelines were designed, with source levels and likely propagation of sound being considerably less than that generated by seismic survey using airgun arrays.

A Marine Mammal Mitigation Plan (MMMP) has been included in Appendix I and includes the following:

- A marine mammal observer will conduct a pre-shooting search for a minimum of 30 minutes prior to commencement of start of sub-bottom profiler systems. If a marine mammal is observed within a 500 m mitigation zone around the acoustic source, survey commencement will be delayed until 20 minutes after the marine mammal has left the mitigation zone or was last observed.

- Soft-start: The JNCC guidelines require that if possible, the operating power of the equipment will be ramped up gradually, in a uniform manner from a low-energy start-up, over a minimum period of 15 minutes. As acknowledged in the guidelines, this will not be possible with most of the sub-bottom systems as they are either off or on and therefore soft start cannot be used.
- Line change: If line changes (or other pauses) are expected to be longer than 40 minutes, equipment operation will be stopped at the end of the survey line and the pre-shooting search will be completed prior to resuming survey at full power. Where practical, equipment operation will also be stopped or operated at a reduced power or pulse rate during line changes/pauses expected to be less than 40 minutes.
- Unplanned breaks: Where there is a gap in data acquisition of greater than 10 minutes, a pre-shooting start will be completed prior to resuming survey at full power.
- Passive Acoustic Monitoring (PAM) system – to include as a minimum:
    - Towed streamer section containing at least 3 hydrophones with built in pre-amplifiers, depth sensor, tow cable, and deck cable;
    - High frequency data acquisition for cetacean clicks up to 175 kHz;
    - Medium frequency data acquisition for cetacean click and whistles up to 48 kHz;

Nearshore survey lines and the offshore survey lines will start at the shore end and progress offshore to minimise risk of flushing animals towards the beach.

If the marine mammal observer identifies basking shark ahead of the survey vessel, if possible, speed will be reduced to minimise the risk of collision with animals.

Information will be submitted to the JNCC Marine Noise Registry (MNR).

6. Conclusion

To determine whether the proposed survey activities are likely to deliberately injure or disturb EPS and nationally protected species a protected species risk assessment has been undertaken.

A review of the baseline identified that the following species are likely to be present within the Application Area:

- European Protected Species
    - Cetaceans: specifically harbour porpoise, bottlenose dolphin, white-beaked dolphin and minke whale. Other cetacean species may be infrequent or rare visitors to the area.
    - Marine turtles: leatherback turtles are occasional visitors to the area.

- Nationally Protected Species
    - Basking shark are occasional visitors to the area
    - Grey and harbour seal are present

A review of the proposed survey activities identified five potential impacts on Protected Species, namely:

- Physical collision with vessel(s)
- Risk of injury or disturbance from underwater noise changes
- Cumulative effects
- Hydrocarbon & PAH contamination – accidental spills
- Visual / physical disturbance or displacement

The risk assessment concluded the following:

- There is a negligible to low risk that protected species will collide with the nearshore and offshore survey vessels.
- The risk of auditory injury occurring in protected species from underwater noise is considered to be negligible.
- There is a low risk that individual animals will be disturbed by underwater noise changes from the geophysical equipment. However, the effects will be transient and short-term and will not lead to lead to long-term displacement of animals or impact on the FCS of any of the EPS present.
- The risk of cumulative effects from other surveys within close proximity to the Application Area is considered negligible.

- The risk of hydrocarbon and PAH contamination will be effectively managed through compliance with legislation.

There is a negligible risk that the presence of nearshore survey vessels will cause short-term visual disturbance to seals at haul-out sites.

Assessment of the potential for impact from geophysical survey concluded that there is the potential for the sounds emitted by the SBP and USBL to induce the onset of PTS (auditory injury) or cause potential for physical injury in cetaceans, pinnipeds and marine turtles at close range (<200 m). Mitigation has therefore been proposed. With the implementation of the industry standard mitigation the potential for the onset of auditory/physical injury to occur is negligible. Any disturbance from geophysical survey is likely to be localised, short term and reversible as evidenced by studies such as Bowles et al., (1994), Morton and Symonds (2002), Stone and Tasker (2006), Gailey et al., (2007), Thompson et al., (2013), and Stone et al., (2017).

Following the JNCC et al., (2010) guidance on whether activities constitute an offence under the Habitats Regulations it can be concluded that with mitigation, the impact of sound produced by operation of equipment used during the proposed geophysical survey is unlikely to be detrimental to the maintenance of the populations of the species concerned at a favourable conservation status in their natural range. There is no potential for an offence to occur as a result of the proposed survey alone.

In considering the potential for an offence to occur, the proposed survey was considered in-combination with the other proposed geophysical surveys occurring in the region. The assessment concluded that in-combination they will not permanently exclude EPS or nationally protected species from part of their range, nor will they permanently prevent access for the species to suitable habitat therein. Widespread or prolonged disturbance is not predicted. There will not be an adverse effect on the favourable conservation status of the EPS or nationally protected species, or significant disturbance of such species, as a result of in-combination effects.

In consideration of alternatives methods to the proposed survey works, a detailed inspection of the seabed is required in order to assess seabed conditions to finalise routeing and allow micro-siting and to ensure the most suitable option is put forward. There are no alternative methods available for the required seabed investigations to assess ground conditions.

In considering alternatives, a robust Options Appraisal process is undertaken whose principles include options which avoid or minimise and mitigate impacts on environmental or socio-economic constraints. These will generally be of benefit/advantage compared to those which have likely significant residual effects, as less environmentally or socially damaging routes support NGET and SHE Transmission's statutory duty under Schedule 9 of the Electricity Act 1989 to 'have regard to the desirability of preserving amenity' and will more readily achieve consent.

In conclusion, the proposed geophysical, geotechnical and benthic survey does not have any reasonable alternatives which would have a lesser or no impact on EPS.

References

Aarts, G., MacKenzie, M., McConnell, B., Fedak, M. and Matthiopoulos, J. 2008. Estimating space-use and habitat preference from wildlife telemetry data. Ecography, 31: 140-160.

Andersen, L.W., Ruzzante, D.E., Walton, M., Berggren, P., Bjørge, A. and Lockyer, C. 2001. Conservation genetics of harbour porpoises, Phocoena phocoena, in eastern and central North Atlantic. Conservation Genetics, 2L 309-324.

Anderwald, P. and Evans, P.G.H. 2010. Cetaceans of the East Grampian Region. Sea Watch Foundation, Oxford.

Anderwald, P., Evans, P.G.H., Dyer, R., Dale, A., Wright, P.J. and Hoelzel, A.R. 2012. Spatial scale and environmental determinants in minke whale habitat use and foraging. Marine Ecology Progress Series, 450: 259-274.

Anderwald, P., Evans, P.G.H., Gygax, L. and Hoelzel, A.R. 2011. Role of feeding strategies in seabird-minke whale associations. Marine Ecology Progress Series, 424: 219-227.

Arso Civil, M., Quick, N.J., Cheney, B., Pirotta, E., Thompson, P.M. and Hammond, P.S. 2019. Changing distribution of the east coast of Scotland bottlenose dolphin population and the challenges of area-based management. Aquatic Conservation: Marine and Freshwater Ecosystems, 29(S1): 178-196.

Arso Civil, M., Quick, N., Mews, S., Hague, E., Cheney, B.J., Thompson, P.M. and Hammond, P.S. 2021. Improving understanding of bottlenose dolphin movements along the east coast of Scotland. SMRU Consulting Final Report 2021 for the European Offshore Wind Deployment Centre, Environmental Research and Monitoring Programme.

Atkinson, C.J.L., Bergmann, M. and Kaiser, M.J. 2004. Habitat selection in whiting. Journal of Fish Biology, 64: 788-793.

Austin, R.A., Hawkes, L.A., Doherty, P.D., Henderson, S.M., Inger, R., Johnson, L., Pikelsey, S.K., Solandt, J-L., Speedie, C.D. and Witt, M.J. 2019. Predicting habitat suitability for basking sharks (Cetorhinus maximus) in UK waters using ensemble ecological niche modelling. Journal of Sea Research, 153: 101767.

Bailey, H., Hammond, P.S. and Thompson, P.M. 2014. Modelling harbour seal habitat by combing data from multiple tracking systems. Journal of Experimental Marine Biology and Ecology, 450: 30-39.

Barros, N.B. and Odell, D.K. 1990. Food habits of bottlenose dolphins in Southeastern United States. Pp. 309-328. In: The Bottlenose Dolphin Leatherwood, S. and Reeves, R.R. (Eds.). Academic Press, London, 653 pp.

Barros, N.B., Parsons, E.C.M. and Jefferson, T.A. 2000. Prey of offshore bottlenose dolphins from South China Sea. Aquatic Mammals, 26: 2-6.

Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B. and Moffat, C.F. (Editors). 2011. Scotland's Marine Atlas: Information on the national marine plan. Marine Scotland, Edinburgh. Pp. 191.

BEIS. (2020a). Review of Consented Offshore Wind Farms in the Southern North Sea Harbour Porpoise SAC. [Online]. Available at: Review of Consented Offshore Wind Farms in the Southern North Sea Harbour Porpoise SAC (publishing.service.gov.uk) [Accessed January 2023].

BEIS (2020b) Record of the Habitats Regulations Assessment undertaken under Regulation 5 of the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (as amended): BP Endurace Field Integrated Site Survey. Available at: Microsoft Word - BP Endurance Survey HRA Rev 2.2.docx (publishing.service.gov.uk) [Accessed March 2023].

Benjamins, S., Dale, A., van Geel, N. and Wilson, B. 2016. Riding the tide: use of a moving tidal-stream habitat by harbour porpoises. Marine Ecology Progress Series, 549: 275-288.

Benjamins, S., van Geel, N., Hastie, G., Elliott, J. and Wilson, B. 2017. Harbour porpoise distribution can vary at small spatiotemporal scales in energetic habitats. Deep Sea Research II, 141: 191-202.

Berrow, S., Massett, N., Whooley, P., Jann, B.V.M., Lopez-Suárez, P., Stevick, P.T. and Wenzel, F.W. 2021. Resightings of humpback whales (Megaptera novaeangliae) from Ireland to a known breeding ground: Cabo Verde, West Africa. Aquatic Mammals, 47(1): 63-70.

Berrow, S. and Whooley, P. 2022. Managing a dynamic North Sea in light of its ecological dynamics: Increasing occurrence of large baleen whales in the southern North Sea. Journal of Sea Research, 182: 102186.

Bertulli, C.G., Tetley, M.J., Magnúsdóttir, E.E. and Rasmussen, M.H. 2015. Observations of movement and site fidelity of white-beaked dolphins (Lagenorhynchus albirostris) in Icelandic coastal waters using photo-identification. Journal of Cetacean Research and Management, 15: 27-34.

BOEM (2016) Characteristics of sounds emitted during high-resolution marine geophysical surveys. U.S. OCS Study BOEM 2016-044 NUWC-NPT Technical Report 12, 203. Available at: https://espis.boem.gov/final%20reports/5551.pdf. [Accessed March 2023].

BOEM (2019) Finding of no significant impact: Proposed sand survey activities for BOEM's marine minerals program – Atlantic and Gulf of Mexico. Available at: MMP FONSI (boem.gov). [Accessed March 2023].

Booth, C.G., Embling, C., Gordon, J., Calderan, S.V. and Hammond, P.S. 2013. Habitat preferences and distribution of harbour porpoise (Phocoena phocoena) west of Scotland. Marine Ecology Progress Series, 478: 273-285.

Botterell, Z.L.R., Penrose, R., Witt, M.J. and Godley, B.J. 2020. Long-term insights into marine turtle sightings, strandings and captures around the UK and Ireland (1910-2018). Journal of the Marine Biological Association of the United Kingdom, 1-9.

Bouveroux, T., Waggitt, J., Belhadjer, A., Cazenave, P.W., Evans, P. and Kiszka, J. 2020. Modelling fine scale distribution and relative abundance of harbour porpoise in the Southern Bight of the North Sea using platform of opportunity data. Journal of the Marine Biological Association of the United Kingdom, 100(3): 481-489.

Bowen, D. 2016. Halichoerus grypus. The IUCN Red List of Threatened Species. e.T9660A45226042. https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T9660A45226042.en . Accessed on 14 April 2023.

Bowen, W.D., Iverson, S.J., McMillan, J.I. and Boness, D.J. 2006. Reproductive performance in grey seals: age related improvement and senescence in a capital breeder. Journal of Animal Ecology, 75(6): 1340-1351.

Bowles, A.E., Smultea, M., Wuesig, B., DeMaster, D.P. and Palka, P. (1994). Relative abundance and behavior of marine mammals exposed to transmissions from the Heard Island Feasibility Test. J Acoust Soc Am. 96 (4) 2469-84, doi 10.1121/1.410120. Available at https://pubmed.ncbi.nlm.nih.gov/7963037/. [Accessed April 2023].

Braulik, G. 2019. Lagenorhynchus acutus. The IUCN Red List of Threatened Species. e.T11141A50361160. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T11141A50361160.en . Accessed on 12 April 2023.

Braulik, G., Jefferson, T.A. and Bearzi, G. 2021. Delphinus delphis. The IUCN Red List of Threatened Species. e.T134817215A199893039. https://dx.doi.org/10.2305/IUCN.UK.2021-2.RLTS.T134817215A199893039.en . Accessed on 13 April 2023.

Braulik, G., Minton, G., Amano, M. and Bjørge, A. 2020. Phocoena phocoena. The IUCN Red List of Threatened Species 2020: eT17027A50369903 https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T17027A50369903.en . Accessed on 31 March 2023.

Brookes, K.L., Bailey, H. and Thompson, P.M. 2013. Predictions from harbour porpoise habitat association models are confirmed by long-term passive acoustic monitoring. Journal of the Acoustical Society of America, 134(3): 2523-2533.

Carroll, A. G., Przeslawski, R., Duncan, A., Gunning, M. & Bruce B. (2017). A critical review of the potential impacts of marine siemic surveys on fish & invertebrates. Available at https://www.researchgate.net/publication/311441406_A_critical_review_of_the_potential_impacts_of_marine_seismic_surveys_on_fish_invertebrates. [Accessed April 2023].

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. and Russell, D.J.F. 2022. Sympatric seals, satellite tracking and protected areas: Habitat based distribution estimates for conservation and management. Frontiers in Marine Science, 9: 875869.

Carter, M.I.D., Boehme, L., Duck, C.D., Grecian, W.J., Hastie, G.D., McConnell, B.J., Miller, D.L., Morris, C.D., Moss, S.E.W., Thompson, D., Thompson, P.M. and Russell, D.J.F. 2020. Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles. Report to BEIS. SMRU, University of St Andrews.

Cheney, B., Thompson, P.M., Ingram, S.N., Hammond, P.S., Stevick, P.T., Durban, J.W., Culloch, R.M., Elwen, S.H., Mandleberg, L., Janik, V.M., Quick, N.J., Islas-Villanueva, V., Robinson, K.P., Costa, M., Eisfeld, S.M., Walters, A., Phillips, C., Weir, C.R., Evans, P.G.H., Anderwald, P., Reid, R.J., Reid, J.B. and Wilson, B. 2013. Integrating multiple data sources to assess the distribution and abundance of bottlenose dolphins Tursiops truncatus in Scottish waters. Mammal Review, 43: 71-88.

Cipriano, F. 2018. Atlantic White-Sided Dolphin: Lagenorhynchus acutus. Encyclopaedia of Marine Mammals (Third Edition) (Würsig, B., Thewissen, J.G.M. and Kovacs, K.M. Eds). Academic Press. Elsevier Inc.

Clark, N.M., Tetley, M.J., Culloch, R.M., Mitchelson-Jacob, E.G. and Robinson, K.P. 2006. Harbour porpoise (Phocoena phocoena L.) have declined in the outer southern Moray Firth, NE Scotland – A spatial and temporal view. Poster presented at 20th Annual Conference of the European Cetacean Societym Gdynia, Poland, 3-6 April 2006.

Cooke, J.G. 2018a. Balaenoptera acutorostrata. The IUCN Red List of Threatened Species 2018. e.T2474A50348265. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T2474A50348265.en . Accessed on 06 April 2023.

Cooke, J.G. 2018b. Megaptera novaeangliae. The IUCN Red List of Threatened Species. e.T13006A50362794. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T13006A50362794.en . Accessed on 13 April 2023.

Cordes, L.S., Duck, C.D., Mackey, B.L., Hall, A.J. and Thompson, P.M. 2011. Long-term patterns in harbour seal site-use and the consequences for managing protected areas. Animal Conservation, 14: 430-438.

Culloch, R.M. and Robinson, K.P. 2008. Bottlenose dolphin 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.

Cunningham, L., Baxter, J.M., Boyd, I.L., Duck, C.D., Lonergan, M., Moss, S.E. and McConnell, B. 2009. Harbour seal movements and haul-out patterns: implications for monitoring and management. Aquatic Conservation: Marine and Freshwater Ecosystems, 19(4): 398-407.

DAHG (2014). Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters. Available at https://www.npws.ie/sites/default/files/general/Underwater%20sound%20guidance_Jan%202014.pdf . [Accessed March 2023].

Danson, E. (2005) Geotechnical & geophysical investigations for offshore and nearshore developments. International Society for Soil Mechanics and Geotechnical Engineering. Available at:https://www.kivi.nl/uploads/media/58a3570951450/Investigations%20for%20developments.pdf [Accessed March 2023]

Davenport, J. 1998. Sustaining endothermy on a diet of cold jelly: energetics of the leatherback turtles Dermochelys coriacea. The British Herpetology Society Bulletin, 62: 4-8.

de Boer, M. 2010. Spring distribution and density of minke whale Balaenoptera acutorostrata along an offshore bank in the central North Sea. Marine Ecology Progress Series, 408: 265-274.

de Boer, M., Eisfeld, S. and Simmonds, M.P. 2012. The Fine Scale Habitat Use of Risso's Dolphin off Bardsey Island, Cardigan Bay (UK). Proceedings of the First European Cetacean Society Workshop on Risso's Dolphin, Galway, 25 March 2012, p. 6.

Deecke, V.B., Nykänen, M., Foote, A.D. and Janik, V.M. 2011. Vocal behaviour and feeding ecology of killer whales Orcinus orca around Shetland, UK. Aquatic Biology, 13: 79-88.

Dellefosse, M., Rahbek, M.L., Roesen, L. and Clausen, K.T. 2018. Marine mammal sightings around oil and gas installations in the central North Sea. Journal of the Marine Biological Association of the United Kingdom, 98(5): 993-1001.

Dinis, A., Carvalho, A., Alves, F., Nicolau, C., Riberio, C., Kaufmann, M., Cañadas, A. and Freitas, L. 2016. Spatial and temporal distribution of bottlenose dolphins, Tursiops truncatus, in the Madeira archipelago, NE Atlantic. Arquipelago. Life and Marine Sciences, 33: 45-54.

Doherty, P.D., Baxter, J.M., Gell, F.R., Godley, B.J., Graham, R.T., Hall, G., Hall, J., Hawkes, L.A., Henderson, S.M., Johnson, L., Speedie, C. and Witt, M.J. 2017. Long-term satellite tracking reveals variable seasonal migration strategies for basking sharks in the north-east Atlantic. Scientific Reports, 7:42837.

Dolman, S., Hodgins, N., MacLeod, C.D., Pierce, G.J. and Weir, C.R. 2013. Harbour porpoises (Phocoena phocoena) and minke whales (Balaenoptera acutorostrata) observed during land-based surveys in The Minch, north-west Scotland. Journal of the Marine Biological Association of the United Kingdom, 94(6): 1185-1194.

Doyle, T.K., Houghton, J., O'Súilleabháin, P.F., Hobson, V.J., Marnell, F., Davenport, J. and Hays, G.C. 2008. Leatherback turtles satellite-tagged in European waters. Endangered Species Research, 4: 23-31.

Eckert, S.A. 2006. High-use oceanic areas for Atlantic leatherback sea turtles (Dermochelys coriacea) as identified using satellite telemetered location and dive information. Marine Biology, 149: 1257-1267.

Eckert, S.A., Eckert, K.L., Ponganis, P. and Kooyman, G.L. 1989. Diving behaviour of leatherback sea turtles (Dermochelys coriacea). Canadian Journal of Zoology, 67: 2834-2840.

Embling, C.B., Gillibrand, P.A., Gordon, J., Shrimpton, J., Stevick, P.T. and Hammond, P.S. 2010. Using habitat models to identify suitable sites for marine protected areas for harbour porpoises (Phocoena phocoena). Biological Conservation, 143: 267-279.

Erbe C. and McPherson C (2017). Underwater noise from geotechnical drilling and standard penetration testing. The Journal of the Acoustical Society of America (142). Available at https://asa.scitation.org/doi/10.1121/1.5003328 . [Accessed March 2023].

European Mammal Assessment team. 2007a. Phoca vitulina (Europe Assessment). The IUCN Red List of Threatened Species. e.T17013A6723347. Accessed on 14 April 2023.

European Mammal Assessment team. 2007b. Halichoerus grypus (Europe Assessment). The IUCN Red List of Threatened Species. E.T9660A13006007. Accessed on 14 April 2023.

Evans, P.G.H., Anderwald, P. and Baines, M.E. 2003. UK Cetacean Status Review. Report to English Nature and Countryside Council for Wales. Sea Watch Foundation, Oxford.

Evans, P.G.H., Baines, M.E. and Coppock, J. 2011. Abundance and behaviour of cetaceans and basking sharks in the Pentland Firth and Orkney Waters. Report by Hebog Environmental Ltd and Sea Watch Foundation. Scottish Natural Heritage Commissioned Report No. 419.

Fall, J. and Skern-Mauritzen, M. 2014. White-beaked dolphin distribution and association with prey in the Barents Sea. Marine Biology Research, 10(10): 957-971.

Fleming, A. and Jackson, J. 2011. Global review of humpback whales (Megaptera novaeangliae). NOAA Technical Memorandum NMFS. NOAA-TM-NMFS-SWFSC-474.

Foote, A.D. 2022. Are 'Type 2' killer whales long in the tooth? A critical reflection on the discrete categorisation of Northeast Atlantic killer whales. Marine Mammal Science, https://doi.org/10.1111/mms.12964 .

Foote, A.D., Newton, J., Piertney, S.B., Willersley, E. and Gilbert, M.T.P. 2009. Ecological, morphological and genetic divergence of sympatric North Atlantic killer whale populations. Molecular Ecology, 18L 5207-5217.

Foote, A.D., Similä, T., Víkingsson, G.A. and Stevick, P.T. 2010. Movement, site fidelity and connectivity in a top marine predator, the killer whale. Evolutionary Ecology, 24: 803-814.

Fossette, S., Girard, C., López-Mendilaharsu, M., Miller, P., Domingo, A., Evans, D., Kelle, L., Plot, V., Prosdocimi, L., Verhage, S., Gaspar, P. and Georges, J-Y. 2010. Atlantic leatherback migratory paths and temporary residence areas. PLoS One, 5(11): e13908.

Frost, M. and Diele, K. 2022. Essential spawning grounds of Scottish herring: current knowledge and future challenges. Reviews in Fish Biology and Fisheries, 32: 721-744.

Gailey, G., Wursig, B. and McDonald, T.L. (2007). Abundance, behavior and movement patterns of western gay whales in relation to a 3-D seismic survey, Northeast Sakhalin Island, Russia. Environ Monit Assess 134, 75 (2007). Available at: https://doi.org/10.1007/s10661-007-9812-1 [Accessed April 2023]

Ghoul A, Reichmuth C. Hearing in the sea otter (Enhydra lutris): auditory profiles for an amphibious marine carnivore. J Comp Physiol A Neuroethol Sens Neural Behav Physiol. 2014 Nov;200(11):967-81. doi: 10.1007/s00359-014-0943-x. Epub 2014 Sep 24. PMID: 25249386. [Accessed May 2023].

Gilles, A., Scheidat, M. and Siebert, U. 2009. Seasonal distribution of harbour porpoise and possible interference of offshore wind farms in the German North Sea. Marine Ecology Progress Series, 383: 295-307.

Gilles, A., Viquerat, S., Becker, A., Forney, K.A., Geelhoed, C.V., Haelters, J., Nabe-Nielsen, J., Scheidat, M., Siebert, U., Sveegaard, S., van Beest, F.M., van Bemmelen, R. and Aarts, G. 2016. Seasonal habitat-based density models for a marine top predator, the harbor porpoise, in a dynamic environment. Ecosphere, 7(6): e01367.

Girondot, M., Mourrain, B., Chevallier, D. and Godfrey, M.H. 2021. Maturity of a giant: age and size reaction norm for sexual maturity for Atlantic leatherback turtles. Marine Ecology, 00: e12631.

Godley, B.J., Gaywood, M.J., Law, R.J., McCarthy, C.J., McKenzie, C., Patterson, I.A.P., Penrose, R.S., Reid, R.J. and Ross, H.M. 1998. Patterns of marine turtle mortality in British Waters (1992-1996) with reference to tissue contaminant levels. Journal of the Biological Association of the United Kingdom, 78: 973-984.

Gordon, J. G., Gillespie, D., Potter, J., Frantzis, A., Simmonds, M., Swift, R. J. and Thompson, D. (2004) A review of the effects of seismic survey on marine mammals. Marine Technology Society Journal, 37, pp.14-34.

Gore, M.A., Rowat, D., Hall, J., Gell, F.R. and Ormond, R.F. 2008. Transatlantic migration and deep mid-ocean diving by basking shark. Biology Letters, 4(4): 395-398.

Goverse, E., Janse, M., Zwartepoorte, H., McLean, P., Bonnet, P., Oosterbaan, A., Hilterman, M. and Dondorp, E. 2014. Notes on Sea Turtles from the Netherlands: An Overview 1707-2013. Marine Turtle Newsletter, 141: 3-7.

Grellier, K. and Lacey, C. 2012. Analysis of The Crown Estate aerial survey data for marine mammals for the FTOWDG region. SMRULSGW-2012-015. Unpublished report to The FTOWDG.

Hague, E.L., Sinclair, R.R. and Sparling, C.E. 2020. Regional baselines for marine mammal knowledge across the North Sea and Atlantic areas of Scottish waters. Scottish Marine and Freshwater Science, 11(12). Marine Scotland Science.

Hammond, P.S., Macleod, K., Berggren, P., Borchers, D.L., Burt, L., Cañadas, A., Desportes, G., Donovan, G.P., Gilles A., Gillespie, D., Gordon, J., Hilby, L., Kuklik, I., Leaper, R., Lehnert, K., Leopold, M., Lovell, P., Øien, N., Paxton, C.G.M., Ridoux, V., Rogan, E., Samarra, F., Schiedat, M., Sequeira, M., Siebert, U., Skov, H., Swift, R., Tasker, M.L., Teilmann, J., Van Canneyt, O. and Vázquez,

J.A. 2013. Cetacean abundance and distribution in European Atlantic shelf waters to inform conservation and management. Biological Conservation, 164: 107-122.

Hammond, P.S., Northridge, S.P., Thompson, D., Gordon, J.C.D., Hall, A.J., Sharples, R.J., Grellier, K. and Mattiopoulos, J. 2004. Background information on marine mammals relevant to Strategic Environment Assessment 5. Sea Mammal Research Unit, University of St Andrews.

Hammond, P.S. and Wilson, L.J. 2016. Grey seal diet composition and prey consumption. Scottish Marine and Freshwater Science, 7(20). Marine Scotland Science.

Hammond, P.S., Lacey, C., Gilles, A., Viquerat, S., Börjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M.B., Scheidat, M., Teilmann, J., Vingada, J. and Øien, N. 2021. Estimates of cetacean abundance in European Atlantic waters in summer 2016 from SCANS-III aerial and shipboard surveys. SMRU, University of St Andrews.

Hanson, N., Thompson, D., Duck, C., Baxter, J. and Lonergan, M. 2015. Harbour seal (Phoca vitulina) abundance within the Firth of Tay and Eden Estuary, Scotland: recent trends and extrapolation to extinction. Aquatic Conservation: Marine and Freshwater Ecosystems.

Hastie, G.D., Wilson, B. and Thompson, P.M. 2003. Fine-scale habitat selection by coastal bottlenose dolphins: application of a new land-based video-montage technique. Canadian Journal of Zoology, 81: 469-478.

Hastie, G.D., Wilson, B., Wilson, L.J., Parsons, K.M. and Thompson, P.M. 2004. Functional mechanisms underlying cetacean distribution patters: hotspots for bottlenose dolphins are linked to foraging. Marine Biology, 144: 397-403.

Hátún, H., Arge, J. and Sandø, A.B. 2007. Environmental influence on the spawning distribution and migration pattern of northern blue whiting (Micromesistius poutassou). ICES CM 2007/B:06.

Hays, G.C., Hobson, V.J., Metcalfe, J.D., Righton, D. and Sims, D.W. 2006. Flexible foraging movements of leatherback turtles across the North Atlantic Ocean. Ecology, 87(10): 2647-2656.

Hays, G.C., Houghton, J.D.R. and Myers, A.E. 2004a. Pan-Atlantic leatherback turtle movements. Nature, 429: 522.

Hays, G.C., Houghton, J.D.R., Isaacs, C., King, R.S., Lloyd, C. and Lovell, P. 2004b. First records of oceanic dive profiles for leatherback turtles (Dermochelys coriacea) indicate behavioural plasticity associated with long distance migration. Animal Behaviour, 67: 733-741.

Heide-Jørgensen, M.P., Nordøy, E.S., Øien, N., Folkow, L.P., Kleivane, L., Blix, A.S., Jensen, M.V. and Laidre, K.L. 2001. Satellite tracking of minke whales (Balaenopatera acutorostrata) off the coast of northern Norway. Journal of Cetacean Research and Management, 3(2): 175-178.

Heinänen, S. and Skov, H. 2015. The identification of discrete and persistent areas of relatively high harbour porpoise density in the wider UK marine area. JNCC Report No. 544. JNCC, Peterborough.

Hernandez-Milian, G., Begoña Santos, M., Reid, D. and Rogan, E. 2016. Insights into the diet of Atlantic white-sided dolphins (Lagenorhynchus acutus) in the Northeast Atlantic. Marine Mammal Science, 32(2): 735-742.

Holland, G.J., Greenstreet, S.P.R., Gibb, I.M., Fraser, H.M. and Robertson, M.R. 2005. Identifying sandeel Ammodytes marinus sediment habitat preferences in the marine environment. Marine Ecology Progress Series, 303: 269-282.

Hopkins, A. (2007) Recommended operating guidelines (ROG) for swath bathymetry. MESH. Available at: https://webarchive.nationalarchives.gov.uk/ukgwa/20101014083441/http:/www.searchmesh.net/PDF/GMHM3_Swath_Bathymetry_ROG.pdf (nationalarchives.gov.uk) [Accessed March 2023]

Houghton, J.D.R., Doyle, T.K., Wilson, M.W., Davenport, J. and Hays, G.C. 2006. Jellyfish aggregations and leatherback turtle foraging patterns in a temperate coastal environment. Ecology, 87(8): 1967-1972.

Huon, M., Planque, Y., Jessopp, M.J., Cronin, M., Caurant, F. and Vincent, C. 2021. Fine-scale foraging habitat selection by two diving central place foragers in the Northeast Atlantic. Ecology and Evolution, 11: 12349.

IAMMWG (Inter-Agency Marine Mammal Working Group). 2015. Management Units for cetaceans in UK waters (January 2015). JNCC Report No. 547. JNCC, Peterborough, ISSN 0963-8091.

IAMMWG (Inter-Agency Marine Mammal Working Group). 2022. Updated abundance estimates for cetacean Management Units in UK waters. JNCC Report No. 680 (Revised March 2022). JNCC, Peterborough, ISSN 0963-8091.

ICES. 2014. ICES Advice May 2014: OSPAR Request on Implementation of MSFD for Marine Mammals. Report and Recommendations of the MSFD Working Group. 21st ASCOBANS Advisory Committee Meeting. Gothenburg, Sweden, 29 September – 1 October 2014.

ICES. 2016. ICES Ecosystem Overviews Greater North Sea Ecoregion. Version 2, published 04 March 2016. ICES CIEM.

IOOA (2020) Seismic source modelling report: A feasibility study of low energy seismic sources for mitigation purposes. Available at: https://www.iooa.ie/wp-content/uploads/2021/02/SEISMIC-SOURCE-MODELLING-REPORT.pdf. [Accessed March 2023].

Isojunno, S., Matthiopoulos, J. and Evans, P.G.H. 2012. Harbour porpoise habitat preferences: robust spatio-temporal inferences from opportunistic data. Marine Ecology Progress Series, 448: 155-170.

IUCN (International Union for the Conservation of Nature). 2023. The IUCN Red List of Threatened Species. Version 2022-2. http://www.iucnredlist.org. Downloaded on 30 March 2023.

IUCN SSC Cetacean Specialist Group. 2007a. Regional assessment by European Mammal assessment team. Phocoena phocoena (Europe Assessment). The IUCN Red List of Threatened Species 2007: eT17027A6734714. Accessed on 31 March 2023.

IUCN SSC Cetacean Specialist Group. 2007b. Regional assessment by European Mammal assessment team. Tursiops truncatus (Europe Assessment). The IUCN Red List of Threatened Species 2007: eT22563A9374943. Accessed on 31 March 2023.

IUCN SSC Cetacean Specialist Group. 2007c. Regional assessment by European Mammal assessment team. Balaenoptera acutorostrata (Europe Assessment). The IUCN Red List of Threatened Species 2007: eT4274A9443827. Accessed on 6 April 2023.

IUCN SSC Cetacean Specialist Group. 2007d. Regional assessment by European Mammal assessment team. Lagenohrynchus albirostris (Europe Assessment). The IUCN Red List of Threatened Species 2007: eT11142A3256072. Accessed on 6 April 2023.

IUCN SSC Cetacean Specialist Group. 2007d. Regional assessment by European Mammal assessment team. Lagenohrynchus acutus (Europe Assessment). The IUCN Red List of Threatened Species e.T11141A3255555. Accessed on 12 April 2023.

IUCN SSC Cetacean Specialist Group. 2007e. Regional assessment by European Mammal assessment team. Delphinus delphis (Europe Assessment). The IUCN Red List of Threatened Species e. T134817215A195828797. Accessed on 13 April 2023.

IUCN SSC Cetacean Specialist Group. 2007f. Regional assessment by European Mammal assessment team. Orcinus orca (Europe Assessment). The IUCN Red List of Threatened Species e.T15421A4581006. Accessed on 12 April 2023.

IUCN SSC Cetacean Specialist Group. 2007g. Regional assessment by European Mammal assessment team. Grampus griseus (Europe Assessment). The IUCN Red List of Threatened Species e.T9461A12989112. Accessed on 13 April 2023.

IUCN SSC Cetacean Specialist Group. 2007h. Regional assessment by European Mammal assessment team. Globicephala melas (Europe Assessment). The IUCN Red List of Threatened Species e.T9250A12974694. Accessed on 13 April 2023.

IUCN SSC Cetacean Specialist Group. 2007i. Regional assessment by European Mammal assessment team. Megaptera novaeangliae (Europe Assessment). The IUCN Red List of Threatened Species e.T13006A3405123. Accessed on 13 April 2023.

Jensen, H., Rindorf, A., Wright, P.J. and Mosegaard, H. 2011. Inferring the location and scale of mixing between habitat areas of lesser sandeel through information from the fishery. ICES Journal of Marine Science, 68(1): 43-51.JNCC et al (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. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/850708/Draft_Guidance_on_the_Protection_of_Marine_European_Protected_Species_from_Injurt_and_Disturbance.pdf. [Accessed March 2023].

JNCC. 2015. Natura 2000 – Standard Data Form for sites within the 'UK national site network of European Sites'. UK0030311 Firth of Tay and Eden Estuary. JNCC, Peterborough.

JNCC. 2019a. European Community Directive on the Conservation of Natural Habitats and Wild Flora and Fauna (92/43/EEC). Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018. Conservation status assessment for the species: S1351 Harbour porpoise (Phocoena phocoena). UNITED KINGDOM.

JNCC. 2019b. European Community Directive on the Conservation of Natural Habitats and Wild Flora and Fauna (92/43/EEC). Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018. Conservation status assessment for the species: S1349 Bottlenose Dolphin (Tursiops truncatus). UNITED KINGDOM.

JNCC. 2019c. European Community Directive on the Conservation of Natural Habitats and Wild Flora and Fauna (92/43/EEC). Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018. Conservation status assessment for the species: S2618 Minke Whale (Balaenoptera acutorostrata). UNITED KINGDOM.

JNCC. 2019d. European Community Directive on the Conservation of Natural Habitats and Wild Flora and Fauna (92/43/EEC). Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018. Conservation status assessment for the species: S2032 – White-beaked Dolphin (Lagenorhynchus albirostris) UNITED KINGDOM.

JNCC. 2019e. European Community Directive on the Conservation of Natural Habitats and Wild Flora and Fauna (92/43/EEC). Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018. Conservation status assessment for the species: S1365 – Common Seal (Phoca vitulina) UNITED KINGDOM.

JNCC. 2019f. European Community Directive on the Conservation of Natural Habitats and Wild Flora and Fauna (92/43/EEC). Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018. Conservation status assessment for the species: S1364 – Grey Seal (Halichoerus grypus) UNITED KINGDOM.

JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys (2017). Available at https://data.jncc.gov.uk/data/e2a46de5-43d4-43f0-b296-c62134397ce4/jncc-guidelines-seismicsurvey-aug2017-web.pdf. [Accessed March 2023].

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. Available at https://data.jncc.gov.uk/data/2e60a9a0-4366-4971-9327-2bc409e09784/JNCC-Report-654-FINAL-WEB.pdf. [Accessed March 2023].

JNCC. 2023. Isle of May Designated Special Area of Conservation. Accessed on 14 April 2023 from https://sac.jncc.gov.uk/site/UK0030172 .

Jefferson, T.A., Weir, C.R., Anderson, R.C., Ballance, L.T., Kenney, R.D. and Kiszka, J.J. 2014. Global distribution of Risso's dolphin Grampus griseus: a review and critical evaluation. Mammal Review, 44: 56-68.

Jones, L.S., Bouveret, L., Stevick, P.T., Thomason, B., Wenzel, F.W. and Whooley, P. 2007. First humpback whale resighting from the British Isles to a breeding ground. Poster presented at the 22nd Biennial Conference on Biology of Marine Mammals, Halifax, Nova Scotia, October 22 – 27 2017.

Jones, E.L., McConnell, B.J., Smout, S., Hammond, P.S., Duck, C.D., Morris, C.D., Thompson, D., Russell, D.J.F., Vincent, C., Cronin, M., Sharples, R.J. and Matthiopoulos, J. 2015. Patterns of space use in sympatric marine colonial predators reveal scales of spatial partitioning. Marine Ecology Progress Series, 534: 235-249.

Jourdain, E., Ugarte, F., Víkingsson, G.A., Samarra, F.I.P., Ferguson, S.H., Lawson, J., Vongraven, D. and Desportes, G. 2019. North Atlantic killer whale Orcinus orca populations: a review of current knowledge and threats to conservation. Mammal Review,

Kastelein, R.A., Hardman, J. and Boer, H. 1997. Food consumption and body weight of harbour porpoises (Phocoena phocoena). In: The Biology of the Harbour Porpoise (Read, A.J., Wiepkema, P.R. and Nachtigall, P.E. Eds.). De Spil Publishers, pp. 217-233.

Kavanagh, A.S., Kett, G., Richardson, N., Rogan, E. and Jessopp, M.J. 2018. High latitude winter sightings of common minke whale calves (Balaenoptera acutorostrata) in the Northeast Atlantic. Marine Biodiversity Records, 11: 22.

Kessler, L. 2021. Stomach contents of common dolphins (Delphinus delphis) and striped dolphins (Stenella coeruleoalba) in Scottish waters between 1992 and 2011. Masters 2 Sciences Pour l'Environnement, parcours Gestion de l'Environnement et Écologie Littorale, La Rochelle Université.

Kettemer, L.E., Rikardsen, A.H., Biuw, M., Broms, F., Mul, E. and Blanchet, M-A. 2021. Round-trip migration and energy budget of a breeding female humpback whale in the Northeast Atlantic. PLoS One, 17(5): e0268355.

Kinze, C.C. 2018. White-beaked dolphin Lagenorhynchus albirostris. In: Encyclopedia of Marine Mammals Third Edition. (Wursig, B., Thewissen, J.G.M. and Kovacs, K.M. Eds.). Academic Press, San Diego, California. Pp. 1077-1079.

Kiszka, J. and Braulik, G. 2018a. Lagenorhynchus albirostris. The IUCN Red List of Threatened Species. e.T11142A50361346. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T11142A50361346.en . Accessed on 06 April 2023.

Kiszka, J. and Braulik, G. 2018b. Grampus griseus. The IUCN Red List of Threatened Species. e.T9461A50356660. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T9461A50356660.en . Accessed on 13 April 2023.

Lacey, C., Gilles, A., Börjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M.B., Scheidat, M., Teilmann, J., Sveegaard, S., Vingada, J., Viquerat, S., Øien, N. and Hammond, P.S. 2022. Modelled density surfaces of cetaceans in European Atlantic waters in summer 2016 from SCANS-III aerial and shipboard surveys. SMRU, University of St Andrews.

Laist, D. W., Knowlton, A. R., Mead, J. G., Collet, A. S., Podesta, M. (2001), Collisions between ships and whales. Marine Mammal Science, 17 (I):35-75. Available at https://www.researchgate.net/publication/235768458_Collisions_between_ships_and_whales . [Accessed March 2023].

Learmonth, J.A., Murphy, S., Luque, P.L., Reid, R.J., Patterson, A.P., Brownlow, A., Ross, H.M., Barley, J.P., Santos, M.B. and Pierce, G.J. 2014. Life history of harbor porpoises (Phocoena phocoena) in Scottish (UK) waters. Marine Mammal Science, 30(4): 1427-1455.

Leopold, M.F., Rotshuizen, E. and Evans, P.G.H. 2018. From nought to 100 in no time: how humpback whales (Megaptera novaeangliae) came into the southern North Sea. Lutra, 61(1): 165-188.

Lockyer, C.H., Desportes, G., Hansen, K., Labberté, S. and Siebert, U. 2003. Monitoring growth and energy utilisation of the harbour porpoise (Phocoena phocoena) in human care. NAMMCO Scientific Publications 5, 107-120.

Lonergan, M., Duck, C.D., Thompson, D., Moss, S. and McConnell, B. 2011. British grey seal (Halichoerus grypus) abundance in 2008: an assessment based on aerial counts and satellite telemetry. ICES Journal of Marine Science, 68(10): 2201-2209.

Louis, M., Viricel, A., Lucas, T., Peltier, H., Alfonsi, E., Berrow, S., Brownlow, A., Covelo, P., Dabin, W., Deaville, R., de Stephanis, R., Gally, F., Gauffier, P., Penrose, R., Silva, M.A., Guinet, C. and Simon-Bouhet, B. 2014. Habitat-driven population structure of bottlenose dolphins, Tursiops truncatus, in the North-East Atlantic. Molecular Ecology, 23(4): 857-874.

Lowry, L. 2016. Phoca vitulina. The IUCN Red List of Threatened Species. e.T17013A45229114. https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T17013A45229114.en . Accessed on 14 April 2023.

Luque, P.L., Davis, C.G., Reid, D.G., Wang, J. and Pierce, G.J. 2006. Opportunistic sightings of killer whales from Scottish pelagic trawlers fishing for mackerel and herring off North Scotland (UK) between 2000 and 2006. Aquatic Living Resources, 19: 403-410.

Lurton D. and DeRuiter S. (2011). Sound radiation of seafloor mapping echosounders in the water column, in relation to the risks posed to marine mammals. Available at https://archimer.ifremer.fr/doc/00115/22607/20313.pdf. [Accessed March 2023].

Mackay, M.M. 2015. Occurrence patterns and social behaviours of humpback whales (Megaptera novaeangliae) wintering off Puerto Rico, USA. Dissertation for Doctor of Philosophy, submitted to the Office of Graduate and Professional Studies of Texas A&M University.

MacLeod, C.D., Bannon, S.M., Brereton, T. and Wall, D. 2007a. Using passenger ferries to study seasonal patterns to study seasonal patterns of minke whale occurrence in NW Europe. In: Proceedings of the Workshop An Integrated Approach to Non-Lethal Research on Minke Whales in European Waters (Robinson, K.P., Stevick, P.T. and MacLeod, C.D. Eds.). Held at the 21st Annual Meeting of the European Cetacean Society, Donostia, San Sebastián, Spain, 22 April 2007.

MacLeod, C.D., Santos, M.B., Burns, F., Brownlow, A. and Pierce, G.J. 2014. Can habitat modelling for the octopus Eledone cirrhosa help identify key areas for Risso's dolphin in Scottish waters? Hydrobiologia, 725: 125-136.

MacLeod, C.D., Weir, C.R., Santos, B.M. and Dunn, T.E. 2008. Temperature-based summer habitat partitioning between white-beaked and common dolphins around the United Kingdom and Republic of Ireland. Journal of the Marine Biological Association of the United Kingdom, 88(6): 1193-1198.

MacLeod, C.D., Weir, C.R., Pierpoint, C. and Harland, E.J. 2007b. The habitat preferences of marine mammals west of Scotland (UK). Journal of the Marine Biological Association of the United Kingdom, 87: 157-164.

Macleod, K. 2004. Abundance of Atlantic white-sided dolphin (Lagenorhynchus acutus) during summer of northwest Scotland. Journal of Cetacean Research and Management, 6(1): 33-40.

Macleod, K., Fairbairns, R., Gill, A., Fairbairns, B., Gordon, J.C.D., Blair-Myers, C. and Parsons, E.C.M. 2004. Seasonal distribution of minke whales Balaenoptera acutorostrata in relation to physiography and prey off the Isle of Mull, Scotland. Marine Ecology Progress Series, 277: 263-274.

Marçalo., Nicolau, L., Giménez, J., Ferreira, M., Santos, J., Araújo, H., Silva, A., Vingada, J. and Pierce, G.J. 2018. Feeding ecology of the common dolphin (Delphinus delphis) in Western Iberian waters: has the decline in sardine (Sardina pilchardus) affected dolphin diet? Marine Biology, 165: 44.

Marine Scotland (2014). Guidance on the Offence of Harassment at Seal Haul-out Sites. Available at https://consult.gov.scot/marine-environment/possible-designation-of-a-seal-haul-out-site/user_uploads/guidance-on-the-offence-of-harassment-at-seal-haul-out-sites.pdf-1. [Accessed March 2023].

Marine Scotland (2020) The Protection of Marine European Protected Species from Injury and Disturbance: Guidance for Scottish Inshore Waters. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2020/07/marine-european-protected-species-protection-from-injury-and-disturbance/documents/marine-european-protected-species-guidance-july-2020/marine-european-protected-species-guidance-july-2020/govscot%3Adocument/EPS%2Bguidance%2BJuly%2B2020.pdf [Accessed March 2023].

McConnell, B.J., Fedak, M.A., Lovell, P. and Hammond, P.S. 1999. Movements and foraging areas of grey seals in the North Sea. Journal of Applied Ecology, 36: 573-590.

McHahon, 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(7): 1330-1338.

Mcneill, L. 2023. Scottish Humpback ID/Firth of Forth Whale and Dolphins. Facebook Page. https://www.facebook.com/groups/ScottishHumpbackID

Minton, G., Reeves, R. and Braulik, G. 2018. Globicephala melas. The IUCN Red List of Threatened Species. e.T9250A50356171. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T9250A50356171.en . Accessed on 13 April 2023.

Morris, C.D., Duck, C.D. and Thompson, D. 2021. Aerial surveys of seals in Scotland during harbour seal moult, 2016-2019. NatureScot Research Report 1256.

Morton, A. and Symonds, H.K. (2002). Displacement of Orcinus orca (L.) by high amplitude sound in British Columbia, Canada. ICES Journal of Marine Science. 59(1). pp 71-80. DOI: 10.1006/jmsc.2001.1136. Available at https://academic.oup.com/icesjms/article/59/1/71/650034. [Accessed April 2023].

Murphy, S., Pinn, E.H. and Jepson, P.D. 2013. The short-beaked common dolphin (Delphinus delphis) in the North-East Atlantic: Distribution, ecology, management and conservation status. Oceanography and Marine Biology: An Annual Review, 51: 193-280.

National Biodiversity Network Trust – Atlas (Scotland). Available at https://species.nbnatlas.org/. [Accessed March 2023].

NatureScot (2019). Draft Advice Scottish MPAs and fisheries Basking Shark. Available at https://www.nature.scot/sites/default/files/2019-06/Marine%20Protected%20Area%20-%20Fisheries%20Guidance%20Note%20-%20Basking%20Shark%20%20June%202019.pdf#:~:text=Basking%20sharks%20are%20most%20at%20risk%20from%20collisions,physical%20presence%20of%20fishing%20vessels%20may%20cause%20disturbance%2C. [Accessed April 2023].

NatureScot (2020a) Basking sharks. Available at: https://www.nature.scot/plants-animals-and-fungi/fish/sea-fish/basking-shark [Accessed March 2023].

NatureScot (2020b). Otter. Available at https://www.nature.scot/plants-animals-and-fungi/mammals/land-mammals/otter. [Accessed April 2023].

NatureScot (2020c). Seals. Available at https://www.nature.scot/plants-animals-and-fungi/mammals/marine-mammals/seals. [Accessed April 2023].

NatureScot. (2020d). Conservation and Management Advice. Southern Trench MPA. NatureScot. Downloaded from https://sitelink.nature.scot/site/10477 on 4 May 2023.

NBN Atlas. 2021. Cetorhinus maximus. Downloaded from: Cetorhinus maximus : Basking Shark | NBN Atlas on the 17th April 2023.

Neumann, D.R. 2001. Seasonal movements of short-beaked common dolphins (Delphinus delphis) in the north-western Bay of Plenty, New Zealand: Influence of sea surface temperature and El Niño/La Niña. New Zealand Journal of Marine and Freshwater Research, 35(2): 371-374.

Nielsen, K.A., Robbins, J.R. and Embling, C.B. 2021. Spatio-temporal patterns in harbour porpoise density: citizen science and conservation in UK seas. Marine Ecology Progress Series

Ó Cahdla, O., Mackey, M., de Aquilar Soto, N., Rogan, E. and Connolly, N. 2014. Cetaceans and Seabirds of Irelands Atlantic Margin. Volume II. Cetacean distribution & abundance. Report on research carried out under the Irish Infrastructure Programme (PIP): Rockall Studies Group (RSG) projects 98/6 and 00/13, Porcupine Studies Group project P00/15 and Offshore Support Group (OSG) project 99/38. 82 pp.

O'Neil, K.E., Cunningham, E.G. and Moore, D.M. 2019. Sudden seasonal occurrence of humpback whales Megaptera novaeangliae in the Firth of Forth, Scotland and first confirmed movement between high-latitude feeding grounds and United Kingdom waters. Marine Biodiversity Records, 12:12.

Oviedo Correa, L., Fernández, M., Pacheco-Polanco, J.D. and Herra-Miranda, D. 2019. Spatial analysis on the occurrence of inshore and offshore bottlenose dolphins (Tursiops truncatus) in Osa Peninsula waters and Golf Dulce, Costa Rica. Journal of Cetacean Research and Management, 20: 1-11.

Palmer, K.J., Brookes, K.L., Davies, I.M., Edwards, E. and Rendell, L. 2019. Habitat of a coastal delphinid population investigated using passive acoustic monitoring. Aquatic Conservation: Marine and Freshwater Ecosystems, 29(S1): 257-270.

Parvin S J, Nedwell J R and Harland E (2007). Lethal and physical injury of marine mammals, and requirements for Passive Acoustic Monitoring. Subacoustech Report 565R0212, report prepared for the UK Government Department for Business, Enterprise and Regulatory Reform. Available at https://tethys.pnnl.gov/sites/default/files/publications/Subacoustech_2007.pdf. [Accessed March 2023].

Pate, S.M. and McFee, W.E. 2012. Prey species of Bottlenose Dolphins (Tursiops truncatus) from South Carolina Waters. Southeastern Naturalist, 11(1): 1-22.

Paxton, C.G.M., Scott-Hayward, L.A.S. and Rexstad, E. 2014. Statistical approaches to aid the identification of Marine Protected Areas for minke whale, Risso's dolphin, white-beaked dolphin and basking shark. Scottish Natural Heritage Commissioned Report No. 594.

Pierce, G.J., Santos, M.B., Reid, R.J., Patterson, I.A.P. and Ross, H.M. 2004. Diet of minke whales Balaenoptera acutorostrata in Scottish (UK) waters with notes on strandings of this species in Scotland 1992 – 2002. Journal of the Marine Biological Association of the United Kingdom, 84: 1241-1244.

Popper, A., Hawkins, A., Fay, R., Mann, D., Bartol, S., Carlson, T., Coombs, S., Ellison, W., Gentry, R., Halvorsen, M., Løkkeborg, S., Rogers, P., Southall, B., Zeddies, D. and Tavolga, W. (2014), ASA S3/SC1.4 TR-2014 Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. 10.1007/978-3-319-06659-2.

Quick, N., Arso, M., Cheney, B., Islas, V., Janik, V., Thompson, P.M. and Hammond, P.S. 2014. The east coast of Scotland bottlenose dolphin population: Improving understanding of ecology outside of the Moray Firth SAC. 14D/086. Document produced as part of the UK Department of Energy and Climate Change's offshore energy Strategic Environmental Assessment programme.

Reeds, K.A. 2004. Dermochelys coriacea Leatherback turtle. In Tyler-Walters H. and Hiscock K. Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 16-04-2023]. Available from: https://www.marlin.ac.uk/species/detail/1534

Reeves, R., Pitman, R.L. and Ford, J.K.B. 2017. Orcinus orca. The IUCN Red List of Threatened Species. e.T15421A50368125. https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T15421A50368125.en. Accessed on 12 April 2023

Reid, J.B., Evans, P.G.H. and Northridge, S.P. 2003. Atlas of cetacean distribution in north-west European waters. Joint Nature Conservation Committee, Peterborough.

Richardson, A.J., Walne, A.W., John, A.W.G., Jonas, T.D., Lindley, J.A., Sims, D.W., Stevens, D. and Witt, M.J. 2006. Using continuous plankton recorder data. Progress in Oceanography, 68: 27-74.

Rigby, C.L., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Francis, M.P., Herman, K., Jabado, R.W., Liu, K.M., Marshall, A., Romanov, E. and Kyne, P.M. 2021. Cetorhinus maximus (amended version of 2019 assessment). The IUCN Red List of Threatened Species. e.T4292A194720078. https://dx.doi.org/10.2305/IUCN.UK.2021-1.RLTS.T4292A194720078.en. Accessed on 16 April 2023.

Risch, D., Castellote, M., Clark, C.W., Davis, G.E., Dugan, P.J., Hodge, L.E.W., Kumar, A., Lucke, K., Mellinger, D.K., Nieukirk, S.L., Popescu, C.M., Ramp, C., Read, A.J., Rice, A.N., Silva, M.A., Siebert, U., Stafford, K.M., Verdaat, H. and Van Parijs, S.M. 2014. Seasonal migrations of North Atlantic minke whales: novel insights from large-scale passive acoustic monitoring networks. Movement Ecology, 2: 24.

Risch, D., Wilson, S.C., Hoogerwerf, M., van Geel, N.C.F., Edwards, E.W.J. and Brookes, K.L. 2019. Seasonal and diel acoustic presence of North Atlantic minke whales in the North Sea. Scientific Reports, 9: 3571.

Robinson, K.P., Baumgartner, N., Eisfeld, S.M., Clark, N.M., Cullock, R.M., Haskins, G.N., Zapponi, L., Whaley, A.R., Weare, J.S. and 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): 19-30.

Robinson, K.P., Bamford, C.C.G., Brown, W.J., Culloch, R.M., Dolan, C.J., Hall, R., Russell, G., Sidiropoulos, T., Spinou, E., Sim, T.M.C., Stroud, E., Williams, G. and Haskins, G.N. In press. Ecological habitat partitioning and feeding specialisation of coastal minke whales (Balaenoptera acutorostrata) using a designated MPA in northeast Scotland. Downloaded from https://www.biorxiv.org/content/10.1101/2021.01.25.428066v1 .full on 6 April 2023.

Robinson, K.P., Eisfeld, S.M., Costa, M. and Simmonds, M.P. 2010. Short-beaked common dolphin (Delphinus delphis) occurrence in the Moray Firth, North East Scotland. Marine Biodiversity Records, 3: e55.

Robinson, K.P., Tetley, M.J. and Mitchelson-Jacob, E.G. 2009. The distribution and habitat preference of coastally occurring minke whales (Balaenoptera acutorostrata) in the outer southern Moray Firth, northeast Scotland. Journal of Coastal Conservation, 13: 39-48.

Rogan, E., Cañadas, A., Macleod, K., Santos, M.B., Mikkelsen, B., Uriate, A., Van Canneyt, O., Vázquez, J.A. and Hammond, P.S. 2017. Distribution, abundance and habitat use of deep diving cetaceans in the North-East Atlantic. Deep Sea Research Part II: Tropical Studies in Oceanography, 141: 8-19.

Sanders, N. 2023. The Last Sunset in the West. Britain's Vanishing West Coast Orcas. Sandstone Press Ltd.

Santos, M.B., German, I., Correia, D., Read, F.L., Martinez Cedeira, J., Caldas, M., López, A., Velasco, F. and Pierce, G.J. 2013. Long-term variation in common dolphin diet in relation to prey abundance. Marine Ecology Progress Series, 481: 249-268.

Santos, M.B., Monteiro, S.S., Vingada, J.V., Ferreira, M., López, A., Martínez Cedeira, J.A., Reid, R.J., Brownlow, A. and Pierce, G.J. 2014. Patterns and trends in the diet of long-finned pilot whales (Globicephala melas) in the northeast Atlantic. Marine Mammal Science, 30(1): 1-19.

Santos, M.B. and Pierce, G.J. 2003. The diet of harbour porpoise (Phocoena phocoena) in the Northeast Atlantic. Oceanography and Marine Biology: An Annual Review. 41: 355-390.

Santos, M.B., Pierce, G.J., Learmouth, J.A., Reid, R.J., Ross, H.M., Patterson, I.A.P., Reid, D.G. and Beare, D. 2004. Variability in the diet of harbor porpoises (Phocoena phocoena) in Scottish waters 1992-2003. Marine Mammal Science, 20(1): 1-27.

Santos, M.B., Pierce, G.J., Reid, R.J., Patterson, I.A.P., Ross, H.M. and Mente, E. 2001. Stomach contents of bottlenose dolphins (Tursiops truncatus) in Scottish waters. Journal of the Marine Biological Association of the United Kingdom, 81(5): 873-878.

Sarnocińska, J., Teilmann, J., Balle, J.D., van Beest, F.M., Delefosse, M., and Tougaard, J. (2020) Harbour porpoise (Phocoena phocoena) reaction to a 3D seismic airgun survey in the North Sea. Frontiers in Marine Science, 6, p. 824

SCOS. 2021. Scientific Advice on Matters Related to the Management of Seal Populations: 2021. Natural Environment Research Council Special Committee on Seals. Downloaded on 14 April 2023 from http://www.smru.st-andrews.ac.uk/scos/

Scottish Government. 2011. Scotland's Marine Atlas: Information for The National Plan. Accessed on 15 April 2023 from https://www.gov.scot/publications/scotlands-marine-atlas-information-national-marine-plan/pages/1/

Scottish Natural Heritage (2015). Trends of Otters in Scotland. Available at https://www.webarchive.org.uk/wayback/archive/20210619115528mp_/https://www.nature.scot/sites/default/files/2017-09/Trend%20note%20-%20Trends%20of%20Otters%20in%20Scotland.pdf. [Accessed March 2023].

Schoeman R. P., Patterson-Abrolat C. & Plon S. (2020). A Global review of vessel collisions with marine animals. Available at https://www.researchgate.net/publication/341480748_A_Global_Review_of_Vessel_Collisions_With_Marine_Animals. [Accessed March 2023].

Scullion, A.J., Harrop, H.R., Munro, K., Truluck, S.R. and Foote, A.D. 2021. Scottish Killer Whale Photo Identification Catalogue.

Sharples, R.J., Arrizabalaga, B. and Hammond, P.S. 2009. Seals, sandeels and salmon: diet of harbour seals in St. Andrews Bay and the Tay Estuary, southeast Scotland. Marine Ecology Progress Series, 390: 265-276.

Sharples, R.J., Moss, S.E., Patterson, T.A. and Hammond, P.S. 2012. Spatial variation in foraging behaviour of a marine top predator (Phoca vitulina) determined by a large scale satellite tagging program. PLoS One, 7(5): e37216.

Sini, M.I., Canning, S.J., Stocking, K.A. and Pierce, G.J. 2005. Bottlenose dolphins around Aberdeen harbour, north-east Scotland: a short study of habitat utilisation and the potential effects of boat traffic. Journal of the Marine Biological Association of the United Kingdom, 85: 1547-1554.

Silva, M.A., Prieto, R., Magalhães, S., Seabra, M.I., Santos, R.S. and Hammond, P.S. 2008. Ranging patterns of bottlenose dolphins living in oceanic waters: implications for population structure. Marine Biology, 156: 179-192.

Sims, D.W., Berrow, S.D., O'Sullivan, K.M., Pfeiffer, N.J., Collins, R., Smith, K.L., Pfeiffer, B.M., Connery, P., Wasik, S., Flounders, L., Queiroz, N., Humphries, N.E., Womersley, F.C. and Southall, E.J. 2022. Circles in the sea: annual courtship 'torus' behaviour of basking sharks Cetorhinus maximus identified in the eastern North Atlantic. Journal of Fish Biology, 101: 1160-1181.

Sims, D.W. and Merrett, D. 1997. Determination of zooplankton characteristics in the presence of surface feeding basking sharks Cetorhinus maximus. Marine Ecology Progress Series, 158: 297-302.

Sims, D.W., Southall, E.J., Quayle, V.A. and Fox, A.M. 2000. Annual social behaviour of basking sharks associated with coastal front areas. Proceedings of the Royal Society of London B. 267: 1897-1904.

Sims, D.W., Southall, E.J., Richardson, A.J., Reid, P.C. and Metcalfe, J.D. 2003. Seasonal movements and behaviour of basking sharks from archival tagging: no evidence of winter hibernation. Marine Ecology Progress Series, 248: 187-196.

Snell, M., Baillie, A., Berrow, S., Deaville, R., Penrose, R., Perkins, M., Williams, R. and Simmonds, M.P. 2023. An investigation into the effects of climate change on baleen whale distribution in the British Isles. Marine Pollution Bulletin, 187: 114565.

Southall, E.J., Sims, D.W., Metcalfe, J.D., Doyle, J.I., Fanshawe, S., Lacey, C., Shrimpton, J., Solandt, J-L. and Speedie, C.D. 2005. Spatial distribution patterns of basking sharks on the European shelf: preliminary comparison of satellite-tag geolocation, survey and public sightings data. Journal of the Marine Biological Association of the United Kingdom, 85: 1083-1088.

Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene Jr, C.R., Kastak, Ketten, D.R., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A. and Tyack, P.L. (2007). Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. Aquatic Mammals, 33: Number 4. Available at: https://www.tandfonline.com/doi/abs/10.1080/09524622.2008.9753846. [Accessed March 2023].

Southall, B.L., Finneran, J.J., Reichmuth, C., Nachtigall, P.E., Ketton, 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. Available at: https://sea-inc.net/wp-content/uploads/2019/10/Southall-et-al_2019_MM-Noise-critieria-update-with-errata_Aq-Mammals.pdf. [Accessed March 2023].

Sparling, C. 2012. Seagreen Firth of Forth Round 3 Zone Marine Mammal Surveys. Report number SMRUL-ROY-2012-006 to Royal Haskoning and Seagreen Wind Energy Ltd, March 2012.

Spitz, J., Mourocq, E., Léauté, J-P., Quéro, J-C. and Ridoux, V. 2010. Prey selection by the common dolphin: fulfilling high energy requirements with high quality food. Journal of Experimental Marine Biology and Ecology, 390(2): 73-77.

Spitz, J., Rousseau, Y. and Ridoux, V. 2006. Diet overlap between harbour porpoise and bottlenose dolphin: An argument in favour of interference competition for food? Estuarine, Coastal and Shelf Science, 70(1-2): 259-270.

Stockin, K.A., Weir, C.R. and Pierce, G.J. 2006. Examining the importance of Aberdeenshire (UK) coastal waters for North Sea bottlenose dolphins (Tursiops truncatus). Journal of the Marine Biological Association of the United Kingdom, 86: 201-207.

Stone, C.J. and Tasker, M.L. 2006. The effects of seismic airguns on cetaceans in UK waters. J. Cetacean Res. Manage. 8(3):255–63. Available at https://www.semanticscholar.org/paper/The-effects-of-seismic-airguns-on-cetaceans-in-UK-Stone-Tasker/971c6f05e0a009f04fa7eaa38c50a1425cdf0c54. [Accessed March 2023].

Stone, C.J., Hall, K., Mendes, S. and Tasker, M. (2017). The effects of seismic operations in UK waters: analysis of Marine Mammal Observer data. Available at: https://www.semanticscholar.org/paper/The-effects-of-seismic-operations-in-UK-waters%3A-of-Stone-Hall/44c6c67ccb84df4b9fe844b4bb0ab27473b133c1 . [Accessed March 2023]

Sveegaard, S., Andreasen, H., Mouritsen, K.N., Jeppesen, J.P., Teilmann, J. and Kinze, C.C. 2012. Correlation between seasonal distribution of harbour porpoises and their prey in the Sound, Baltic Sea. Marine Biology, International Journal on Life in Oceans and Coastal Waters. Springer.

Tetley, M.J., Mitchelson-Jacob, E.G. and Robinson, K.P. 2008. The summer distribution of coastal minke whales (Balaenoptera acutorostrata) in the southern Outer Moray Firth, NE Scotland, in relation to co-occurring mesoscale oceanographic features. Remote Sensing of the Environment, 112: 3449-3454.

Thompson, P.M., Mackay, A., Tollitt, D.J., Enderby, S. and Hammond, P.S. 1998. The influence of body size and sex on the characteristics of harbour seal foraging trips. Canadian Journal of Zoology, 76: 1044-1053.

Thompson, P.M., McConnell, B.J., Tollitt, D.J., Mackay, A., Hunter, C. and Racey, P.A. 1996. Comparative distribution, movements and diet of harbour and grey seals from the Moray Firth, N.E. Scotland. Journal of Applied Ecology, 33: 1572-1584.

Thompson, P.M., Miller, D., Cooper, R. and Hammond, P.S. 1994. Changes in the distribution and activity of female harbour seals during the breeding season: Implications for their lactation strategy and mating patterns. Journal of Animal Ecology, 63: 24-30.

Thompson, P.M., Tollitt, D.J., Wood, D., Corpe, H.M., Hammond, P.S. and Mackay, A. 1997. Estimating harbour seal abundance and status in an estuarine habitat in north-east Scotland. Journal of Applied Ecology, 34: 43-52.

Thompson, P.M. and Wheeler, H. 2008. Photo-ID based estimates of reproductive patterns in harbour seals. Marine Mammal Science, 24: 138-146.

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 longterm displacement of harbour porpoises. Proceedings of the Royal Society B: Biological Sciences. DOI: 10.1098/rspb.2013.2001. Available at https://royalsocietypublishing.org/doi/10.1098/rspb.2013.2001. [Accessed April 2023].

Tolley, K.A. and Rosel, P.E. 2006. Population structure and histological demography of eastern North Atlantic harbour porpoises inferred through mtDNA sequences. Marine Ecology Progress Series, 327: 297-308.

van Beest, F.M., Teilmann, J., Dietz, R., Galatius, A., Mikkelsen, L., Stalder, D., Sveegaard, S. and Nabe-Nielsen, J. 2018. Environmental drivers of harbour porpoise fine-scale movements. Marine Biology, 165: 95.

Vance, H.M., Hooker, S.K., Mikkelsen, L., van Neer, A., Teilmann, J., Siebert, U. and Johnson, M. 2021. Drivers and constraints on offshore foraging in harbour seals. Scientific Reports, 11: 6514.

Vongraven, D. and Bisther, A. 2013. Prey switching by killer whales in the north-east Atlantic: observational evidence and experimental insights. Journal of the Marine Biological Association of the United Kingdom, 94(6): 1357-1365.

Waggitt, J.J., Evans, P.G.H., Andrade, J., Banks, A.N., Boisseau, O., Bolton, M., Bradbury, G., Brereton, T., Camphuysen, C.J., Durinck, H., Felce, T., Fijn, R.C., Garcia-Baron, I., Garthe, S., Geelhoed, S.C.V., Gilles, A., Goodall, M., Haelters, J., Hamilton, S., Hartny-Mills, L., Hodgins, N., James, K., Jessopp, M., Kavangh, A.S., Leopold, M., Lohrengel, K., Louzao, M., Markones, N., Martínez-Cedeira, J., Cadhla, O.Ó., Perry, S.L., Pierce, G.J., Ridoux, V., Robinson, K.P., Santos, B.M., Saavedra, C., Skov, H., Stienen, E.W.M.,

Sveegaard, S., Thompson, P., Vanermen, N., Wall, D., Webb, A., Wilson, J., Wanless, S. and Geert Hiddink, J. 2020. Distribution maps of cetacean and seabird populations in the North-East Atlantic. Journal of Applied Ecology, 57(2): 203-446.

Waggitt, J. 2019. Data from: Distribution maps of cetacean and seabird populations in the North-East Atlantic. Dryad, Dataset https://doi.org/10.5061/dryad.mw6m905sz. [Accessed April 2023].

Wallace, B.P., Tiwari, M. and Girondot, M. 2013. Dermochelys coriacea. The IUCN Red List of Threatened Species. e.T6494A43526147. https://dx.doi.org/10.2305/IUCN.UK.2013-2.RLTS.T6494A43526147.en . Accessed on 16 April 2023.

Wang, C., Lyons, S. B., Corbett, J. J., and Firestone, J. (2007). Using Ship Speed and Mass to Describe Potential Collision Severity with Whales: an Application of the Ship Traffic, Energy and Environment Model (STEEM) [Report by the University of Delaware]. Available at https://tethys.pnnl.gov/sites/default/files/publications/Wang-et-al-2007.pdf. [Accessed April 2023].

Wells, R.S., Natoli, A. and Braulik, G. 2019. Tursiops truncatus (errata version published in 2019). The IUCN Red List of Threatened Species 2019. e.T22563A156932432. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en . Accessed on 31 March 2023.

Weir, C.R., Canning, S., Hepworth, K., Sim, I. and Stockin, K. 2008. A long-term opportunistic photo-identification study of bottlenose dolphins (Tursiops truncatus) off Aberdeen, United Kingdom: Conservation value and limitations. Aquatic Mammals, 34(4): 436-447.

Weir, C.R., Hodgins, N.K., Dolman, S.J. and Walters, A.E.M. 2019. Risso's dolphin (Grampus griseus) in a proposed Marine Protected Area off east Lewis (Scotland, UK), 2010-2017. Journal of the Marine Biological Association of the United Kingdom, 99(3): 703-714.

Weir, C.R., Pollack, C., Cronin, C. and Taylor, S. 2001. Cetaceans of the Atlantic Frontier, north and west of Scotland. Continental Shelf Research, 21: 1047-1071.

Weir, C.R. and Stockin, K.A. 2001. The occurrence and distribution of bottlenose dolphins (Tursiops truncatus) and other cetacean species in the coastal waters of Aberdeenshire, Scotland. Sea Watch Foundation, Oxford.

Weir, C.R., Stockin, K.A. and Pierce, G.J. 2007. Spatial and temporal trends in the distribution of harbour porpoises, white-beaked dolphins and minke whales off Aberdeenshire (UK), north-western North Sea. Journal of the Marine Biological Association of the United Kingdom, 87: 327-338.

Williamson, L.D., Scott, B.E., Laxton, M.R., Bachl, F.E., Illian, J.B., Brookes, K.L. and Thompson, P.M. 2022. Spatiotemporal variation in harbour porpoise distribution and foraging across as landscape of fear. Marine Mammal Science, 38: 42-57.

Wilson, S. 2001. Population growth, reproductive rate and neo-natal morbidity in a re-establishing habour seal colony. Seal Workshop, 13th European Cetacean Society Annual Conference, Valencia, Spain, 5 April 1999.

Wilson S. C (2013). The impact of human disturbance at seal haul-outs. A literature review for the Seal Conservation Society. Available at https://docslib.org/doc/12859887/the-impact-of-human-disturbance-at-seal-haul-outs. [Accessed March 2023].

Wilson, L.J. and Hammond, P.S. 2019. The diet of harbour and grey seals around Britain: Examining the role of prey as a potential cause of harbour seal decline. Aquatic Conservation Marine and Freshwater Ecosystems, 29(1): 71-85.

Wilson, B., Reid, R.J., Grellier, K., Thompson, P.M. and Hammond, P.S. 2004. Considering the temporal when managing the spatial: a population range expansion impacts protected areas-based management for bottlenose dolphins. Animal Conservation, 7: 331-338

Wilson, B., Thompson, P.M. and Hammond, P.S. 1997. Habitat use by bottlenose dolphins: seasonal distribution and stratified movement patterns in the Moray Firth, Scotland. Journal of Applied Ecology, 34: 1365-1374.

Wisniewska, D.M., Johnson, M., Teilmann, J., Rojano-Doñate, L., Shearer, J., Sveegard, S., Miller, L.A., Siebert, U. and Teglberg Madsen, P. 2016. Ultra-high foraging rates of harbour porpoises make them vulnerable to anthropogenic disturbance. Current Biology, 26: 1441-1446.

Witt, M.J., Broderick, A.C., Johns, D.J., Martin, C., Penrose, R., Hoogmoed, S. and Godley, B.J. 2007. Prey landscapes help identify potential foraging habitats for leatherback turtles in the NE Atlantic. Marine Ecology Progress Series, 337: 231-243.

Witt, M.J., Hardy, T., Johnson, L., McClellan, C.M., Pikesley, S.K., Ranger, S., Richardson, P.B., Solandt, J-L., Speedie, C., Williams, R. and Godley, B.J. 2012. Basking sharks in the northeast Atlantic: spatio-temporal trends in sightings from UK waters. Marine Ecology Progress Series, 459: 121-134.

Appendix 1 Marine mammal Mitigation Plan (MMMP)

CEA Environmental – Eastern Green Link (EGL3)

Marine Mammal Mitigation Plan

Rev No.	Date	Status/Reason for Issue	Author	Checked by	Approved by
1	17/04/2023	Draft - Issued for Internal Review	Jackie Smith	Amanda Hyam	Amanda Hyam
2	05/05/2023	Amendments needed	Jackie Smith	Rachael Barber	

TABLE OF CONTENTS

List of Figures

List of Tables

1 INTRODUCTION

1.1 THE PROJECT

The Eastern Green Link 3 (EGL 3) Project is part of major reinforcement of the electricity transmission system needed to provide additional network capacity and greater power transfer capability across the Anglo-Scottish border. EGL 3 will link Peterhead in Scotland and South Humber in England and is being developed between National Grid Electricity Transmission (NGET) and Scottish Hydro Electric Transmission Plc (SHE Transmission). The High Voltage Direct Current (HVDC) marine cable will be approximately 554 km in length and will have a capacity of 2 GW operating at 525 kV. Completion is scheduled for 2030/31.

NGET and SSEN Transmission intend to undertake a marine cable route survey to include geophysical, geotechnical and benthic vessel-based surveys. The objective of the survey campaign is to obtain baseline data that will contribute to determining the physical and ecological conditions, the location and design of the final cable route and inform the environmental assessments necessary to obtain consent for the project. Within the Application Area, see Figure 1, the survey will consist of a 500 m to 1 km wide corridor, centred on a preferred cable route. The offshore scope is estimated to take a minimum of 41 days in Scottish waters and 80 days in English waters (excluding weather downtime and port calls).

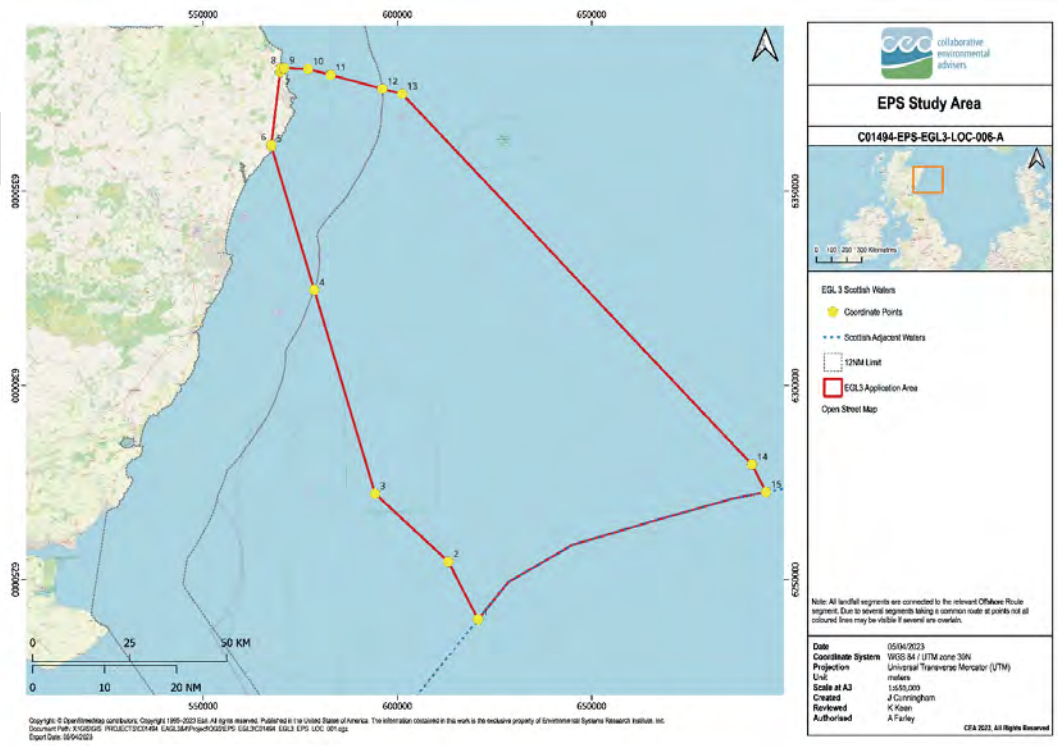


Figure 1: EGL3 Application Area

The geophysical survey will include the following methods:

Multi Beam Echo Sounder (MBES), Side Scan Sonar (SSS), magnetometer, Sub-Bottom Profiling (SBP), Autonomous Underwater Vehicle (AUV), Remotely Operated Vehicle (ROV), and Ultra-Short Baseline (USBL) positioning system.

The specific equipment to be used during the proposed marine cable route surveys is currently unknown. Table 1 below presents the characteristic acoustic parameters for a reasonable range of geophysical equipment that could potentially be used.

Table 1: Geophysical survey equipment and acoustic parameters

Equipment Type	Frequency (kHz)	Sound Pressure Level SPL (peak) in dB re 1 µPa	Sound Exposure Level SEL (dB re1 µP a2s)
MBES	200 - 500	210 - 245	169.5
SSS	300 - 900	200 - 240	163
SBP	Pinger: 2 - 12 Boomer: 0.5 - 5 Chirp: 2 - 40 Sparker: 1 - 2	178 - 225	174 - 241
Ultrashort baseline (USBL)	14-50	194 - 207	200

1.2 SPECIES IN AND AROUND THE EGL3 APPLICATION AREA

Below is summary of the marine mammals (cetaceans & pinnipeds), marine turtles and basking shark (*Cetorhinus maximus*) that may be seen in and around the EGL3 survey area. Please refer to the EGL3 European Protected Species (EPS) baseline report for full details.

1.2.1 CETACEANS

All cetaceans (whales, dolphins and porpoises) are listed as EPS under Annex IV of the EU Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive). There are four species of cetacean known to regularly occur over wide areas of the North Sea off Northeast Scotland, with a further five species considered regular but less common (ICES, 2016; Hammond *et al*., 2004; Reid *et al*., 2003). Table 2 summarises these species and includes their status on the International Union for the Conservation of Nature (IUCN) Red List (IUCN, 2023).

Table 2: Cetaceans recorded in the northern North Sea

Common Name	Scientific Name	Occurrence	IUCN Status
Fin whale	*Balaenoptera physalus*	Rare	Vulnerable
Humpback whale	*Megaptera novaeangliae*	Occasional	Least Concern
Common minke whale	*Balaenoptera acutorostrata*	Regular	Least Concern
Sperm whale	*Physeter macrocephalus*	Rare	Vulnerable
Northern bottlenose whale	*Hyperoodon ampullatus*	Rare	Near Threatened
Orca (killer whale)	*Orcinus orca*	Regular, less common	Data Deficient
Long-finned pilot whale	*Globicephala melas*	Regular, less common	Least Concern
Risso's dolphin	*Grampus griseus*	Regular, less common	Least Concern
Common bottlenose dolphin	*Tursiops truncatus*	Regular	Least Concern
White-beaked dolphin	*Lagenorhynchus albirostris*	Regular	Least Concern
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Regular, less common	Least Concern
Common dolphin	*Delphinus delphis*	Regular, less common	Least Concern
Harbour porpoise	*Phocoena phocoena*	Regular	Least Concern

Within Scottish inshore waters of the Application Area (<12 nm) four species are regularly recorded, the harbour porpoise (*Phocoena phocoena*), white-beaked dolphin (*Lagenorhynchus albirostris*), common bottlenose dolphin (*Tursiops truncatus*) and common minke whale (*Balaenoptera acutorostrata*) (Hammond *et al*., 2004; Reid *et al*., 2003; Hague *et al*., 2020).

In 2020 the Southern Trench Marine Protected Area (MPA) was designated to protect four biodiversity features including the common minke whale. The area was selected due to persistently above average densities of minke whale, with both adult and juvenile whales regularly observed feeding (NatureScot, 2020).

Within offshore (> 12 nm) waters of the Application Area, three species are regularly recorded, the harbour porpoise, white-beaked dolphin and common minke whale (Hammond *et al*., 2004; Reid *et al*., 2003; Hague *et al*., 2020). In addition, there are occasional records of a further 10 species. Most of these occasional species are recorded further north of the project area, although there are records of offshore common bottlenose dolphins and orca (*Orcinus orca*), within the Application Area (Hague *et al*., 2020).

1.2.2 PINNIPEDS

Whilst not EPS, pinnipeds are protected as Annex II species under the EU Habitats Directive and are subject to national legislation, with haul-out sites protected by The Protection of Seals (Designated Sea Haul-out Sites) (Scotland) Order 2014. The two most regularly occurring species in UK waters are the harbour seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*) (Hammond *et al*., 2004).

The harbour seal is listed globally as Least Concern on the IUCN Red List, with an unknown population trend (Lowry, 2016). Approximately 32% of European harbour seals are found in the UK (SCOS, 2021). SCOS defines seven SMU in Scottish waters, of which the project route falls within the East Scotland SMU.

The grey seal is listed as Least Concern globally on the IUCN Red List, with an increasing population trend (Bowen, 2016SCOS defines seven SMU in Scottish waters, of which the project route falls within the East Scotland SMU.

Under the Marine (Scotland) Act a Sea Conservation Area has been designated on the east coast of Scotland, to the south of the project area (Scottish Government, 2011).

1.2.3 Marine Turtles

All species of marine turtles are listed as EPS under Annex IV of the EU Habitats Directives. There have been records of four species of marine turtle in the North Sea, the leatherback (*Dermocheylys coriacea*), loggerhead turtle (*Caretta caretta*), green turtle (*Chelonia mydas*) and Kemp's ridley (*Lepidochelys kempii*) (Goverse *et al*., 2014; Botterell *et al*. 2020). Of these the most commonly recorded is the leatherback turtle which are regularly recorded along the north-western part of the European Continental Shelf (Godley *et al*., 1998; Doyle *et al*., 2008; Botterell *et al*. 2020). Records within the North Sea tend to be more occasional (Botterell *et al*., 2020; Goverse *et al*., 2014; Reeds, 2004). Records of the other, hard shelled species of turtle are sparse. As with leatherback turtles most occur on the western side of the UK although most tend to occur during the winter months and are of juvenile individuals. It is likely that these individuals are arriving via North Atlantic current systems (Botterell *et al*., 2020).

The leatherback turtle is listed as Vulnerable globally on the IUCN Red List, with a decreasing population trend (Wallace *et al*., 2013).

1.2.4 Basking Shark

Although not an EPS listed under Annex IV of the Habitats Directive, the basking shark (*Cetorhinus maximus*) is protected in inshore Scottish waters under the Nature Conservation (Scotland) Act 2004 and are protected under the Wildlife and Countryside Act 1981. Sightings on the east coast and the North Sea are rarer although are recorded (Witt *et al*., 2012).

The basking shark is listed as Endangered globally on the IUCN Red List, with a decreasing population trend (Rigby *et al*., 2021).

1.3 Relevant Legislation

All marine mammals in UK waters are protected as EPS under the European Union (EU) Habitats Directive, which lists cetaceans under Annex IV and pinnipeds (seals) under Annex V. Marine turtles are also listed under Annex IV as EPS.

In Scottish waters the requirements of the Habitats Directive are transposed into The Conservation (Natural Habitats &c.) Regulations 1994 for inshore waters (0 to 12 nm) and The Conservation of Offshore Marine Habitats and Species Regulations 2017 for offshore waters (12 to 200 nm). Collectively known as the Habitats Regulations, these make it an offence to deliberately kill, injure or disturb an EPS.

Marine mammals, marine turtles and the basking shark are also protected within inshore waters under the Wildlife and Countryside Act 1981 and the Nature Conservation (Scotland) Act 2004.

There will be a European Protected Species (EPS) Licence and Basking Shark Licence in place and licence conditions of which will need to be complied with.

1.4 Scope of Work

Seiche have been contracted by CEA to provide a Marine Mammal Mitigation Plan (MMMP) for the geophysical survey, which will be run in accordance with industry standard guidelines namely the Joint Nature Conservation Committee (JNCC) 2017 'Guidelines for minimising the risk of injury to marine mammals from geophysical surveys' and the Scottish Marine Wildlife Watching Code SNH (2017) to reduce the risk of injury to marine mammals, marine turtles and basking sharks from geophysical survey activities to negligible.

JNCC (2017) notes that protocols recommended for marine mammals would also be appropriate for other protected species such as marine turtles and basking sharks (*Cetorhinus maximus*), as such mitigation will be implemented for marine mammals (cetaceans, pinnipeds), marine turtles and basking sharks. In addition if an observer identifies basking shark ahead of the survey vessel, if possible, speed will be reduced to minimise the risk of collision with animals (Ref: C01494).

JNCC guidelines will be applied to reduce the risk of injury occurring from the SBP and SSS. No mitigation is required for the MBES or USBL (Ref: C01494 and JNCC, 2017). The survey equipment and activities proposed here are well-within the envelope of those for which the guidelines were designed, with source levels and likely propagation of sound being considerably less than that generated by seismic survey using airgun arrays (Ref: C01494).

It is considered that adherence to recommendations in the JNCC guidelines would reduce the risk of causing an offence under the Habitats Regulations to negligible levels. It should be noted that the mitigation measures recommended and laid out here are more relevant to the prevention of injury rather than disturbance, however as the activity is likely to be of a very short duration it is considered there would be a low likelihood of disturbance occurring that would constitute an offence under the Habitats Regulations.

This MMMP defines:

- The Mitigation Zone (MZ)
- Mitigation measures that will be implemented to reduce the risk of injury to protected species
- Pre-Shoot Search
- Soft Start
- Line Changes
- Breaks In Operation
- The roles of personnel involved in ensuring effective implementation of the MMMP
- Communication protocols to ensure mitigation measures are carried out effectively

2 MARINE MAMMAL, MARINE TURTLE AND BASKING SHARK MONITORING

The presence of marine mammals, marine turtles and basking sharks and implementation of this MMMP will be monitored by Marine Mammal Observer (MMO) and Passive Acoustic Monitoring Operator (PAMO).

2.1 VISUAL MONITORING / MARINE MAMMAL OBSERVER

The role of the MMO will be to undertake visual monitoring for marine mammals, marine turtles and basking sharks during the hours of daylight hours (with good visibility of 1 km or more and sea state Beaufort 4 or less). The MMO will focus monitoring effort to the Mitigation Zone (MZ) throughout all acoustic operations, including the 30 minute pre-start monitoring period and during any breaks in operations. The MMO will advise whether a delay to operations is required for marine mammals, marine turtles or basking sharks detected within the established MZ, slow the vessel for basking sharks if observed in the MZ and to provide advice on other aspects of implementing this MMMP. The MMO must have undertaken the formal training on a JNCC registered course.

When marine mammals, marine turtles and asking sharks are observed the distance and bearing to the sighting will be recorded along with species, time, position, and other relevant data required for completing sightings forms (Appendix A). Species identification will be aided where possible by photographic records taken using digital cameras and reference to a field guide (e.g., Shirihai & Jarrett, 2006). Distance to the animal will be calculated using reticule binoculars or range finder equipment.

MMOs will record data on location and effort, operations (timings of when the acoustic source is active) and sightings using appropriate JNCC data forms.

The MMO will utilise the following equipment to monitor and identify marine mammals and their associated distance from the explosive source:

- Binoculars for scanning and identifying targets of interest.
- Reticule binoculars (Figure 2) or range finding stick (using Heinemann, 1981) to assist in the estimation of distance.
- Binoculars with inbuilt compass (Figure 2) or an angle board for accurate determination of location of marine mammals.
- Digital camera to record and validate sightings where possible.

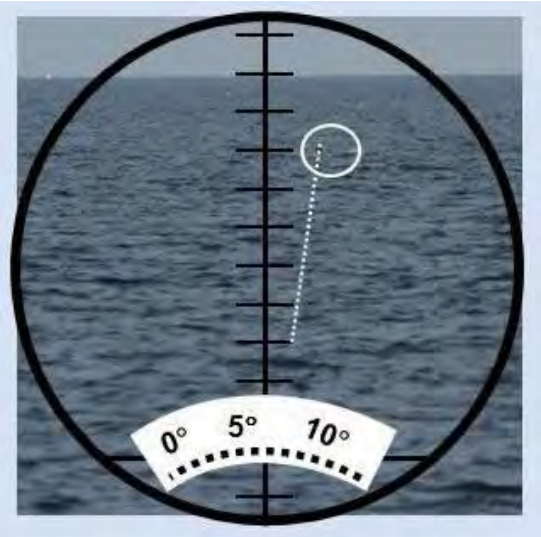


Figure 2: Example view through binoculars with inbuilt reticules for range estimation and compass for bearing

2.2 Passive Acoustic Monitoring / Passive Acoustic Monitoring Operator

Passive Acoustic Monitoring (PAM) is the process in which an array of hydrophones, acquisition unit and sound processing software are used in concert with a trained PAM operator to passively detect marine mammal vocalisations. Analysis of vocalisation Time Differences of Arrival (TDOA), to each hydrophone allows two-dimensional localisation of vocalisations, providing a sound source bearing in relation to the hydrophone array. Knowledge of vocalisation intensity and sound propagation properties allow estimation of distance, whilst analysis of vocalisation characteristics can be used to deduce marine mammal species.

Acoustic monitoring should be undertaken using a PAM system and a trained, experienced and dedicated PAMO. PAM system to include as a minimum (Ref: C01494):

- Towed streamer section containing at least 3 hydrophones with built in pre-amplifiers, depth sensor, tow cable, and deck cable;
- High frequency data acquisition for cetacean clicks up to 175kHz;
- Medium frequency data acquisition for cetacean click and whistles up to 48kHz;

The role of the PAMO will be to deploy and maintain the PAM system and to undertake acoustic monitoring for cetaceans during the hours of darkness and when conditions during daylight hours are not conducive to visual monitoring (i.e., visibility less than 1 km, sea state associated with Beaufort Wind Force of Force 4 or more), to advise a delay to the start of the acoustic source is required, and to monitor implementation of relevant mitigation measures. The PAMO will record data on location and effort, operations and detections using appropriate JNCC data forms (Appendix A).

2.3 COMMUNICATIONS PLAN

The MMO/PAMO will be the main line of communication with the Party Chief (PC)/ Survey Team offshore. The PC/Survey Team has the authority to delay operations where necessary. There should always be direct communication between the PC/Survey Team and MMO/PAMO, as two-way flow of information is vital to ensuring operations run smoothly. The Survey Team will be responsible for informing the MMO/PAMO at least 1 hour before acoustic operations are due to commence. Communications will either be face-to-face or via Very High Frequency (VHF) radio.

The MMO/PAMO will alert the Survey Team of any marine mammal, marine turtle or basking shark sightings or marine mammal detections, that have the potential to delay operations, even if operations are not due to start immediately. The Survey Team will keep the MMO/PAMO abreast of changes to operational plans and any likely delays, and their duration, throughout operations.

Should there be any queries that cannot be resolved onboard, the MMO/PAMO can liaise with their Project Manager for further assistance and advice.

A summary of the communication plan is provided in Figure 3.

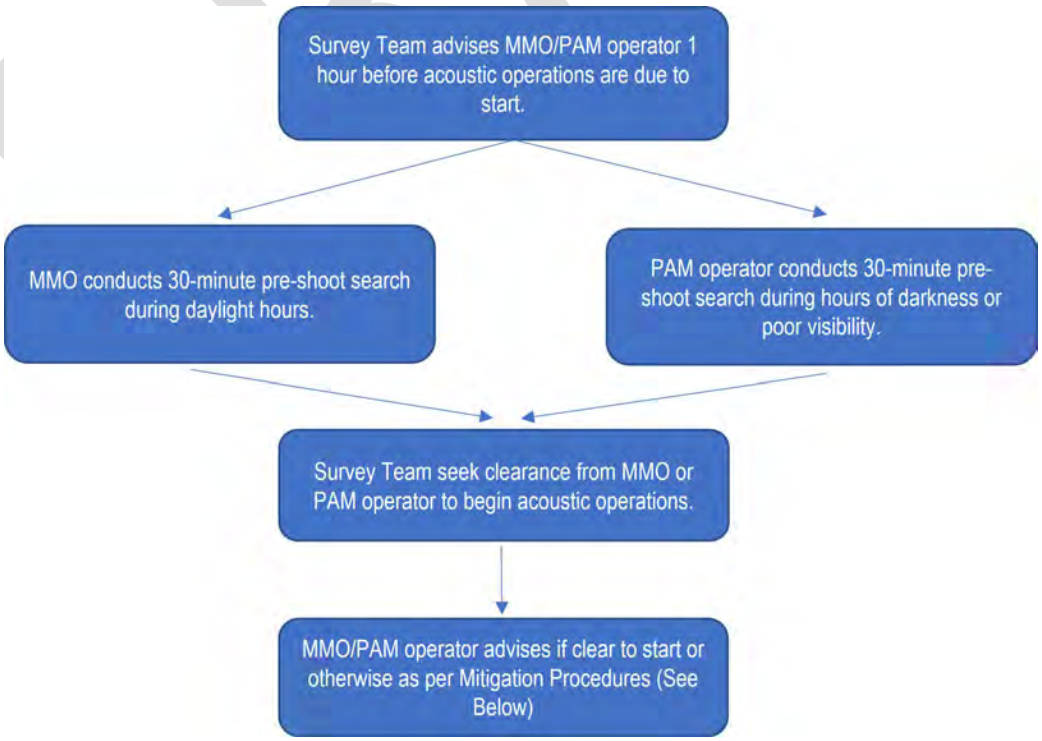


Figure 3: Flow chart for the communication plan

3 MARINE MAMMAL MITIGATION PROCEDURES

The following mitigation procedures are in adherence to the JNCC guidelines and applied to reduce the risk of injury to marine mammals (cetaceans and pinnipeds), marine turtles and basking sharks, and in adherence to EGL3 Protected Species Assessment (Ref: C01494) to minimise the risk of collision with basking sharks.

JNCC (2017) advise that any High Resolution Surveys (HRS) using electromagnetic sources such as sub bottom profiling (SBP, e.g. pingers, sparkers, boomers and CHIRP systems), side-scan sonar and multi-beam echosounders all use electromagnetic sources that uses airguns requires mitigation. Multi-beam surveys in shallower waters (<200m) are not subject to these requirements as it is thought the higher frequencies typically used fall outside the hearing frequencies of cetaceans and the sounds produced are likely to attenuate more quickly than the lower frequencies used in deeper waters (JNCC, 2017). JNCC do not, therefore, advise that mitigation is required for multi-beam surveys in shallow waters.

3.1 MITIGATION ZONE (MZ)

The MZ is a 500 m radius from the centre of the noise source, based on JNCC (2017) guidelines, within which mitigation measures for marine mammals, turtles and basking sharks are to be implemented. If the size of the MZ is adjusted for any reason, this will be stipulated within the survey consent or licence conditions.

3.2 PRE-SHOOT SEARCH

An MMO or PAMO will conduct a pre-shooting search for a minimum of 30 minutes prior to commencement of start of SBP/SSS. A visual pre-shoot search will be undertaken during daylight hours, with acoustic pre-shoot search undertaken during the hours of darkness or during daylight hours in conditions not conducive to visual monitoring.

Should marine mammals (cetaceans and pinnipeds), marine turtles or basking sharks be detected within the 500 m MZ during pre-shooting search, the soft-start or the start of the acoustic source (SBP, SSS) will be delayed 20 minutes from the time of the last sighting/detection within the mitigation zone, to allow animals unavailable for detection (i.e. not re-surfacing in that time) to have moved outside of the MZ.

If the MMO identifies basking shark ahead of the survey vessel, if possible, speed will be reduced to minimise the risk of collision with animals (Ref: C01494).

If several types of HRS equipment are to be started sequentially or interchanged during the operation, only one pre-shooting search is required prior to the start of acoustic output, only if there are no gaps in data acquisition of greater than 10 minutes (refer to Section 3.5 for breaks in operations).

The outline mitigation procedure (as outlined above) is summarised below in the respective flow charts, Figure 4.

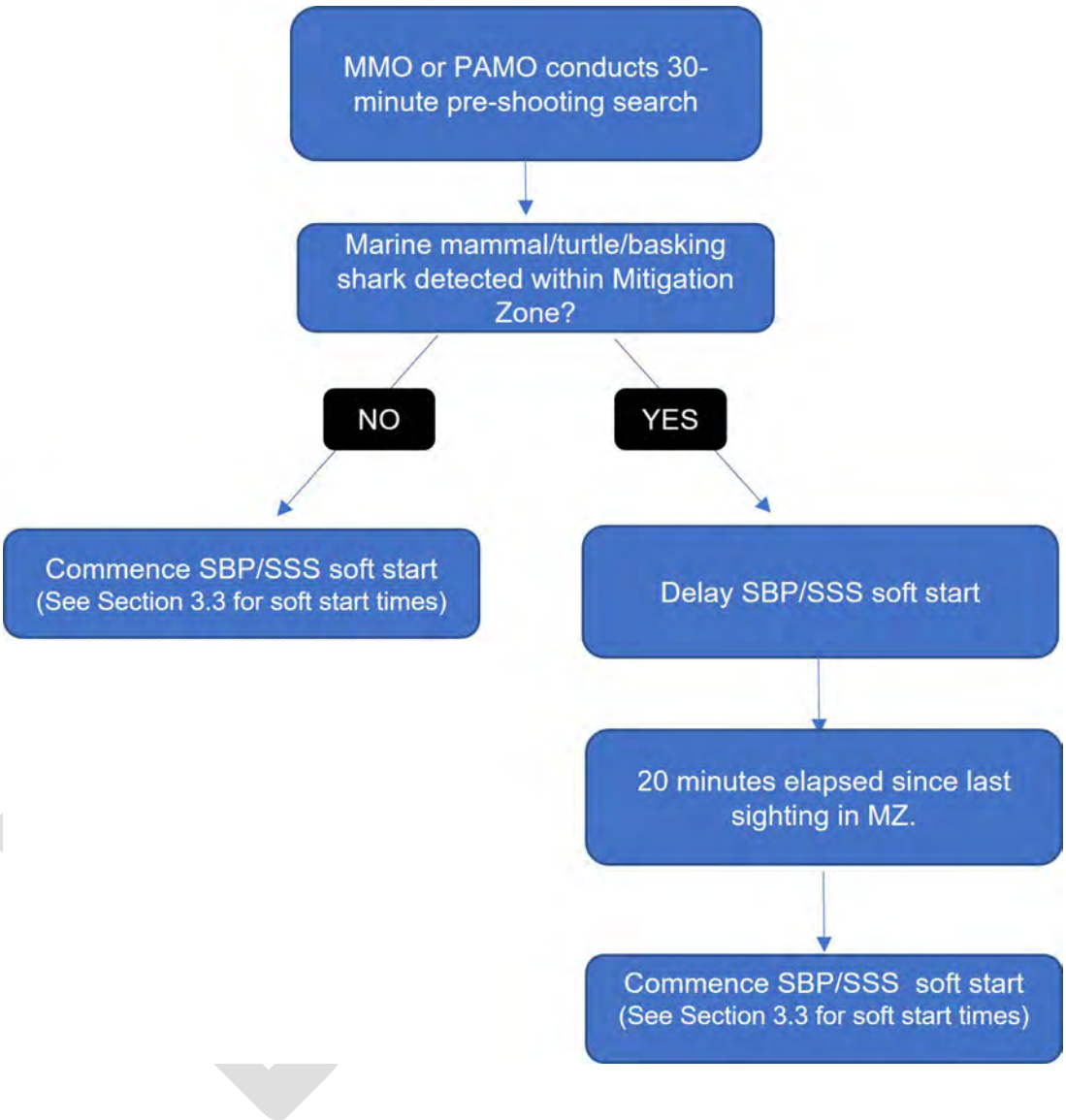


Figure 4: Flow chart for marine mammals/turtles/basking shark pre-shooting search

3.3 SOFT START

Soft start is defined as the gradual build-up of acoustic energy over a defined period of time until full power is reached. The method for soft start of the SBP and SSS may include gradually increasing the power output or

increasing the firing frequency (the Shot Point Interval, SPI). As acknowledged in the JNCC guidelines, this will not be possible with most of the sub-bottom systems as they are either off or on and therefore soft start cannot be used.

Once the MZ is clear of marine mammals (cetaceans & pinnipeds), marine turtles and basking sharks the SBP/SSS will commence firing with a soft start.

Two criteria define the standard duration of a soft start, as recommended in JNCC (2017) and one exception to these criteria is for surveys where the maximum airgun volume is for surveys where the maximum airgun volume is < 180 Cubic inches, in which case:

- From the start of the soft-start until full operational power: minimum of 15 minutes;
- From the start of the soft-start until the start of the survey line: maximum of 25 minutes.

3.4 Line Changes

Line change is the term used to describe the activity of turning the survey vessel at the end of one survey line prior to the commencement of the next survey line.

When the SBP/SSS equipment is active, during any line change expected to take more than 40 minutes, the SBP/SSS will be stopped, and a full 30-minute pre-shoot search conducted prior to the next survey line. If a marine mammal, marine turtle or basking shark is detected within the MZ during the pre-start monitoring period, the start of the SBP/SSS will be delayed until 20 minutes after the last detection within the MZ.

Where line changes are expected to take less than 40 minutes the SBP/SSS equipment will remain active and firing at a reduced power or pulse rate (increased SPI of no more than 5 minutes). SPI will be increased in the final 10 minutes prior to data collection resuming.

3.5 Breaks in Operations

For any unplanned breaks in operation of less than 10 minutes the acoustic source can be restarted, and acquisition resumed at the same power level. There is no requirement for a soft start. Should a marine mammal or marine turtle be detected within the MZ, the start of the SBP/SSS will be delayed until 20 minutes has passed since the last detection within the MZ and a soft start must be undertaken as previously described.

For any unplanned breaks in operations of more than 10 minutes, a 30 minute dedicated pre-shoot search will be completed prior to resuming survey at full power. If the MMO or PAMO has been monitoring prior to and throughout the break, this time can contribute to the pre-start monitoring time. As detailed above, the source will only start once the MZ has been clear of marine mammals, marine turtles or basking sharks for 20 minutes. A summary of the procedure for breaks in SBP/SSS operations is provided in Figure 5.

For any planned breaks, the same procedures apply. However, if the planned break is less than 10 minutes, the MMO or PAMO will begin monitoring 30 minutes prior to the planned break and continue for its duration.

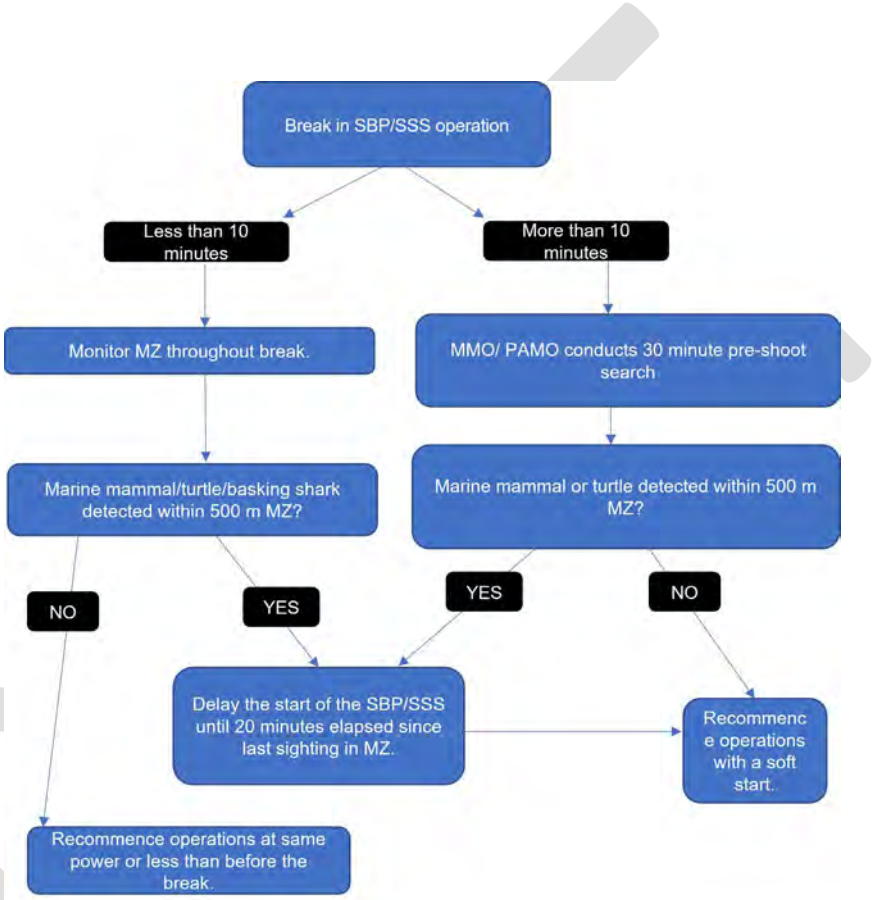


Figure 5: Flow chart for breaks in operations

3.6 TESTS OF SBP/SSS

All tests of acoustic equipment will be preceded by full 30-minute dedicated pre-shooting search.

4 MARINE MAMMAL MITIGATION REPORTING

The MMO and PAMO are responsible for reporting on compliance with MMMP throughout and on completion of operations. This will include daily progress reports and a final report which will detail monitoring effort, operational summaries and any sightings and summaries of environmental conditions.

4.1 Reporting of Non-Compliance

Should there be any issue of non-compliance during the project full details will be emailed to the relevant people at the earliest possible opportunity following resolution of the non-compliance and following completion of any require marine mammal mitigation or monitoring activities.

4.2 Daily Operations Report

The MMO/PAMO will distribute a daily update each morning by 09:00. The update will include any Health and Safety Executive (HSE) updates as well as a summary of the previous 24-hour operations, marine mammal monitoring effort summary, sightings, and compliance. The update will be sent to the relevant distribution list.

4.3 Final Marine Mammal Mitigation Report

On completion of geophysical survey operations and demobilisation of the MMO and PAMO, the MMO/PAMO will create a Marine Mammal Mitigation Report to be issued to the Regulatory Authorities, following approval by CEA.

The report should include but not be limited to the following:

- Introduction and Scope of Work
- Methodology
    - Monitoring Methods
    - Mitigation Procedures
    - Communication Protocols
- Results
    - Operation Summary
    - Marine Mammal Monitoring Effort
    - Sightings
    - Weather Conditions
    - Compliance with MMMP
- Discussion
- References

5 REFERENCES

Botterell, Z.L.R., Penrose, R., Witt, M.J. and Godley, B.J. 2020. Long-term insights into marine turtle sightings, strandings and captures around the UK and Ireland (1910-2018). *Journal of the Marine Biological Association of the United Kingdom*, 1-9.

Bowen, D. 2016. *Halichoerus grypus. The IUCN Red List of Threatened Species.* e.T9660A45226042. https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T9660A45226042.en. Accessed on 14 April 2023.

C01494. EGL3 Protected Species Assessment & MMMP.

Doyle, T.K., Houghton, J., O'Súilleabháin, P.F., Hobson, V.J., Marnell, F., Davenport, J. and Hays, G.C. 2008. Leatherback turtles satellite-tagged in European waters. *Endangered Species Research*, 4: 23-31.

European Mammal Assessment team. 2007a. *Phoca vitulina (Europe Assessment). The IUCN Red List of Threatened Species.* e.T17013A6723347. Accessed on 14 April 2023.

European Mammal Assessment team. 2007b. *Halichoerus grypus (Europe Assessment). The IUCN Red List of Threatened Species.* E.T9660A13006007. Accessed on 14 April 2023.

Godley, B.J., Gaywood, M.J., Law, R.J., McCarthy, C.J., McKenzie, C., Patterson, I.A.P., Penrose, R.S., Reid, R.J. and Ross, H.M. 1998. Patterns of marine turtle mortality in British Waters (1992-1996) with reference to tissue contaminant levels. *Journal of the Biological Association of the United Kingdom*, 78: 973-984.

Goverse, E., Janse, M., Zwartepoorte, H., McLean, P., Bonnet, P., Oosterbaan, A., Hilterman, M. and Dondorp, E. 2014. Notes on Sea Turtles from the Netherlands: An Overview 1707-2013. *Marine Turtle Newsletter*, 141: 3-7
Hague, E.L., Sinclair, R.R. and Sparling, C.E. 2020. *Regional baselines for marine mammal knowledge across the North Sea and Atlantic areas of Scottish waters.* Scottish Marine and Freshwater Science, 11(12). Marine Scotland Science.

Hammond, P.S., Northridge, S.P., Thompson, D., Gordon, J.C.D., Hall, A.J., Sharples, R.J., Grellier, K. and Mattiopoulos, J. 2004. *Background information on marine mammals relevant to Strategic Environment Assessment 5*. Sea Mammal Research Unit, University of St Andrews.

Heinemann, D. 1981. A range finder for pelagic bird censusing. Journal of Wildlife Management. 45(2): 489-493.

ICES. 2016. *ICES Ecosystem Overviews Greater North Sea Ecoregion*. Version 2, published 04 March 2016. ICES CIEM.

IUCN (International Union for the Conservation of Nature). 2023. The IUCN Red List of Threatened Species. Version 2022-2. http://www.iucnredlist.org. Downloaded on 30 March 2023.

Joint Nature Conservation Committee (JNCC). 2017. JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys. August 2017. JNCC, Aberdeen.

JNCC. 2019e. European Community Directive on the Conservation of Natural Habitats and Wild Flora and Fauna (92/43/EEC). Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018. Conservation status assessment for the species: S1365 – Common Seal (Phoca vitulina) UNITED KINGDOM.

JNCC. 2019f. European Community Directive on the Conservation of Natural Habitats and Wild Flora and Fauna (92/43/EEC). Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018. Conservation status assessment for the species: S1364 – Grey Seal (Halichoerus grypus) UNITED KINGDOM.

Reeds, K.A. 2004. *Dermochelys coriacea* Leatherback turtle. In Tyler-Walters H. and Hiscock K. *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 16-04-2023]. Available from: https://www.marlin.ac.uk/species/detail/1534

Reid, J.B., Evans, P.G.H. and Northridge, S.P. 2003. *Atlas of cetacean distribution in north-west European waters*. Joint Nature Conservation Committee, Peterborough.

Rigby, C.L., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Francis, M.P., Herman, K., Jabado, R.W., Liu, K.M., Marshall, A., Romanov, E. and Kyne, P.M. 2021. *Cetorhinus maximus* (amended version of 2019 assessment). *The IUCN Red List of Threatened Species.* e.T4292A194720078. https://dx.doi.org/10.2305/IUCN.UK.2021-1.RLTS.T4292A194720078.en. Accessed on 16 April 2023.

SCOS. 2021. Scientific Advice on Matters Related to the Management of Seal Populations: 2021. Natural Environment Research Council Special Committee on Seals. Downloaded on 14 April 2023 from http://www.smru.st-andrews.ac.uk/scos/

Scottish Government. 2011. Scotland's Marine Atlas: Information for The National Plan. Accessed on 15 April 2023 from https://www.gov.scot/publications/scotlands-marine-atlas-information-national-marine-plan/pages/1/

Scottish Marine Wildlife Watching Code SNH (2017). The Scottish Marine Wildlife Watching Code (nature.scot)

Sims, D.W., Berrow, S.D., O'Sullivan, K.M., Pfeiffer, N.J., Collins, R., Smith, K.L., Pfeiffer, B.M., Connery, P., Wasik, S., Flounders, L., Queiroz, N., Humphries, N.E., Womersley, F.C. and Southall, E.J. 2022. Circles in the sea: annual courtship 'torus' behaviour of basking sharks *Cetorhinus maximus* identified in the eastern North Atlantic. *Journal of Fish Biology*, 101: 1160-1181.

Sims, D.W., Southall, E.J., Quayle, V.A. and Fox, A.M. 2000. Annual social behaviour of basking sharks associated with coastal front areas. *Proceedings of the Royal Society of London B.* 267: 1897-1904.

Wallace, B.P., Tiwari, M. and Girondot, M. 2013. *Dermochelys coriacea. The IUCN Red List of Threatened Species*. e.T6494A43526147. https://dx.doi.org/10.2305/IUCN.UK.2013-2.RLTS.T6494A43526147.en. Accessed on 16 April 2023.

Witt, M.J., Hardy, T., Johnson, L., McClellan, C.M., Pikesley, S.K., Ranger, S., Richardson, P.B., Solandt, J-L., Speedie, C., Williams, R. and Godley, B.J. 2012. Basking sharks in the northeast Atlantic: spatio-temporal trends in sightings from UK waters. *Marine Ecology Progress Series*, 459: 121-134.

APPENDIX A MARINE MAMMAL RECORDING FORMS

MARINE MAMMAL RECORDING FORMS COVER PAGE

Regulatory reference number	Country	Location	Ship/ platform name

Client	Contractor	Survey type
		☐ site ☐ VSP ☐ 2D ☐ WAZ ☐ 3D ☐ piling ☐ 4D ☐ explosives ☐ OBC ☐ other ☐ 4C
Start date	End date	

Number of source vessels	Type of source (e.g. airguns / Piling)	Number of airguns (only if airguns used)	Source volume (cu. in.)
Source depth (metres)	Frequency (range in which peak energy is emitted, in Hz)	Intensity (primary peak-to-peak amplitude in dB re. 1µPa or bar metres)	Shot point interval (metres)

Method of soft start

☐ increase number of guns ☐ increase frequency (where permitted) ☐ increase pressure (where permitted) ☐ increase number and frequency ☐ increase number and pressure ☐ other

Visual monitoring equipment used (e.g. binoculars, big eyes, etc.)	Magnification of optical equipment (e.g. binoculars)	Height of eye above water surface (metres)	How was distance of animals estimated?
			☐ by eye ☐ with laser rangefinder ☐ with rangefinder stick/ callipers ☐ with reticle binoculars ☐ by relating to object at known distance ☐ other

Number of dedicated MMOs	Training of MMOs
	☐ JNCC approved MMO training course for UK waters ☐ PSO training course for the Gulf of Mexico ☐ MMO training course for Irish waters ☐ MMO training course for New Zealand waters ☐ other ☐ none

Was PAM used?	Number of PAM operators	
☐ yes ☐ no		

Description of PAM equipment

MARINE MAMMAL RECORDING FORMS SIGHTINGS FORM

Regulatory reference number (e.g. DECC no., BOEM permit no., OCS lease no., etc.)	Ship/ platform name	Sighting number (start at 1 for first sighting of survey)	Acoustic detection number (start at 500 for first detection of survey)
Date		Time at start of encounter (UTC, 24hr clock)	Time at end of encounter (UTC, 24hr clock)

Were animals detected visually and/ or acoustically? ☐ visual ☐ acoustic ☐ both	How were the animals first detected? ☐ visually detected by observer keeping a continuous watch ☐ visually spotted incidentally by observer or someone else ☐ acoustically detected by PAM ☐ both visually and acoustically before operators/ observers informed each other

Observer's/ operator's name	Position (latitude and longitude)	Water depth (metres)

Species/ species group	Description (include features such as overall size; shape of head; colour and pattern; size, shape and position of dorsal fin; height, direction and shape of blow; characteristics of whistles/ clicks)
Bearing to animal (when first seen or heard) (bearing from true north)	Range to animal (when first seen or heard) (metres)

Total number	Number of adults (visual sightings only)	Number of juveniles (visual sightings only)	Number of calves (visual sightings only)	Photograph taken ☐ yes ☐ no

Behaviour (visual sightings only)

Direction of travel (relative to ship) ☐ towards ship ☐ away from ship ☐ parallel to ship in same direction as ship ☐ parallel to opposite direction to ship ☐ crossing perpendicular ahead of ship ☐ variable ☐ milling ☐ stationary ☐ other ☐ unknown	Direction of travel (compass points) ☐ N ☐ W ☐ NE ☐ NW ☐ E ☐ variable ☐ SE ☐ stationary ☐ S ☐ unknown ☐ SW

Airgun (or other source) activity when animals first detected ☐ full power ☐ not firing ☐ soft start ☐ reduced power (other than soft start)	Airgun (or other source) activity when animals last detected ☐ full power ☐ not firing ☐ soft start ☐ reduced power (other than soft start)	Time animals entered mitigation/ exclusion zone (UTC, 24hr clock) Closest distance of animals from airguns (or other source) (metres)	Time animals left mitigation/ exclusion zone (UTC, 24hr clock) Time of closest approach (UTC, 24hr clock)

If seen during soft start give: First distance Closest distance Last distance during soft start (metres)	What action was taken? (according to requirements of guidelines/ regulations in country concerned) ☐ none required ☐ delay start of firing ☐ shut-down of active source ☐ power-down of active source ☐ power-down then shut-down of active source	Length of power-down and/ or shut-down (if relevant) (length of time until subsequent soft start, in minutes)	Estimated loss of production (if relevant) due to mitigating actions (km)

MARINE MAMMAL RECORDING FORMS OPERATIONS FORM

Regulatory reference number ……..…….. Ship/ platform name ……

Complete this form every time the airguns are used, including overnight, whether for shooting a line or for testing or for any purpose.

Times should be in UTC, using the 24 hour clock.

Date	Reason for firing l = line t = test x = test followed immediately by line	Time soft start/ ramp-up began	Time of full power	Time of start of line	Time of end of line	Time of reduced output (if relevant)	Time airguns/ source stopped	Time pre-shooting search began	Time search ended	Time PAM began	Time PAM ended	Depth range (during pre-shooting search) s = <200m d = >200m b = both	Was it day or night in period prior to firing? d = day n = night w = dawn k = dusk	Was any mitigating action required? (yes/ no)

MARINE MAMMAL RECORDING FORMS EFFORT

Regulatory reference number ..... Ship/ platform name .....
(e.g. DECC no., BOEM permit no., OCS lease no., etc.)

Record the following for all watches, even if no marine mammals are seen.
START A NEW LINE IF SOURCE ACTIVITY OR WEATHER CHANGES. ENTER DATA AT LEAST EVERY HOUR.

Date	Visual watch or PAM (v/ p)	Observer's/ operator's name(s)	Time of start of section of watch (UTC, 24hr clock)	Time of end of section of watch (UTC, 24hr clock)	Source activity (f/ s/ r/ n/ v)	Start position (latitude and longitude)	Depth at start (m)	End position (latitude and longitude)	Depth at end (m)	Speed of vessel (knots)	Wind dir'n	Wind force (B'fort scale)	Sea state (g/ s/ c/ r)	Swell (o/ m/ l)	Vis. (visual watch only) (p/ m/ g)	Sun glare (visual watch only) (n/ wf/ sf/ vf/ wb/ sb/ vb)	Precip. (n/ l/ m/ h/ s)

Visual watch or PAM: v = visual watch; p = PAM
Source activity: f = full power; s = soft start; r = reduced power (not soft start); n = not active; v = variable (e.g. tests)
Sea state: g = glassy (like mirror); s = slight (no/ few white caps); c = choppy (many white caps); r = rough (big waves, foam, spray)
Swell: o = low (< 2 m); m = medium (2-4 m); l = large (> 4 m)
Visibility: p = poor (< 1 km); m = moderate (1-5 km); g = good (> 5 km)
Sun glare: n = none; wf = weak forward; sf = strong forward; vf = variable forward; wb = weak behind; sb = strong behind; vb = variable behind
Precipitation: n = none; l = light rain; m = moderate rain; h = heavy rain; s = snow

collaborative
environmental
advisers