TotalEnergies E&P North Sea UK Ltd

Culzean Floating Offshore Wind Turbine Pilot Project

Environmental Impact Assessment Report – Chapter 10 - Marine Mammals and Other Megafauna

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GLOSSARY

TERMINOLOGY	DESCRIPTION
Culzean Floating Offshore Wind Turbine Pilot Project ("the Project")	The entire Development including all offshore components and all project phases from pre-construction to decommissioning.
Environmental Impact Assessment (EIA)	The procedure to predict, minimise, measure and, if necessary, correct and compensate the impacts produced by any human action.
Export Cable	Cable connecting the Floating Wind Turbine to the Culzean Platform.
Floating Wind Turbine Generator (WTG)	Device that converts the kinetic energy of wind into electrical energy. Can be functionally divided into four parts: wind turbine, tower and transition piece, floating foundation, and mooring system.
Habitats Regulations Assessment (HRA)	Under the Habitats Regulations, all competent authorities must consider whether any plan or project could affect a European site before it can be authorised or carried out. This includes considering whether it will have a 'Likely Significant Effect' (LSE) on a European site, and if so, they must carry out an 'Appropriate Assessment' (AA). This process is known as Habitats Regulations Appraisal (HRA).
Innovation and Targeted Oil and Gas (INTOG)	The Initial Plan Framework Sectoral Marine Plan for Offshore Wind for INTOG encompasses spatial opportunities and a strategic framework for future offshore wind developments within sustainable and suitable locations that will help deliver the wider United Kingdom (UK) and Scottish Government Net Zero targets. The 'IN' component of INTOG consists of small-scale innovative projects of 100 Megawatts (MW) or less. The aim of the 'TOG' component is to supplying renewable electricity directly to oil and gas infrastructure. The Culzean project falls under the TOG component of INTOG.
Marine Licence Application ("the Application")	A Marine Licence is granted under the Marine and Coastal Access Act 2009 for projects between 12-200 Nautical Miles (nm) from shore, or the Marine (Scotland) Act 2010 for projects between Mean High-Water Springs (MHWS) out to 12 nm from shore. The Application includes Habitats Regulations Appraisal (HRA) supporting documentation (where required), an application letter, Marine Licence application form and this Environmental Impact Assessment Report (EIAR).
Net Zero	Refers to a government commitment to ensure the UK reduces its greenhouse gas emissions by 100% from 1990 levels by 2050 and in Scotland, the same target is set for 2045. If met, this would mean the amount of greenhouse gas emissions produced by the UK would be equal to or less than the emissions removed by the UK from the environment.
Project Area	The extent of the immediate area surrounding the floating Wind Turbine Generator (WTG) and cable route as characterised by the extent of the seabed environmental and habitat surveys. Also referred to as the Survey Area where specifically relating to survey activities.
Project Design Envelope	The maximum range of design parameters of all infrastructure assessed as part of the EIA.
Study Area	Receptor specific area used to characterise the baseline.
Survey Area	The area surveyed during site-specific surveys.

ACRONYMS AND ABBREVIATIONS

ACRONYM/ABBREVIATION	DEFINITION
BEIS	The Department for Business, Energy and Industrial Strategy
BWM	Ballast Water Management
CaP	Cable Plan
CBRA	Cable Burial Risk Assessment
CEMP	Construction Environmental Management Plan
CGNS	Celtic and Greater North Seas
CIEEM	Chartered Institute of Ecology and Environmental Management
cm	Centimetre
CMS	Construction Method Statement
CNS	Central North Sea
CoCP	Code of Construction Practice
dB re 1 µPA	Decibels relative to 1 Micro Pascal
DECC	The Department of Energy and Climate Change
DSLP	Development Specification Layout Plan
DTU	University of Denmark
EcIA	Ecological Impact Assessment
ECOMMAS	East Coast Scotland Marine Mammal Acoustic Array
eDNA	Environmental Deoxyribonucleic Acid (eDNA)
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMF	Electromagnetic Fields
EMP	Environmental Management Plan
EPS	European Protected Species
EU	European Union
ft	Feet

ACRONYM/ABBREVIATION	DEFINITION
GEN	General Principle
GNS	Greater North Sea
GSD	Ground Sampling Distance
HF	High Frequency
HRA	Habitats Regulations Appraisal
Hz	Hertz
IAMMWG	Inter-Agency Marine Mammal Working Group
INNS	Invasive Non-Native Species
INTOG	Innovation and Targeted Oil and Gas
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
kHz	Kilohertz
km	Kilometre
km^2	Kilometres Squared
LF	Low Frequency
LSE	Likely Significant Effects
m	Metres
m/s	Metres per Second
MARPOL	International Convention for the Prevention of Pollution from Ships
MASTS	Marine Alliance for Science and Technology for Scotland
MD-LOT	Marine Directorate – Licensing Operations Team
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs
MU	Management Unit
MW	Megawatt
NCMPA	Nature Conservation Marine Protected Area

ACRONYM/ABBREVIATION	DEFINITION
NID	Nature Inclusive Design
NM	Nautical Mile
NMFS	National Marine Fisheries Service
NMPI	National Marine Plan Interactive
NOAA	National Oceanic and Atmospheric Administration
NS	North Sea
OEMP	Operational Environmental Management Plan
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
PDE	Project Design Envelope
PEMP	Project Environmental Monitoring Plan
PMF	Priority Marine Feature
PTS	Permanent Threshold Shift
PW	Phocid Seals in Water
R&D	Research and Development
RIAA	Report to Inform Appropriate Assessment
ROV	Remote Operated Vehicle
SAC	Special Area of Conservation
SCANS	Small Cetaceans in European Atlantic waters and the North Sea
SCOS	Special Committee on Seals
SEL	Sound Exposure Level
SELcum	cumulative Sound Exposure Level
SMA	Seal Management Area
SMU	Seal Management Unit
SNCB	Statutory Nature Conservation Body
SPL	Sound Pressure Level
SPLrms	Sound Pressure Level Root Mean Squared

ACRONYM/ABBREVIATION	DEFINITION
SSSI	Site of Special Scientific Interest
TEPNSUK	TotalEnergies Exploration and Production North Sea UK Limited
UK	United Kingdom
UK BAP	UK Biodiversity Action Plan
UKCS	United Kingdom Continental Shelf
USBL	Ultra-Short Baseline
UXO	Unexploded Ordnance
VHF	Very High Frequency
VMP	Vessel Management Plan
WCA	Wildlife and Countryside Act
WTG	Wind Turbine Generator
ZoI	Zone of Influence

10 MARINE MAMMALS AND OTHER MEGAFAUNA

10.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) presents the baseline environment with respect to the marine megafauna receptors of relevance to the Project and assesses the potential impacts from the construction, operation and maintenance, and decommissioning of the Culzean Floating Offshore Wind Turbine Pilot Project (the Project) on these receptors. Where required, mitigation is proposed, and the residual impacts and their significance are assessed. Potential cumulative and transboundary impacts are also considered.

The chapter specifically assesses two types of marine megafauna which are regularly encountered off the northeast coast of Scotland: marine mammals and basking sharks (*Cetorhinus maximus)*.

Sea turtles are another taxon of marine megafauna which may be encountered off the coast of Scotland. However, they are considered rare visitors to the Project Area, based on confirmed and unconfirmed sightings records and accounts (National Biodiversity Network Trust, 2023). Of the five species of sea turtle which have been recorded in the UK, the leatherback turtle (*Dermochelys coriacea)* is the only species considered a regular constituent of the UK marine fauna, however records of this species are concentrated in the south and west coasts of England, Ireland and Wales, with limited sightings in Scotland along the west coast and in the Northern Isles (The Department for Business, Energy and Industrial Strategy (BEIS), 2022). As their occurrence is likely to be very rare within the Project Area, sea turtles have not been considered further within this assessment of impacts upon marine megafauna.

Xodus Group Ltd have drafted and carried out the impact assessment. Further competency details of the Project Team including lead authors for each chapter are provided in Chapter 1: Introduction. Table 10-1 below provides a list of all the supporting studies which relate to and should be read in conjunction with the Marine Mammal and Other Megafauna impact assessment.

Table 10-1 Supporting studies

DETAILS OF STUDY	LOCATIONS OF SUPPORTING STUDY
APEM Culzean Ornithological and Marine Mammal Baseline Characterisation Surveys	Appendix F: Ornithological and Marine Mammal Baseline Characterisation (2024)
Xodus Culzean Topsides Ornithology (Nesting Bird) Surveys	Appendix G: Culzean Topsides Ornithology (Nesting Bird) Surveys (2023)

An assessment under the Habitats Regulations for Europeans Sites designated for marine mammal has been undertaken for the Project within the Combined Habitats Regulations Appraisal (HRA) Screening and Report to Inform Appropriate Assessment (RIAA) Report (Document Reference: GB-CZN-00-XODUS-000023). This report has been submitted alongside the Application.

10.2 Legislation, policy and guidance

The following relevant legislation and guidance relating to marine mammals and basking sharks has been considered in the preparation of this chapter.

10.2.1 Legislation

Marine mammals are afforded varying levels of protection under international and national legislation. Within UK waters, cetaceans (whales, dolphins, and porpoises) are protected through the following:

- The Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) in offshore (>12 NM) waters;
- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) for Scottish territorial (<12 NM) waters;
- Schedule 5 of the Wildlife and Countryside Act 1981;
- Marine (Scotland) Act 2010;
- European Protected Species (EPS) listing under Schedule 2 of the Habitat Regulations 1994 (as amended in Scotland);
- The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention); and
- The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention).

Bottlenose dolphin (*Tursiops truncatus*) and harbour porpoise (*Phocoena phocoena*) gain additional protection through Annex II of the Habitats Directive, which includes provisions for their consideration in designating Special Areas of Conservation (SACs).

Current legislation makes it an offence to deliberately or recklessly injure or disturb cetaceans within Scottish inshore and offshore waters; however, the definition of disturbance legally varies between these two jurisdictions. As the Project is in offshore waters, the definition of disturbance for waters beyond 12 NM from shore the relevant legislation is derived from the Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended). The definition of relevant offences is under Regulation 45 whereby:

(1) Subject to regulations 46 and 55, a person who—

(a) deliberately captures, injures, or kills any wild animal of a European protected species,
(b) deliberately disturbs wild animals of any such species,
(c) deliberately takes or destroys the eggs of such an animal, or
(d) damages or destroys, or does anything to cause the deterioration of, a breeding site or resting place of such an animal, is guilty of an offence.

(2) For the purposes of paragraph (1)(b), disturbance of animals includes in particular any disturbance which is likely—

(a) to impair their ability—
(i) to survive, to breed or reproduce, or to rear or nurture their young; or
(ii) in the case of animals of a hibernating or migratory species, to hibernate or migrate; or
(b) to affect significantly the local distribution or abundance of the species to which they belong.

Whilst pinnipeds are not EPS, grey seal (*Halichoerus grypus)* and harbour seal (*Phoca vitulina)* are protected through the following legislation:

- Annex V of the Habitats Directive, which defines them as species of community interest, meaning that any taking of these species in the wild is subject to management measures;
- Annex II of the Habitats Directive, which includes provisions for their consideration in designating SACs;
- Part 6 of the Marine (Scotland) Act 2010, which makes it an offence to intentionally or recklessly kill, injure or take a live seal; and
- Through the designation of seal haul-outs, which are coastal locations that seals use to breed, pup, moult and rest which are designated under the Protection of Seals (Designation of Haul-Out Sites) (Scotland) Order 2014 (as amended). All haul-outs in Scotland are protected from adverse anthropogenic impacts under Section 117 of the Marine (Scotland) Act 2010.

Additionally, all marine mammal species (both pinnipeds and cetaceans) which regularly occur within Scottish waters are designated as Priority Marine Features (PMFs) (Tyler-Walters *et al.*, 2016). PMFs are habitats and species that are marine nature conservation priorities in Scottish waters (NatureScot, 2020a).

Basking sharks are similarly protected by legislation which makes it illegal to intentionally kill, injure, or harass any individuals of this species within 12 NM by following:

- Schedule 5 of the Wildlife and Countryside Act (WCA) (1981); and
- The Nature Conservation (Scotland) Act 2004. Part 3 and Schedule 6 make amendments to the WCA, strengthening the legal protection for threatened species to include 'reckless' acts, and specifically makes it an offence to intentionally or recklessly disturb or harass protected species.

Additionally, UK Biodiversity Action Plan (UK BAP) has highlighted to regulators the urgent need for management intervention for basking sharks in UK waters.

10.2.2 Policy and Guidance

To support the legal protections for marine mammals and basking sharks, the UK and Scottish Governments, their Statutory Nature Conservation Bodies (SNCBs), and relevant conservation charities have published a suite of policy and guidance for marine users which include:

- The UK Post-2010 Biodiversity Framework and the Scottish Biodiversity Strategy, including the 2020 Challenge for Scotland's Biodiversity;
- Scotland's National Marine Plan: A Single Framework for Managing our Seas, including the following General Principle (GEN) Policies which are relevant to marine mammal and basking shark receptors:
  - GEN 1: General planning principle: There is a presumption in favour of sustainable development and use of the marine environment when consistent with the policies and objectives of this Plan;
  - GEN 9 Natural heritage: Development and use of the marine environment must:
    i) Comply with legal requirements for protected areas and protected species;
    ii) Not result in significant impact on the national status of PMF;
    iii) Protect and, where appropriate, enhance the health of the marine area;

  - GEN 11 Marine litter: Developers, users, and those accessing the marine environment must take measures to address marine litter where appropriate. Reduction of litter must be taken into account by decision-makers;
  - GEN 13 Noise: Development and use in the marine environment should avoid significant adverse effects of man-made noise and vibration, especially on species sensitive to such effects;
  - GEN 19 Sound evidence: Decision making in the marine environment will be based on sound scientific and socio-economic evidence;
  - GEN 20 Adaptive management: Adaptive management practices should take account of new data and information in decision-making, informing future decisions and future iterations of policy;
  - GEN 21 Cumulative impacts: Cumulative impacts affecting the ecosystem of the marine plan area should be addressed in decision making and plan implementation;
- Guidance on the Offence of Harassment at Seal Haul-out Sites (Marine Scotland, 2014);
- Scottish Marine Wildlife Watching Code (NatureScot, 2017);
- Priority Marine Features list (NatureScot, 2020a);
- Guidelines for Ecological Impact Assessment (EcIA) in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine (Chartered Institute of Ecology and Environmental Management (CIEEM), 2019); and
- The Basking Shark Code of Conduct (Shark Trust, 2020).

The policies and guidance listed above have been taken into account within the assessment of environmental impacts provided below and in the development of effective mitigation and management measures for the proposed activities.

10.3 Scoping and consultation

Stakeholder consultation has been ongoing throughout the EIA process and has played an important part in ensuring the scope of the baseline characterisation and impact assessment are appropriate with respect to the Project and the requirements of the regulators and their advisors.

The Scoping Report was submitted to Scottish Ministers (Via Marine Directorate – Licensing Operations Team (MD-LOT), on 14th April 2023, who then circulated the report to relevant consultees. The Scoping Opinion was received on 20th July 2023. Relevant comments from the Scoping Opinion and other consultations specific to Marine Mammals and Other Megafauna are provided in Table 10-2 below, which provides a high-level response on how these comments have been addressed within the EIAR.

Table 10-2 Summary of consultation responses specific to Marine Mammals and Other Megafauna

CONSULTEE	COMMENT	RESPONSE
Scoping Opinion		
Scottish Ministers (Via MD-LOT) / NatureScot	The Scottish Ministers, in line with the NatureScot representation, are content with the study area and proposed use of the appropriate species Management Units and the site specific survey area for an indication of local densities of the marine mammal's species, as detailed in section 7.3.3 of the Scoping Report.	Noted, no further response required.
	Table 7-9 of the Scoping Report summarises the key datasets and reports used to inform the marine mammal baseline. The Scottish Ministers advise, in line with the NatureScot representation, that SCANS IV, a campaign to examine the abundance and distribution of cetaceans in European Atlantic waters, is expected to report later this year and, if available, should be included in the EIA Report.	Marine mammal densities have been considered in the baseline using the Carter *et al.* (2022) seal density data and Small Cetacean Abundance in the North Sea (SCANS)-IV survey data published in September 2023 (Gilles *et al.* (2023))
	The Scottish Ministers are content with the species identified in section 7.3.5 of the Scoping Report; however, should any additional species be identified during the surveys, such results should be used to inform the species list.	During the APEM surveys (see Appendix F) one observation of basking shark was made in the June 2023 survey period, and the species list was updated accordingly.
	The Scottish Ministers are broadly content with the proposed mitigation measures listed in Table 7-11; however, should piling be required, the 2010 Joint Nature Conservation Committee ("JNCC") protocol for minimising the risk of injury to marine mammals from piling noise should be included. Furthermore, only the JNCC (2017) guidelines for minimising the risk of injury to marine mammals from geophysical surveys are required, rather than the JNCC (2010) guidelines for minimising the risk of injury or disturbance from seismic surveys. This is supported by the NatureScot representation.	TotalEnergies Exploration and Production North Sea UK Limited (TEPNSUK) acknowledge this requirement; however, since the initial planning stage, pile driving has been removed from the Project Design Envelope (PDE). As such, the JNCC 2010 guidance is not applicable for this Project. Furthermore, there are no planned future geophysical surveys for the Project, as such the JNCC 2017 guidelines are also not applicable. Should the need for any geophysical surveys change in the future these will be subject to a separate marine licence and the JNCC 2017 guidance shall be adhered to.

CONSULTEE	COMMENT	RESPONSE
	The Scottish Ministers, in line with the NatureScot response, are content with the impacts to be scoped into the EIA Report as noted in Table 7-12 as well as the proposed assessment approach to underwater noise modelling detailed in section 7.3.10 of the Scoping Report. Furthermore, the Scottish Ministers support the proposed use of the Cumulative Effect Framework and, in line with section 7.3.9 of the Scoping Report, agree that transboundary impacts should be further assessed.	TEPNSUK acknowledge this requirement, however since the initial planning stage, pile driving has been removed from the PDE. As such, pile driving is not assessed within this chapter. Although the use of the Cumulative Effects Framework was intended as required, it has still not been made available for use. The methodology for the cumulative impact assessment is further outlined in Section 10.11 of this chapter. Transboundary impacts have been considered in Section 10.13.
NatureScot HRA Screening Consultation Meeting 29/01/2024		
NatureScot	Marine mammals Pin piling was initially considered within the project design envelope, however we note this noisy activity is no longer being considered. Other potential noise emitting activities (e.g. vessel and anchoring activities) during construction will be both localised and temporary. As such, we do not consider there to be any impact pathways of concern to marine mammal interests.	Noted, no further response required.
	Marine mammals: HRA requirements Due to the distance from designated sites and the lack of any impact pathways, we are content that there is no likely significant effect from this proposed development on the seal or cetacean qualifying features of any Special Area of Conservation. As such, we agree that marine mammals can be screened out and require no further consideration under HRA.	Noted, within the Combined HRA Screening and RIAA Report (Document Reference: GB-CZN-00-XODUS-000023), submitted alongside the Application, all SACs designated for marine mammals have been screened out for further assessment as no potential for Likely Significant Effects (LSE) has been concluded.
	Marine mammals: EIA requirements Given the scale of the development combined with lack of impact pathway, we are also content that no further assessment is required for marine mammals under EIA.	Noted, however, as this chapter had been sufficiently progressed prior to the advice received, this chapter does undertake an assessment of underwater noise on marine mammals for other noise emitting activities such as vessels and

CONSULTEE	COMMENT	RESPONSE
		cable installation. Nonetheless, the assessments conclude no significant effects for these impacts, as detailed in Section 10.9.
	Marine mammals: European Protected Species (EPS) licensing As discussed during the meeting held on 29 January 2024, it is unlikely that any noise emitting work will be required. However, we consider if geophysical activities or unexploded ordnance (UXO) clearance activities are to be carried out, there could be potential impacts to marine mammals - we advise that these impacts can be addressed through the EPS licensing process – should they be required.	Noted, at this point in time further geophysical surveys or UXO clearance activities are not required. Should this change, any future geophysical or UXO activities would be carried out under a separate EPS licensing process.
	Marine Mammals / Megafauna: Survey results and density estimates We note that harbour porpoise (16 individuals) and unidentified dolphin/porpoise (one individual) were recorded in the one year of surveys. One basking shark was also recorded.	Noted, no further response required.
	An abundance estimate and density estimate is provided for basking shark, based on a single sighting. Given the likely low abundance of basking shark in this area, we advise only carrying out a qualitative assessment and not trying to assess impacts to this species quantitatively.	Noted, basking sharks have been considered qualitatively within this chapter.
	A relatively small number of individual harbour porpoise were seen (16 in total). This may be due to surveys being carried out in conditions in which it would be difficult to see harbour porpoise (up to 26 knot winds, and sea state of 3). However, the density estimates are not dissimilar to those in SCANS surveys (SCANS III and IV). We advise using the most precautionary estimate for any quantitative assessments.	Noted, the most conservative density estimates for harbour porpoise have been used to underpin the assessments presented in this chapter, as discussed in Section 10.5.3.2.

In line with the Scoping Opinion, aspects relevant to Marine Mammals and Other Megafauna scoped out of further assessment in this EIAR include:

- Noise-related impacts to marine mammals associated with operational noise, including the risk of injury and disturbance/displacement;
- Indirect impacts of construction noise on the prey species of marine mammals during construction, operation, and decommissioning;
- Vessel disturbance during construction, operation, and decommissioning;
- Risk of injury resulting from collision of marine mammals with installation vessels during construction and decommissioning;
- Impacts associated with effects upon marine water quality, particularly due to any disturbed sediments affecting turbidity during construction and decommissioning;
- Risk of injury resulting from entanglement of marine mammals with mooring lines or cable, including secondary interactions with derelict fishing gears, or entrapment with mooring systems during operation;
- Risk of injury resulting from collision of marine mammals with WTG substructures during operation;
- Displacement or barrier effects resulting from the physical presence of devices and infrastructure during operation;
- Risk of injury resulting from collision of marine mammals with operations and maintenance vessels;
- Risk associated with Electromagnetic Fields (EMFs) associated with subsea cabling during operation;
- Impacts associated with effects upon marine water quality due to any accidental release of pollutants during operation; and
- Long term habitat changes, including the potential for change in foraging opportunities during operation.

10.4 Study Area

The Study Area for marine megafauna has been defined at two spatial scales: the site specific, where the Study Area covers the Project Area and 50 kilometre (km) buffer zone, to take into account the scale of possible effects, movement, and population structure of megafauna species; and at the scale of marine mammal Management Units (MU) for assessment against species MU populations. The Project Area falls within the cetacean MU's listed below:

- North Sea (NS): MU for harbour porpoise;
- Celtic and Greater North Seas (CGNS): for Atlantic white-sided dolphin (*Lagenorhynchus acutus*), white-beaked dolphin (*Lagenorhynchus albirostris*) and minke whale (*Balaenoptera acutorostrata*);
- Greater North Sea (GNS): MU for bottlenose dolphin.

Additionally, the Study Area overlaps with the East Scotland Seal Management Area (SMA) for harbour seal and grey seal (Special Committee on Seals (SCOS), 2021). The SMAs define the geographic extent of the Seal Management Units (SMUs), which are distinct populations of breeding seals.

It should be noted that MUs are currently undefined for basking sharks in the UK and genetic research has shown very little differentiation, indicating the presence of a single global population (Rigby *et al.*, 2021). It has therefore been assumed that the biogeographic extent of basking sharks is circumglobal within polar to tropical seas.

In terms of available data on cetacean habitat use, the Study Area falls within Block NS-D and close to the border with block NS-G of the SCANS-IV survey used to define density and abundance of cetaceans in UK and Northern European waters (Gilles *et al.*, 2023). Following a precautionary approach, the cetacean densities from the block with the highest density were used in this chapter.

Where species-specific data was unavailable for key receptors in Block NS-D or NS-G, data from the appropriate SCANS III survey block were used, following the same precautionary approach. Additionally, site-specific surveys, or modelled predicted density estimates from Waggitt *et al.*, 2020 and Lacey et al., 2022, have been considered. It should be acknowledged that the SCANS IV survey blocks consider regions beyond the Project Area. Furthermore, population data used to define the species MUs for cetacean populations utilising the Study Area are on a much broader, regional-seas scale.

The most recent population estimates for each SMU are published in the latest SCOS report (SCOS, 2022).

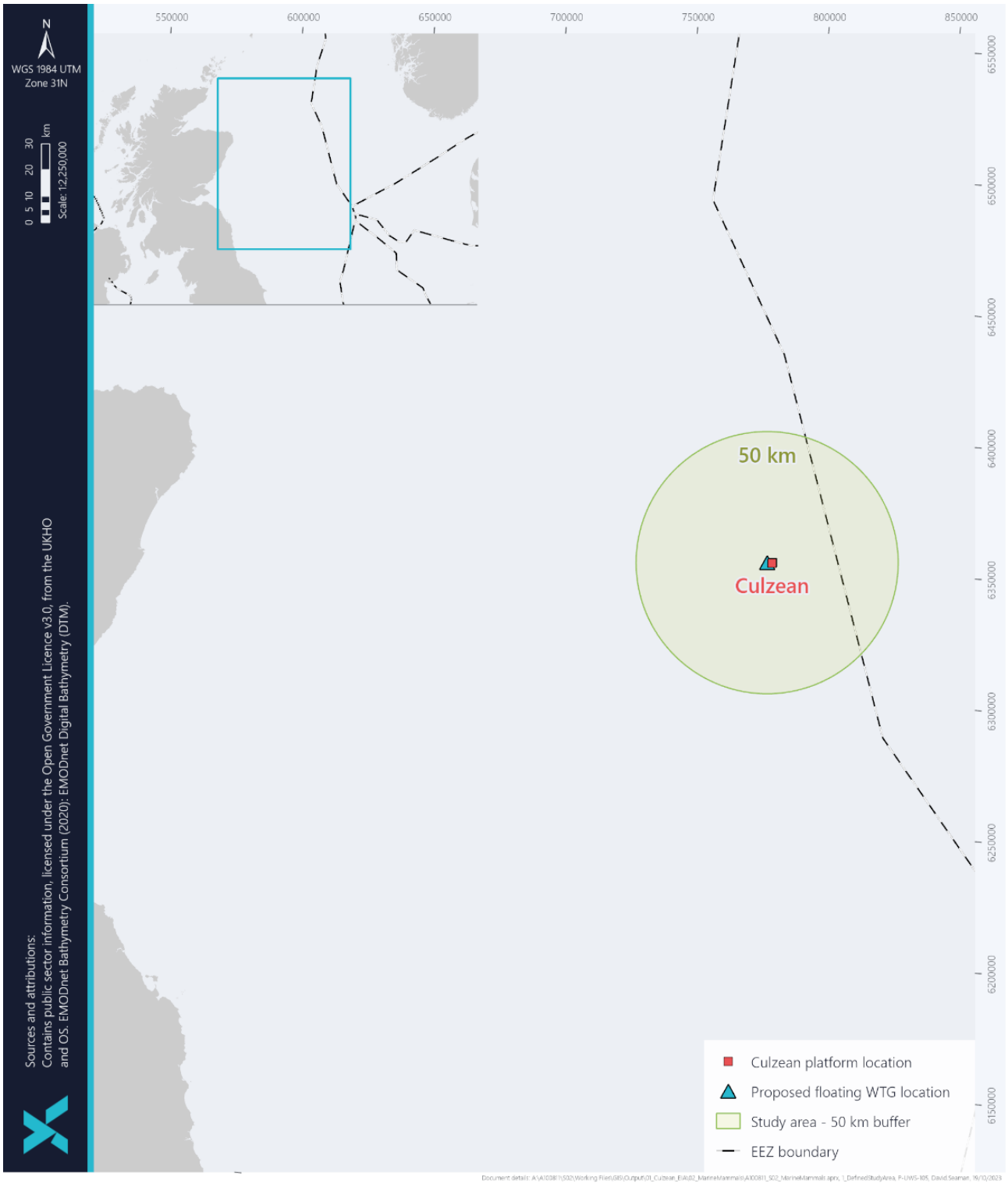

Figure 10-1 Defined Study Area

10.5 Baseline environment

This Section assesses the marine mammal and basking shark receptors that may be present within the Study Area. To understand habitat use by marine mammals and basking sharks within the Study Area a desk-based review of available data has been undertaken. The data are supplemented by site-specific aerial surveys which included megafauna observations. The output of this review is presented in the sections below.

10.5.1 Data sources

The existing data sets and literature with relevant coverage to the Project, which have been used to inform the baseline characterisation for Marine Mammals and Other Megafauna are outlined in Table 10-3

Table 10-3 Summary of key datasets and reports

TITLE	SOURCE	AUTHOR	YEAR
A Framework for Studying the Effects of Offshore Wind Development on Marine Mammals and Turtles	https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/A-Framework-for-Studying-the-Effects.pdf	Kraus *et al.*	2019
Regional Baselines for Marine Mammal Knowledge Across the North Sea and Atlantic Areas of Scottish Waters	https://data.marine.gov.scot/sites/default/files//Scottish%20Marine%20and%20Freshwater%20Science%20%28SMFS%29%20Vol%2011%20No%2012_%20Regional%20baselines%20for%20marine%20mammal%20knowledge%20across%20the%20North%20Sea%20and%20Atlantic%20areas%20of%20Scottish%20waters%20-%20Appendix%201%20Data%20Sources.pdf	Hague *et al.*	2020
Improving understanding of bottlenose dolphin movements along the east coast of Scotland. Final report.	https://tethys.pnnl.gov/publications/improving-understanding-bottlenose-dolphin-movements-along-east-coast-scotland-interim	Arso Civil *et al.*	2019
Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS III aerial and shipboard surveys	https://scans3.wp.st-andrews.ac.uk/files/2021/06/SCANS-III_design-based_estimates_final_report_revised_June_2021.pdf	Hammond *et al.*	2021
Modelled density surfaces of cetaceans in European Atlantic waters in summer 2016 from the SCANS III aerial and shipboard surveys	https://scans3.wp.st-andrews.ac.uk/files/2022/08/SCANS-III_density_surface_modelling_report_final_20220815.pdf	Lacey *et al.*	2022

TITLE	SOURCE	AUTHOR	YEAR
Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS IV aerial and shipboard surveys	https://tinyurl.com/3ynt6swa	Gilles et al.	2023
Scientific Advice on Matters Related to the Management of Seal Populations	http://www.smru.st-andrews.ac.uk/files/2022/08/SCOS-2021.pdf	SCOS	2021
Updated abundance estimates for cetacean Management Units in UK waters (Inter-Agency Marine Mammal Working Group (IAMMWG)	https://hub.jncc.gov.uk/assets/3a401204-aa46-43c8-85b8-5ae42cdd7ff3	IAMMWG	2022
NatureScot SiteLink	https://sitelink.nature.scot/home	NatureScot	2023
National Marine Plan Interactive (NMPi)	https://marine.gov.scot/maps/844	Scottish Government	2023
Atlas of Cetacean Distribution	https://hub.jncc.gov.uk/assets/a5a51895-50a1-4cd8-8f9d-8e2512345adf	JNCC	2003
Distribution Maps of Cetacean and Seabird Populations in the North-East Atlantic	https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/1365-2664.13525	Waggitt *et al.*	2020
Uncovering the links between foraging and breeding regions in a highly mobile mammal	https://besjournals.onlinelibrary.wiley.com/doi/10.1111/1365-2664.12048	Russell *et al.*	2013
Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/959723/SMRU_2020_Habitat-based_predictions_of_at-sea_distribution_for_grey_and_harbour_seals_in_the_British_Isles.pdf	Carter *et al.*	2020
Sympatric Seals, Satellite Tracking and Protected Areas: Habitat-Based Distribution Estimates for Conservation and Management	https://www.frontiersin.org/articles/10.3389/fmars.2022.875869/full	Carter *et al.*	2022
Seal telemetry data (1988 –2018)	https://risweb.st-andrews.ac.uk/portal/en/researchoutput/smru-seal-telemetry-data-holdings(758f5208-c2d5-4cae-8508-892204cadc0c).html	SMRU, University of St Andrews	2018
East Coast Scotland Marine Mammal Acoustic Array (ECOMMAS)	https://marine.gov.scot/information/east-coast-marine-mammal-acoustic-study-ecommas	Marine Scotland	2020

TITLE	SOURCE	AUTHOR	YEAR
Spatial distribution patterns of basking sharks on the European shelf: preliminary comparison of satellite-tag geolocation, survey and public sightings data.	Marine Biological Association of the United Kingdom. Journal of the Marine Biological Association of the United Kingdom, 85(5): 1083.	Southall et al	2005
Basking sharks in the northeast Atlantic: spatio-temporal trends from sightings in UK waters.	https://doi.org/10.3354/meps09737	Witt et al	2012
Basking Shark (Cetorhinus maximus) Literature Review, Current Research and New Research Ideas.	http://marine.gov.scot/datafiles/misc/MREP/Archive/03/Documents/DrewryHelen_Baskingsharks.pdf	Drewery et al	2012

10.5.2 Project site-specific surveys

Digital aerial surveys of the Project, off the north-east coast of Scotland, were conducted between September 2022 and August 2023 using APEM's high-resolution camera system to capture digital still imagery (see Appendix F).

The main aim of the aerial surveys was to assess the abundance and distribution of seabirds present within and around Culzean. The Survey Area covered the area surrounding the Culzean platform and three potential sites considered for the wind turbine location with a 4 km buffer zone surrounding these sites (Figure 10-2).

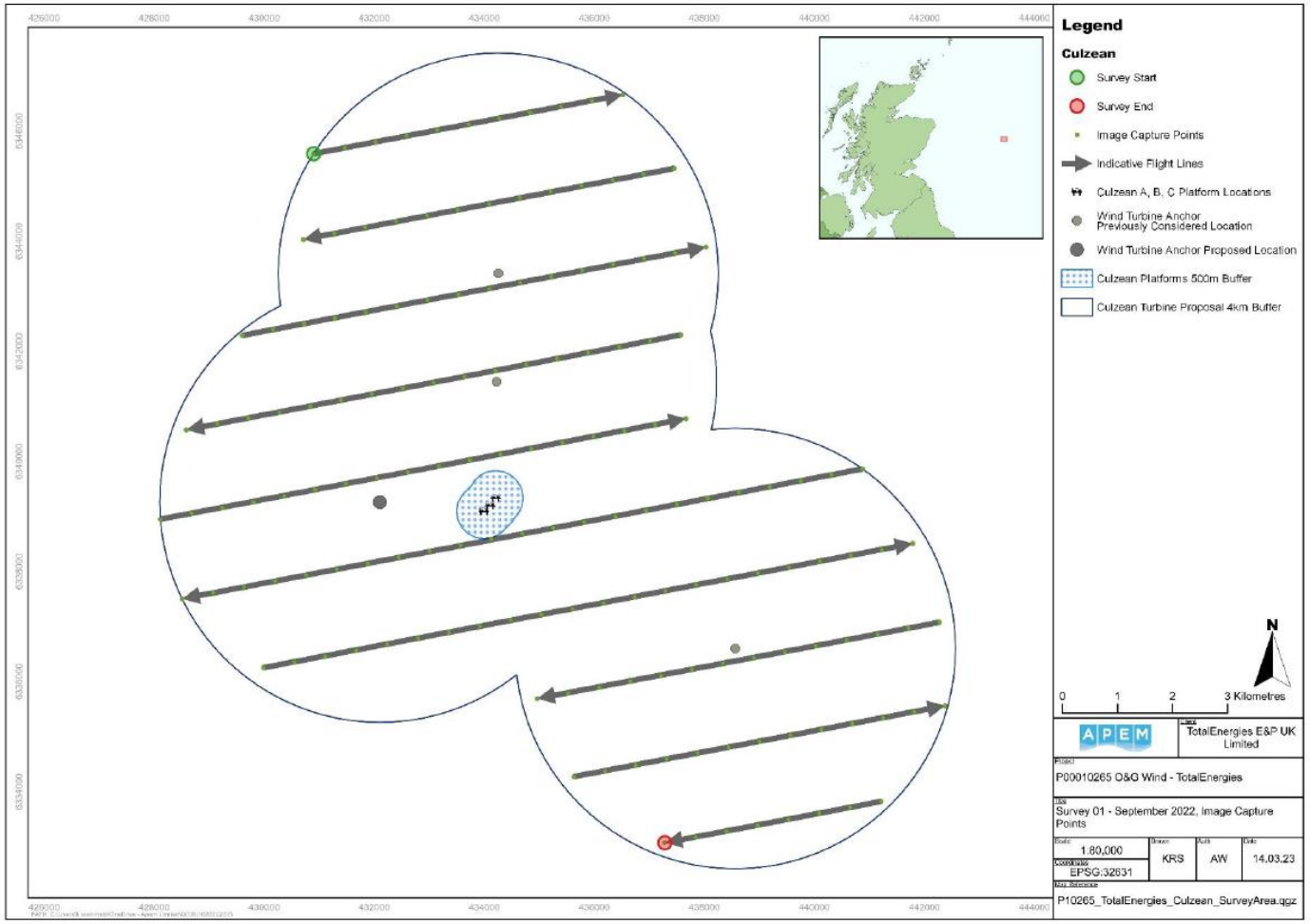

Figure 10-2 Exemplary indicative flight lines and image capture points of the Culzean Platforms Survey Area (March 2023)

Images were captured using a grid-based survey design with a 1.5 (centimetre) cm ground sampling distance (GSD) and were analysed and quality assured by APEM (see Appendix F). Images were captured along 10 lines spaced approximately 1.5 km across-track and 0.6 km along-track between image nodes within the area, at an altitude of approximately 396 m (1,300 ft) and a speed of approximately 120 knots. Coverage of images analysed was calculated to be approximately 10% of the area surveyed, as specified in the APEM method statement. Observations of Marine Mammals and Other Marine Megafauna, as well as observations of anthropogenic objects were also recorded during the APEM surveys.

10.5.3 Current Baseline

10.5.3.1 Cetaceans

A review of literature and available data sources augmented by consultation and APEM site-specific surveys (see Appendix F) have been undertaken to describe the current baseline status of marine mammals in the Study Area.

Around 20 species of cetaceans are known to occur within Scottish waters (HWDT, 2018) and four of these species are likely to occur in the Project Area. Harbour porpoise and white-beaked dolphin are considered to be the most abundant cetacean species within the North Sea, found throughout the waters off the coast of Scotland all year round, with the highest densities recorded in the summer months (Reid *et al.*, 2003; Hague *et al.*, 2020). Minke whales generally occur in greater numbers in the North Sea during the summer months (May – September) but have been also observed until November (The Department of Energy and Climate Change (DECC), 2016; Risch *et al.*, 2019). Populations of bottlenose dolphins are regularly sighted in the waters off the east coast of Scotland, with fewer sightings offshore, although some surveys have reported this species in the central North Sea (Hammond *et al.*, 2021). Other species, including killer whales *Orcinus orca,* Atlantic white-sided dolphins, Risso's dolphins (*Grampus griseus)* and long-finned pilot whales (*Globicephala melas)* are also occasionally sighted in the waters off the east coast of Scotland (DECC, 2016).

Several key data sources have been used to describe the habitat use of cetacean species considered important within the Project Area. These include the most recent report by the IAMMWG (2022) on cetacean MU populations; predictive habitat modelling undertaken by Waggitt *et al.* (2020); published survey data from SCANS III and IV by Hammond *et al* (2021) and Gilles *et al*. (2023); modelled cetacean densities published by Lacey *et al.* (2022); and aerial surveys of the Project Area undertaken by APEM (Appendix F).

Table 10-4 outlines the abundance and density estimates of key cetacean species for which MUs are defined and were taken forward for consideration in this impact assessment.

Table 10-4 Abundance and density estimates for the key cetacean MUs within the Project Area (Hammond et al 2021; Gilles et al., 2023 and IAMMWG, 2022)

SPECIES	ANIMALS/ KM^2 (SCANS III AND SCANS IV)	MU
Harbour porpoise	0.599; 1.039 (SCANS IV block NS-D, NS-G)	NS: 346,601 (UK portion: 159,632)
White-beaked dolphin	0.079; 0.105 (SCANS IV block NS-D, NS-G)	CGNS: 43,951 (UK portion: 34,025)
Minke whale	0.042; 0.010 (SCANS IV block NS-D, NS-G)	CGNS: 20,118 (UK portion: 10,288)
Bottlenose dolphin	0.030 (SCANS III block R)	GNS: 2,022 (UK portion: 1,885)
Atlantic-white sided dolphin	0.010 (SCANS III block R)	CGNS: 18,128 (UK portion: 12,293)

Additionally, Figure 10-3 provides spatial context of the cetacean MUs and their proximity to the Project Area.

During the site-specific aerial surveys (Appendix F), of the key cetaceans identified harbour porpoises were recorded almost every month in very low numbers (maximum seven individuals in June 2023). Dolphins or porpoises (not identified to species level) were observed during one survey in October (2 individuals).

All species of cetacean are deemed Scottish PMFs and are thus considered to be marine nature conservation priorities in Scottish waters. This listing, coupled with the protections afforded in UK, has enabled the designation of various protected areas for the conservation and management of cetaceans.

The conservation status of marine mammals in the UK, protected under European Union legislation was last reported by JNCC in 2019 as a part of the 2019 UK reporting under Article 17 of the European Union (EU) Habitats Directive. Table 10-5 highlights key information on the conservation status of key cetacean species within the Study Area, in terms of their current and future prospective ecological condition (JNCC, 2022).

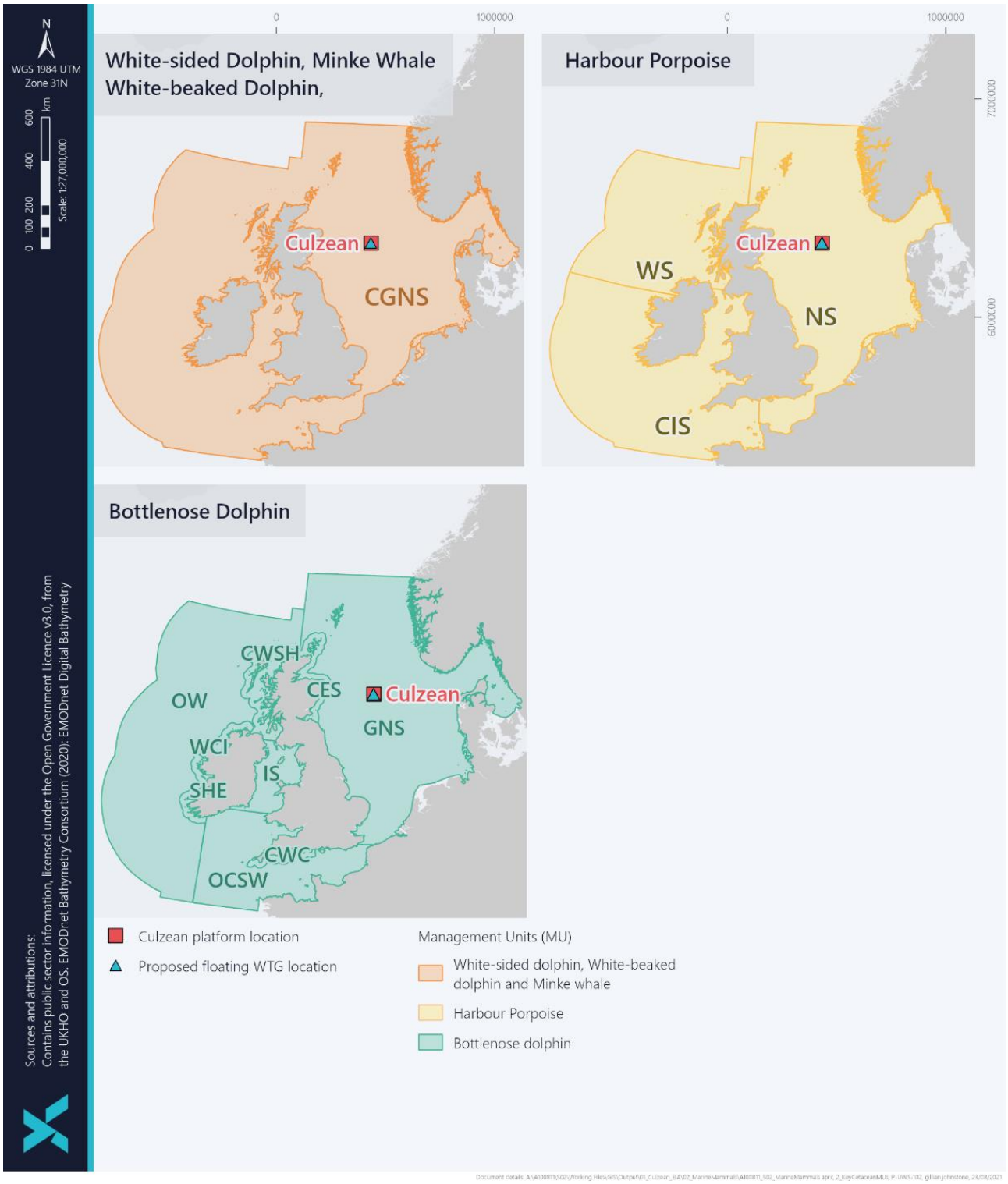

Figure 10-3 Key cetacean species MUs and Project Area.

Table 10-5 Conservation status of key cetacean species relevant for the Project (JNCC, 2022)

SPECIES	RANGE	POPULATION	HABITAT	FUTURE PROPOSECTS	CONSERVATION STATUS	OVERALL TREND
Harbour porpoise	FV	XX	XX	FV	XX	XX
Minke whale	FV	XX	XX	XX	XX	XX
Bottlenose dolphin	FV	XX	XX	XX	XX	XX
White-beaked dolphin	FV	XX	XX	XX	XX	XX
Atlantic white-sided dolphin	FV	XX	XX	XX	XX	XX

Key: FV = Favourable, + = Improving U = Unfavourable to Inadequate, XX = Unknown

The following sections provide further detail on the biology, habitat use, and distribution of the cetacean species which require further consideration in the assessment of potential impacts from the proposed activities within the Project Area.

10.5.3.2 Harbour Porpoise

Ecology

Harbour porpoises are the most abundant cetacean species in UK waters and are generally observed in small groups of one to three individuals (Reid *et al.*, 2003). They are the most frequently sighted cetacean along the east coast of Scotland where they are present year-round (NMPi, 2023; Reid *et al.*, 2003; Hague *et al.*, 2020). Sightings records peak for this species during the summer months (Evans, 2011). These small cetaceans favour shallow continental shelf waters of approximately 150 m or less and areas with highly sloped topographic features, where prey species, such as (but not limited to) sandeels (*Ammodytes marinus)*, herring (*Clupea harengus)* and sprat (*Sprattus sprattus)*, may be concentrated (Santos and Pierce, 2003; Booth *et al.*, 2013; Ransijn *et al.*, 2019).

Calving is thought to take place in Scottish waters primarily between April and June, with a subsequent weaning period of up to 12 months, during which sensitivity to disturbance is expected to be elevated for mothers and calves (Evans, 2011). Within UK waters individuals are concentrated mainly in the Southern North Sea, from the coastline skirting Northumberland down to Norfolk (Hammond *et al.*, 2021). Density estimates for this species are lower in the northern North Sea especially around the north and north-east coasts of Scotland (Hammond *et al.* 2021). This reflects substantive changes in populations over recent years whereby surveys have revealed the core distribution of this species has moved from the northern to the Southern North Sea.

Management Unit

The MU identified for this species is the North Sea MU with estimated abundance of 346,601 individuals, of which 159,632 individuals are estimated to occur within the UK portion of this MU (IAMMWG, 2022). The results of the recent

SCANS-IV survey, carried out during 2022, indicate no clear changing trend in the abundance in the North Sea population and a continuing increase in sightings in the southern part of North Sea (Gilles *et al.*, 2023).

Density Data

Table 10-6 outlines the density estimates for harbour porpoise across the Study Area and the surrounding waters.

Table 10-6 Available density estimates for harbour porpoises covering the Study Area

DATA SOURCE	AREA	TEMPORAL SCALE	DENSITY (NO. INDIVIDUALS/KM^2)
Gilles *et al.*, (2023)	NS-D NS-G	Summer 2022	0.599 1.039
Lacey *et al.*, (2022)	Project Area	Summer 2016	0.77
Waggitt *et al.*, (2020)	Project Area	Data collected between 1980 and 2018	Jan: 0.250 Jul: 0.420

Harbour porpoises were sighted in very low numbers during the site-specific APEM surveys (16 observations in total). July was the month where most of the sightings were made, when seven individuals were observed (as further detailed in Appendix F). Harbour porpoise was the only cetacean identified to species level from the APEM aerial survey data.

The SCANS-IV surveys were undertaken in Summer 2022. Surveys Block NS-D which overlaps the Study Area contained of a total of 1,703.8 km of primary search effort. The most abundant species sighted was harbour porpoise with an estimated abundance of 38,577 individuals in block NS-D (95% CI: 18,017 to 76,361) with an estimated density of 0.599 individuals/km^2 (Gilles *et al.*, 2023). The estimated abundance and density adjacent to Study Area block NS-G (primary search effort of 1264.7 km) was 51,646 individuals (95% CI: 30,773 to 79,506) and 1.039 individuals/km^2 respectively, being the highest density estimate for a SCANS-IV survey block.

Waggitt *et al.* (2020) collated multiyear sighting data to generate annual density and distribution estimates of cetaceans in the North Sea. The density estimates provided in Waggitt *et al.* (2020) show seasonal variation in harbour porpoise distribution in the North Sea with animal distribution extending further north in the summer (density estimates of 0.379 individuals/km^2 within the Study Area in July and 0.210 individuals/km^2 in January). As noted by the authors these density maps should be used as a general overview of relative densities and broad-scale distribution of a species over years rather than absolute densities or fine scale abundance estimates. Therefore, the SCANS IV survey block densities are considered more appropriate than Waggitt *et al.*, (2020) densities for quantitative impact assessment.

The SCANS IV density estimates are expected to be the most representative baseline data available on harbour porpoise occurrence within the Study Area. As the abundance and density estimates vary significantly for block NS- D and NS-G, the density estimate for block NS-G has been taken forward for the quantitative impact assessment to provide the most conservative estimate.

10.5.3.3 White-beaked dolphin

Ecology

White-beaked dolphins are commonly found in the northern and Central North Sea and are present year-round in Scottish waters with a widespread distribution (Hague *et al.*, 2020). They are considered to be the second most abundant cetacean in the North Sea after harbour porpoise (Banhuera-Hinestroza *et al.*, 2009; Hammond *et al.*, 2021). White-beaked dolphins predominantly utilise shallow shelf waters of approximately 50 m to 100 m in depth (Reid *et al.*, 2003), although this species may be spotted hundreds of kilometres offshore in certain areas (Hammond *et al.*, 2021). In Scottish waters, white-beaked dolphin distribution spans mainly across the central and northern North Sea and north-west Scotland, mostly within water depths around 50-100 m (Reid *et al.*, 2003). Animals feed on a variety of demersal and pelagic fishes, as well as squids and crustaceans (Kiszka and Braulik, 2018).

The mating season for white-beaked dolphins is thought to occur between July and August, with a subsequent gestation period lasting approximately 11 months (Culik, 2010). As such, females and their calves may be present at any time of year throughout their range. Groups generally comprise of less than 10 individuals; however, larger aggregations of up to 50 individuals formed from several subgroups are not uncommon, and temporary aggregations formed by several hundred animals have been sighted in the North Sea (Reid *et al.*, 2003). Generally, such large aggregations are more commonly seen further offshore.

Management Unit

The UK population of white-beaked dolphin belongs to CGNS MU, without any prominent biogeographic distinction in distribution. It comprises of an estimated 43,951 individuals (95% CI: 28,439 to 67,924) (UK portion: 34,025 individuals) spread patchily across the northern extent of the contiguous continental shelf of northern Europe (IAMMWG, 2022). The trend analysis of white-beaked dolphins in the North Sea conducted by Gilles *et al.* 2023 showed no significant change in abundance of this species since 1994.

Density Data

Table 10-7 outlines the density estimates for white-beaked dolphin across the Study Area and the surrounding waters.

Table 10-7 Available density estimates for white-beaked dolphins within the Study Area

DATA SOURCE	AREA	TEMPORAL SCALE	DENSITY (NO. INDIVS/KM^2)
Gilles *et al.*, (2023)	NS-D NS-G	Summer 2022	0.079 0.105
Lacey *et al.*, (2022)	Project Area	Summer 2016	0.021
Waggitt *et al.*, (2020)	Project Area	Data collected between 1980 and 2018	Jan: 0.032 Jul: 0.089

The SCANS IV survey was undertaken in Summer 2022. Surveys Block NS-D covering Study Area consisted of a total of 1,703.8 km of primary search effort. The estimated abundance of white-beaked dolphins in this block was 5,149 individuals (95% CI: 961 to 10,586) and an estimated density of 0.079 individuals/km^2 (Gilles *et al.*, 2023). The estimated abundance and density for adjacent to Study Area block NS-G (primary search effort of 1264.7 km) was 5,218 individuals (95% CI: 2,616 to 9,736) and 0.105 individuals/km^2 respectively. The highest densities for the North Sea were estimated around the Shetland Islands and further north from the Study Area (up to 0.305 individuals/km^2) (Gilles *et al.*, 2023).

The density estimates from Waggitt *et al.* (2020) indicate an increased presence of white-beaked dolphin in the northern North Sea in the summer months, with density estimates within the Study Area of 0.146 individuals/km^2 in July, compared with 0.083 individuals/km^2 in January. As noted by the authors density maps should be used as a general overview of relative densities and broad-scale distribution of a species over years rather than absolute densities or fine scale abundance estimates. Therefore, the SCANS IV survey block densities are considered more appropriate than Waggitt *et al.*, (2020) densities for quantitative impact assessment.

The SCANS-IV density estimates are expected to be the most representative baseline data available on white-beaked dolphin occurrence within the Study Area. As the abundance and density estimates vary slightly for block NS-D and NS-G, density data provided for block NS-G have been taken forward for the quantitative impact assessment to provide the most conservative estimate.

Throughout the 12-month survey period porpoise/dolphin individuals (species not identified) were observed on two occasions in October (as detailed in Appendix F).

10.5.3.4 Minke Whale

Ecology

Minke whales are the most abundant species of baleen whale recorded within UK waters, where it occurs as a seasonal summer visitor (Anderwald *et al.*, 2012; Hague *et al.*, 2020). This smallest baleen whale (Mysticete) species feeds mainly in shallower waters over the continental shelf and regularly appears around shelf banks and mounds, or near fronts where zooplankton and fish are concentrated at the surface (Reid *et al.*, 2003). They are also commonly seen in the strong currents around headlands and small islands, where they can come close to land, even entering estuaries, bays, and inlets.

Minke whales feed on herring and other seasonal prey aggregations formed by Scotland's unique marine topography along the southern Moray coast and within the Hebridean Sea (Haug *et al.*, 1995; NatureScot, 2020b; Hammond *et al.*, 2021). Minke whales are usually sighted alone or in pairs; however, this species can form larger aggregations of 10 to 15 individuals or may gather in groups during feeding events (Reid *et al.*, 2003). These larger aggregations have been recorded within the Southern Trench of the outer Moray Firth, a known summer feeding hotspot for both adults and juveniles of this species (NatureScot, 2020c), leading to a designation of this area a Marine Protected Area (MPA) for minke whales. Relative density estimates of minke whales within MPA are high but taper off quickly in surrounding waters further north along the east coast of Scotland (NatureScot, 2020c). In the UK, minke whales feed primarily on herring, haddock (*Melanogrammus aeglefinus)*, mackerel (*Scomber scombrus)*, and sandeel (Cooke,

2018). Outwith the summer foraging season, minke whales breed and calve in the winter months (Risch *et al.*, 2014), sometime between October and March, with a peak in calving in February (Kavanagh *et al.*, 2018).

Management Unit

Minke whales are managed as a single population across the CGNS MU. The abundance of minke whales in this MU was estimated at 20,118 individuals (95% CI: 14,061 to 28,786) (UK portion: 10,288 individuals) (IAMMWG, 2022). Recent SCANS IV survey resulted in many sightings further south in the North Sea than had previously been observed, suggesting an expansion of minke whale range in the summer, but no significant change in animal abundance since 1989 (Gilles *et al.*, 2023).

Density Data

Table 10-8 outlines the density estimates for minke whale across the Study Area and the surrounding waters.

Table 10-8 Available density estimates for minke whale within the Study Area

DATA SOURCE	AREA	TEMPORAL SCALE	DENSITY (NO. INDIVS/KM^2)
Gilles *et al.*, (2023)	NS-D NS-G	Summer 2022	0.0419 0.0103
Lacey *et al.*, (2022)	Project Area	Summer 2016	0.046
Waggitt *et al.* (2020)	Project Area	Data collected between 1980 and 2018	Jan: 0.001 Jul: 0.004

The SCANS IV survey was undertaken in Summer 2022. Surveys Block NS-D covering Study Area consisted of a total of 1,703.8 km of primary search effort. The estimated abundance of minke whales in this block was 2,702 individuals (95% CI: 547 to 7,357) and an estimated density of 0.0419 individuals/km^2 (Gilles *et al.*, 2023). The estimated abundance and density for adjacent to Study Area block NS-G (primary search effort of 1264.7 km) was 510 individuals (95% CI: 2 to 1,860) and 0.0103 individuals/km^2 respectively, with estimates for block NS-D being the highest for the whole SCANS IV Survey Area (Gilles *et al.*, 2023).

The density estimates provided in Waggitt *et al.* (2020) show an increased minke whale presence in the northern North Sea summer months, with density estimates within the Project Area of 0.024 individuals/km^2 in July. As noted by the authors density maps should be used as a general overview of relative densities and broad-scale distribution of a species over years rather than absolute densities or fine scale abundance estimates. Therefore, the SCANS IV survey block densities are considered more appropriate than Waggitt *et al.*, (2020) densities for quantitative impact assessment.

The SCANS IV density estimates are expected to be the most representative baseline data available on white-beaked dolphin occurrence within the Study Area. As the abundance and density estimates vary slightly for block NS-D and NS-G, density data provided for block NS-D have been taken forward for the quantitative impact assessment to provide the most conservative estimate.

No minke whales were identified in the Study Area during the site-specific APEM surveys. (as detailed in Appendix F).

10.5.3.5 Bottlenose dolphin

Ecology

Bottlenose dolphins are one of the most cosmopolitan delphinid species in the world, occupying inshore and offshore waters across a large range of temperate and tropical latitudes. Two ecotypes characterise global bottlenose dolphin populations: (1) an offshore ecotype which is wide-ranging and occurs in both open-ocean waters and along continental shelf edges and the outer shelf in the north-east Atlantic Ocean; and (2) a coastal ecotype which predominantly forms small groups as subsets of a larger, residential population occupying bays, inlets, and estuaries (Louis *et al.*, 2014).

In Scotland, coastal bottlenose dolphins appear to have a wide but patchy distribution, with three distinct populations separated across the east and west coasts (Cheney *et al.*, 2013). The main bottlenose dolphin population on the east coast of Scotland resides between the Moray Firth and Fife (Cheney *et al.*, 2013). These bottlenose dolphins are highly mobile and do move offshore in smaller numbers (Cheney *et al.*, 2013; NMPi, 2023). It should be noted that even though this species is highly mobile, it is unlikely that they will occur as far offshore as the Study Area as they have a strong preference for shallow, coastal waters (Quick *et al.*, 2014). Northern Scotland represents the most northerly known extent of the coastal bottlenose dolphin ecotype off the Atlantic coasts of Western Europe. Bottlenose dolphins encountered further north and off the shelf edge, are likely to be the offshore ecotype (Cheney *et al.*, 2013; Hague *et al.*, 2020).

Bottlenose dolphins breed throughout the year in UK waters (Anderwald *et al.*, 2010), and appear to be generalist predators. Historical data suggests a peak in summer occupancy within the shallow inner Moray Firth by resident individuals of the CGNS MU (Wilson *et al.*, 1997). This is likely a reflection of seasonal changes in prey availability and not due to reproductive behaviour (Wilson *et al.*, 1997; Thompson *et al.*, 2011).

Management Unit

There are seven bottlenose dolphin MUs within the waters of the UK and Republic of Ireland. The Study Area falls within the boundaries of Greater North Sea MU for this species, with abundance estimated at 2,022 individuals (95% CI: 548 to 7453), (UK portion: 1,885 individuals; IAMMWG, 2022).

Density Data

Table 10-9 outlines the density estimates for bottlenose dolphin across the Study Area and the surrounding waters.

Table 10-9 Available density estimates for bottlenose dolphin within the Study Area

DATA SOURCE	AREA	TEMPORAL SCALE	DENSITY (NO. INDIVS/KM^2)
Hammond et al. (2021)	Block R Block Q	Summer 2016	0.030 No data
Lacey *et al.*, (2022)	Project Area	Summer 2016	0.000-0.001
Waggitt *et al.* (2020)	Project Area	Data collected between 1980 and 2018	Jan: 0.001 Jul: 0.001

Data gathered during SCANS IV surveys did not allow for a calculation of reliable abundance and density estimates for bottlenose dolphins in survey blocks in the north part of the Northern Sea, thus available data from SCANS III survey were used to inform this report. Block R covering Study Area comprised a total of 2,178.7 km of primary search effort. Bottlenose dolphin abundance was estimated as 1,924 individuals (95% CI: 0 to 5,048) with an estimated density of 0.0298 individuals/km^2. No estimates were given for adjacent block Q (Hammond *et al.*, 2021).

Density estimates provided by Waggitt *et al.* (2020) should be used as a general overview of relative densities and broad-scale distribution of a species over years rather than absolute densities or fine scale abundance estimates. Therefore, the SCANS survey densities are considered more appropriate than Waggitt *et al.*, (2020) densities for quantitative impact assessment.

The SCANS III density estimates are expected to be most representative baseline data on bottlenose dolphin occurrence within the Study Area and have, therefore, been taken forward for the quantitative impact assessment.

Throughout the 12-month survey period porpoise/dolphin individuals (of unknown species) were observed on two occasions in October (as detailed in Appendix F).

10.5.3.6 Atlantic white-sided dolphin

Ecology

Atlantic white-sided dolphins are present in low number in Scottish waters with distribution mainly in deeper offshore waters during the summer months (Hague *et al.*, 2020). They are usually seen in small groups and are restricted to temperate and sub-Arctic seas of the North Atlantic. Preferring temperate and sub-polar seas, and waters below 200 m deep, off the shelf slope and beyond the continental shelf, the Atlantic white-sided dolphin is not commonly recorded in Scottish waters, except in areas close to the shelf edge (e.g., Shetland; Hague *et al.*, 2020).

The diet of Atlantic white-sided dolphins consists of a wide variety of fish, particularly gadoids such as blue whiting (*Micromesistius poutassou*), cod (*Gadus morhua*) and hake (*Merluccius merluccius*). They also feed on clupeids, in particular herring, silvery pout (*Gadiculus argenteus*), lantern fishes (Myctophidae), pearlsides (Maurolicus muelleri), mackerel (*Scomber scombrus*) and horse mackerel (*Trachurus trachurus*) (Reid *et al.*, 2003).

Management Unit

Atlantic white-sided dolphin in UK waters belong to a single CGNS MU. The abundance estimate for Atlantic white-sided dolphin in this MU was assessed as 18,128 individuals (UK portion: 12,293 individuals) (95% CI: 6,049 to 54,323), (IAMMWG, 2022).

Density Data

Table 10-10 outlines the density estimates for Atlantic white-sided dolphin across the Study Area and the surrounding waters.

Table 10-10 Available density estimates for Atlantic white-sided dolphin within the Study Area

DATA SOURCE	AREA	TEMPORAL SCALE	DENSITY (NO. INDIVS/KM^2)
Hammond *et al.*, (2021)	R	Summer 2016	0.01
Lacey *et al.*, (2022)	Project Area	Summer 2016	No data
Waggitt *et al.*, (2020)	Project Area	Data collected between 1980 and 2018	Jan: 0.009 Jul: 0.014

Data gathered during SCANS IV surveys did not allow for a calculation of reliable abundance and density estimates for Atlantic white-sided dolphin in survey blocks in the north part of the North Sea, thus available data from SCANS III survey were used to inform this report. The SCANS III surveys of Block R covering Study Area consisted of a total of 2,178.7 km of primary search effort. Atlantic white-sided dolphins had an estimated block-wide abundance of 644 individuals (95% CI: 0 to 2,069) and an estimated density of 0.01 individuals/km^2 (Hammond *et al.*, 2021). This density estimate is subject to high uncertainty as it corresponds to single sighting in this Block (Hammond *et al.*, 2021). No data are available for block Q.

Waggitt *et al.* (2020) indicate presence of Atlantic white-sided dolphin in the North Sea in the summer months with density estimates within the Study Area of <0.36 individuals/km^2 for both January and July. As noted by the authors density maps should be used as a general overview of relative densities and broad-scale distribution of a species over years rather than absolute densities or fine scale abundance estimates. Therefore, the SCANS survey densities are considered more appropriate than Waggitt *et al.*, (2020) densities for quantitative impact assessment. Nevertheless, the density estimates calculated by Waggitt *et al.* (2020) are very similar to the density estimate derived from SCANS III surveys (Table 10-10).

The SCANS III density estimates, although of high uncertainty, are expected to be most representative baseline data on Atlantic white-sided dolphin occurrence within the Study Area and have, therefore, been taken forward for the quantitative impact assessment.

Throughout the 12-month survey period porpoise/dolphin individuals (of unknown species) were observed on two occasions in October (as detailed within Appendix F).

10.5.3.7 Pinnipeds

Two species of seals regularly occur in UK waters and breed onshore: the grey seal and the harbour seal (DECC, 2016). Both species are listed under Annex II of the Habitats Directive and are recognised as Scottish PMFs. Harbour seals and grey seals are also listed as Least Concern on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (Bowen, 2016; Lowry, 2016). Through the Marine (Scotland) Act 2010, protected haul-out sites have been designated to reduce disturbance impacts to seals in key terrestrial habitats, and under the same legislation it is an offence to intentionally or recklessly kill, injure or take a seal.

Harbour seal and grey seal are phocids, or true seals, whose distributions vary seasonally between terrestrial / nearshore occupancy and offshore foraging periods. Seasonal patterns in distribution are governed by reproductive and life-history stages. Both species tend to concentrate close to shore, particularly during their respective pupping and moulting seasons, and then disperse during their at-sea period.

Both seal species feed in inshore and offshore waters corresponding to prey availability and seasonality, with numbers of harbour seals particularly high in inshore waters during the pupping and moulting seasons when they remain close to breeding and haul-out sites. Seal tracking studies indicate that harbour seals typically forage within coastal regions, ca. 50 km from shore, although longer travel distances do occur (e.g., Carter *et al.*, (2022) gives a maximum recorded distance from a haul-out as 273 km). Grey seals have been observed travelling larger distances than harbour seals, often >100 km, with some grey seal individuals travelling hundreds of kilometres away from their haul-out sites (Carter *et al.*, 2022 gives a maximum recorded distance from a haul-out as 448 km).

The modelled habitat preference data presented by Carter *et al.* (2022) estimates densities of grey and harbour seals in the North Sea waters, with estimated population densities of grey and harbour seals as being <1 individual per 25 km^2 in the Project Area (i.e., 0.164 for grey seals and 0 for harbour seals) (Cater *et al.*, 2022).

The most recent assessment of conservation status (JNCC, 2022) concluded that, for grey seals in the UK, the species has a 'favourable' conservation status. However, the assessment concluded an 'unfavourable to inadequate' conservation status for harbour seals due to the declining population trends in certain areas of the UK, including the East Scotland SMU. Table 10-11 highlights key information on the conservation status of both seal species, in terms of their current and future prospective ecological condition, based on the outcomes of JNCC (2022).

Table 10-11 Conservation status of key pinniped species (JNCC, 2022)

SPECIES	RANGE	POPULATION	HABITAT	FUTURE PROPOSECTS	CONSERVATION STATUS	OVERALL TREND
Harbour seal	FV	U1	XX	U1	U1	XX
Grey seal	FV	FV	FV	FV	FV	+

Key: FV = Favourable, + = Improving U1 = Unfavourable to Inadequate, XX = Unknown

Three key data sources were used to identify and describe the environmental baseline of harbour seals and grey seals: annual population parameter reports from the Special Committee on Seals (SCOS; 2022); and predicted habitat usage maps from Carter *et al.* (2022). From these data sources, abundance and density estimates for seals within the Study Area have been defined for the respective SMUs defined by the SCOS (2022). These data are provided in Table 10-12 below.

The Study Area is located within the East Scotland SMU.

Table 10-12 Density and abundance estimates for pinniped species within the SMU to the Project Area (SCOS, 2022[1]; Carter et al., 2022[2])

SPECIES	SMU[1]	SMU ABUNDANCE[1]	MAX. DENSITY WITHIN STUDY AREA (NO. INDIVIDUALS/KM²)
Harbour seal	East Scotland	Count: 261 Abundance estimate: 364	0.164
Grey seal	East Scotland	Count: 2,707 Abundance estimate*: 10,764	0.000

**Assumes that 25.15% of the total grey seal population is hauled-out during the August surveys when harbour seals are counted (Russell et al., 2021). To account for the portion of the population at sea, the data are thus scaled as: (2707/25.15) *100 = 15,410.*

No seals were observed in the Survey Area during the site-specific APEM surveys (as detailed in Appendix F). One opportunistic sighting of a grey seal was made during the Culzean Platform topsides bird survey undertaken in July 2023 (Appendix G).

10.5.3.8 Harbour seals

Ecology

Harbour seals have a near-circumpolar distribution, with at least four subspecies recognised, each from the eastern and western Pacific Ocean and eastern and western Atlantic Ocean. Individuals occupying UK waters represent roughly 5% of the global population of harbour seal and approximately 50% of the individuals occurring in European waters (Lowry, 2016).

Harbour seals remain at sea for the majority of the year, with short terrestrial periods for breeding and moulting. In the UK pupping occurs in the summer months of June and July, with a subsequent moult taking place in August (SCOS, 2022). Individuals are considered particularly vulnerable to terrestrial disturbance during these periods (Marine Scotland, 2014).

Two historic declines in harbour seal abundance (in 1988 and 2002) have been attributed to epizootic events caused by phocine distemper virus. Whilst the population in the south-east of England has since recovered from these events, along the east and north coasts of Scotland and the Northern Isles, populations have continued to decline (SCOS, 2021). Recently published survey data have illustrated the possible onset of a population decline within the southeast

England region as well, which would make western Scotland the region with the largest harbour seal population in UK, holding approximately 85% of the UK harbour seal population, followed by 12% in England and 3% in Northern Ireland (SCOS, 2022).

Harbour seals are abundant around the west coast of Scotland, i.e., around the Argyll coast, throughout the Sea of the Hebrides and in the Northern Isles (SCOS, 2022). On the east coast of Scotland, harbour seal density estimates are much lower, with relatively few individuals concentrated in the inner firths of the major estuaries and very few animals counted along the coastlines of Caithness, Moray, Angus, and Fife (SCOS, 2021). This observation carries over to the exposed north coast of Scotland, in which seal count data suggest a relatively small number of individuals occupy the coastline at low densities on the eastern and western extents (SCOS, 2021).

In 2011, the Scottish Government extended existing protections to harbour seals through the designation of 'Seal Conservation Areas' in those regions with elevated abundance or which contain protected sites for the species. Consequently, four Seal Conservation Areas have been established in Orkney and Shetland, the Western Isles, the Moray Firth, and the central east coast of Scotland (including the Firth of Tay and Firth of Forth), all of which lie outside (>200 km) of the Project Area.

Seal Management Unit

The Project Area falls within the biogeographic range of the East Scotland SMU, which is estimated to contain nearly 370 individuals when counts undertaken during the month of August are scaled to account for availability (see Table 10-12) (SCOS, 2022). In the East Scotland SMU, these animals are mainly concentrated in the Firth of Tay and Eden Estuary Special Area of Conservation (SAC) and in the Firth of Forth with small groups also present in the Montrose Basin and at coastal sites in Aberdeenshire (SCOS,2022).

The East Scotland SMU has been in substantial decline for many years. The haul-out count for the SMU in 1996 to 1997 was 764 harbour seals, which dropped to 343 harbour seals in the count period between 2016 and 2019 (SCOS, 2021) and 261 in 2021 count (SCOS, 2022). The latest counts are approximately 24% lower than the 2016 count.

Haul-out counts

The closest harbour seal haul-out sites are located on the east coast of Scotland (e.g., Eden estuary), >200 km from the Study Area. As such, harbour seal haul-out sites are not discussed further in this report.

At-sea density

The modelled habitat preference data from Carter *et al.* (2022) estimates that harbour seals are not likely to be present in the Study Area, with estimated population densities of 0.00 individuals 25 km^2 (Cater *et al.*, 2022). When compared to other areas within UK waters, these densities are considered to be low (Marine Scotland, 2017) (Figure 10-4).

No harbour seals were sighted in any of the dedicated aerial surveys (as detailed within Appendix F).

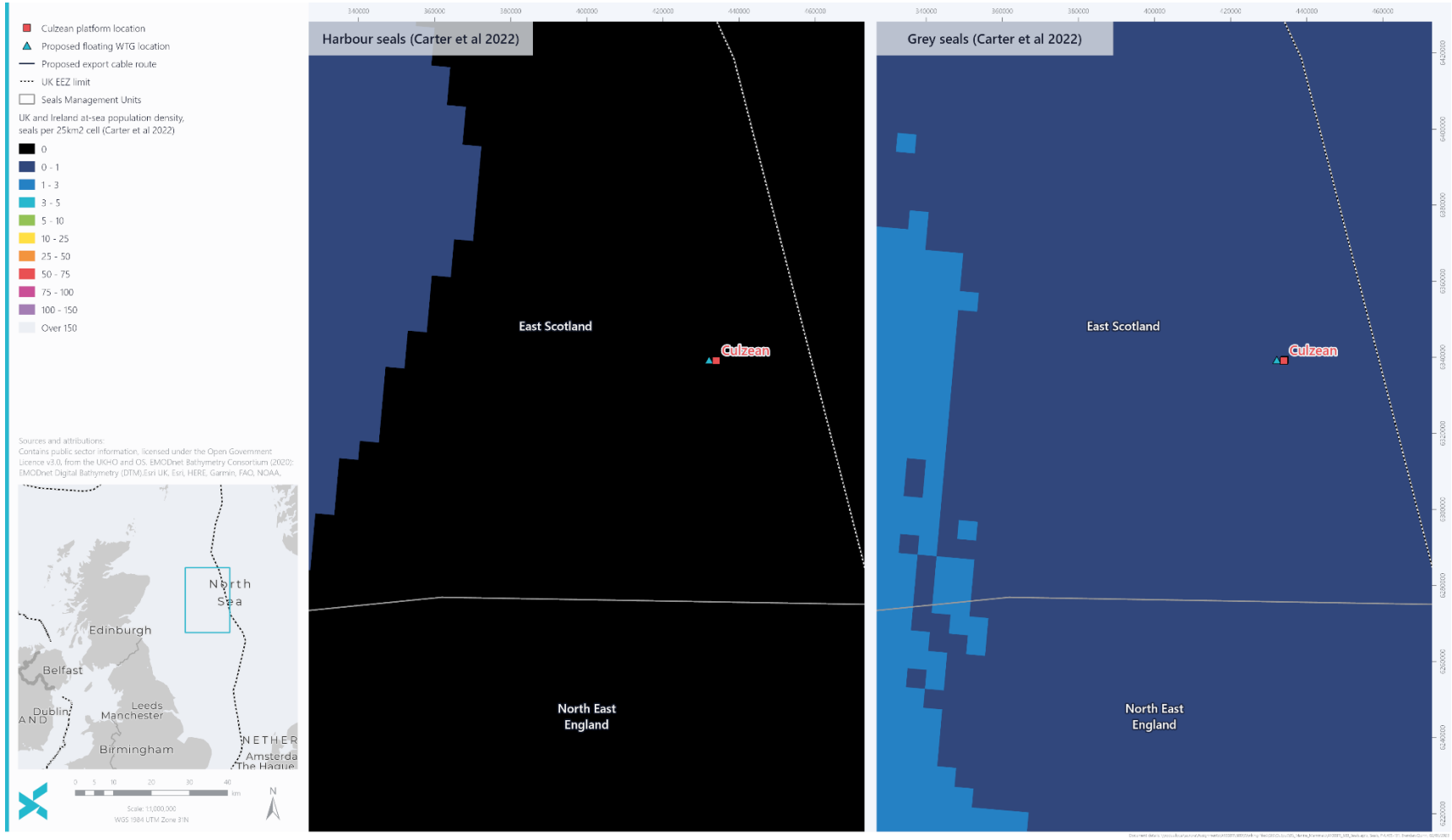

Figure 10-4 At-sea distribution of harbour (left) and grey (right) seals derived from seal telemetry data (Carter et al., 2022)

10.5.3.9 Grey seal

Ecology

Grey seals are found only within the North Atlantic Ocean, with a subspecies identified in the Baltic Sea (Bowen, 2016). Approximately 35% of the world's grey seals breed in the UK, and 80% of the UK's grey seals breed at colonies in Scotland (SCOS, 2022). In the UK, grey seals typically breed on remote, uninhabited islands or coasts and in small numbers in caves. The largest breeding colonies in Scotland are in Orkney and the Outer Hebrides (SCOS, 2022). Grey seals breed in the autumn, although timing of pupping varies by location, occurring predominantly between September and late November in Scotland (SCOS, 2022).

Telemetry data (obtained by SMRU) from grey seals tagged in the East Scotland SMU show this species ranges much further than harbour seals, with grey seal tracks from animals tagged in the East Scotland SMU being recorded in the Shetland, Moray Firth, East Scotland, North-East England, West of Scotland, and Western Isles SMUs (Russell *et al.*, 2013).

Seal Management Unit

The Study Area falls within grey seal East Scotland SMU, which consists of approximately 11,000 individuals when August counts are scaled to account for availability (see Table 10-12) (SCOS, 2022).

The East Scotland SMU was in decline for many years from the count data acquired in 1996-1997 (2,328 individuals) to 2007-2009 (1,238 individuals), equating to a decrease of 47%. The haul-out count conducted in 2020 was 3,683 in 2020 which is an 37% increase from 1996-1997 (SCOS, 2021), while most recent count (2021) suggest a stable trend for this SMU in recent years (SCOS, 2022).

Haul-out counts

The closest haul-outs for grey seals lie on the east coast of Scotland (e.g., Isle of May), >200 km from the Study Area. Grey seal haul-out sites are therefore not discussed further in this report.

At-sea density

No grey seals were sighted in any of the dedicated aerial surveys (Appendix F). One opportunistic sighting of a grey seal was made during the Culzean Platform topsides bird survey undertaken in July 2023 (Appendix G).

The modelled habitat preference data from Carter *et al.* (2022) estimates densities of grey seals in the waters of the Study Area, are < 1 per 25 km^2 (i.e., specifically 0.164; Figure 1 3; Cater et al., 2022). Considering that the Project lies >200 km from the nearest coastline, this low density is not surprising for a marine mammal which regularly hauls out on land. When compared to other regions in UK waters (in particular, areas closer to the coast), these densities are considered to be low (Marine Scotland, 2017).

10.5.3.10 Basking Sharks

Ecology

The basking shark is the largest fish species to occur in UK waters; individuals can reach up to 12 m in length. The species experienced substantial declines having been hunted until the mid-1990s, and basking shark is listed as Endangered by the IUCN Red List of Threatened Species (Rigby *et al.*, 2021) and is now protected by a suite of national and international legislation. Basking sharks are included in several key international conventions, including Appendix II of the Berne Convention, Appendix I/II of the Convention on Migratory Species (Bonn Convention), and Annex V of the Convention for the Protection of the Marine Environment of the North East Atlantic (i.e., the OSPAR Convention). Basking sharks are protected in the UK through the definition of 'offences' by the Wildlife and Countryside Act 1981 (as amended) and in the Nature Conservation (Scotland) Act 2004, whilst the Wildlife and Natural Environment (Scotland) Act 2011 provides a mechanism for licensing potential offences (e.g., disturbance) within Scottish waters. Basking sharks are also listed in several conservation policy documents for their importance as a UK species, including their designation as a Scottish PMF (Tyler-Walters *et al.*, 2016) and their inclusion in the Scottish Biodiversity List.

As cosmopolitan filter-feeders with a circumglobal distribution (Doherty *et al.*, 2017), basking sharks solitarily traverse the open ocean opportunistically foraging for planktonic prey (Bloomfield and Solandt, 2008; Gore *et al.*, 2008). When not occupying deep-ocean waters, basking sharks appear to target oceanic and tidal fronts, such as those seen in the English Channel and along the west coast of Scotland, as they provide more stable foraging opportunities for planktivorous elasmobranchs (Sims *et al.*, 2000; Priede and Miller, 2009). Foraging activity appears to increase in the summer months in response to increase in zooplankton abundance (Sims *et al.*, 2005). Elevated seasonal densities of basking sharks along these foraging hotspots promote an increase in social activity during the summer season and groups of basking sharks can be seen engaging in courtship behaviours along the thermal fronts (Sims *et al.*, 2000).

There is some evidence of seasonal migrations by this species, which appears to occur on both trans-Atlantic and trans-equatorial bearings (Gore *et al.*, 2008; Skomal *et al.*, 2009). Tagging data on individuals in the North-East Atlantic Ocean have shown a seasonal trans-Atlantic migration (Gore *et al.*, 2008), with the Irish Sea and Firth of Clyde serving as key migratory pathways (Sims *et al.*, 2005). Whilst several movement pathways have been identified in the North-East Atlantic Ocean, tagging data indicate that there is much plasticity in individual movement strategies and the use of specific migration routes by entire populations is unlikely (Doherty *et al.*, 2017).

In the UK, basking sharks may be seen throughout the North and North-East Atlantic Ocean, Irish Sea, and Hebridean Sea (Southall *et al.*, 2005; Witt *et al.*, 2012). They visit Scottish coastlines seasonally, arriving in the spring and departing in the autumn. In the summer, individuals spend the majority of their time near the surface, where they appear to be 'basking' whilst feeding on plankton. Summer also functions as a potential breeding season for the species in Scotland, with aggregations of individuals peaking in July and August, including in the Pentland Firth (Evans *et al.*, 2011). Although mainly found around the Western Isles, basking sharks can be seen in the Northern Isles and along the north and east coasts of Scotland as an occasional visitor (Evans *et al.*, 2011).

This species can be found throughout the offshore waters in the UK continental shelf (Sims, 2008) and are considered frequent visitors to the west coast of Scotland (HWDT, 2018; Witt *et al.*, 2012). They are widely distributed in cold and temperate waters and feed predominantly on plankton and zooplankton e.g., barnacles, copepods, fish eggs and

deep-water oceanic shrimps by filtering large volumes of water through their wide-open mouth. They typically move very slowly (around four miles per hour). In the winter, they dive to great depths to get plankton while in the summer they are mostly near the surface, where the water is warmer.

Basking sharks were hunted in Scotland up to 1995. However, they are now protected in the UK waters principally under Schedule 5 of the WCA Act 1981 and under the Nature Conservation (Scotland) Act 2004 and are classed as a Scottish PMF, as well as a species on the OSPAR List of Threatened and Declining species. Due to their size, slow swimming speeds and preference for swimming in coastal waters during the summer months, basking sharks are considered to be at potential risk of collision with vessels associated with the proposed survey activities. Given that basking sharks are slow to mature and have a long gestation period, the species can be slow to recover if populations are depleted.

Basking sharks seasonally arrive in Scottish waters during spring and leave in autumn. They appear to aggregate in summer to breed, with peak sighting densities in the west coast of Scotland occurring in August (Witt *et al.*, 2012).

Density and Abundance

During dedicated aerial surveys basking shark was sighted on one occasion in June 2023 (as detailed in Appendix F). Historical sightings within the Study Area are fairly irregular, without conclusive trends in abundance or distribution (Evans *et al.*, 2011). Sightings have been recorded throughout the year on an *ad-hoc* basis but appear to peak in the summer months (Evans *et al.*, 2011). However, dedicated basking shark surveys are extremely limited in the UK and estimations of absolute density are not available for this species out-with identified hotspots, such as the Sea of the Hebrides and South-West England (Webb *et al.*, 2018; Austin *et al.*, 2019). Whilst individuals may occur within the Study Area sporadically, the area does not appear to constitute essential habitat for this species.

During summer 2023, an exceptional number of basking shark sightings were recorded within Moray Firth, with at least 40 individuals reported to Hebridean Whale and Dolphin Trust, with animals mostly congregating off the coast at Nairn (HWDT, 2023).

As the Project Area falls within offshore waters (>12 NM), where basking sharks are not a protected feature, and given the low likelihood of occurrence within the Study Area, the potential impacts of the Project on this species have been scoped out from this assessment. Nevertheless, measures put in place to conserve and protect other megafauna (e.g., vessels adhering to the Scottish Marine Wildlife Watching Code) will also help conserve and protect basking sharks.

10.5.4 Protected Sites

Protected sites considered relevant to the assessment of impacts from the proposed Project activities have been identified for cetaceans, seals, and basking sharks. The estimated distances to these sites have been calculated discounting movement over waters which fall below the MHWS limit. Due to this, the distances will be greater than that which would be estimated using straight-line measurements; however, they are more biologically meaningful for the purposes of this impact assessment.

As mentioned in Section 10.1, an assessment under the Habitats Regulations for SACs designated for marine mammal features (harbour porpoise, bottlenose dolphin, grey seal and harbour seal) has been undertaken for the Project within the Combined HRA Screening and RIAA (Document Reference: GB-CZN-00-XODUS-000023), submitted alongside the marine licence application.

10.5.4.1 Protected sites with cetaceans as a feature

There are several protected sites designated for the conservation of cetacean features within Scotland. However, none of these sites overlap with the Study Area. Figure 10-5 and Figure 10-6 show the SACs and Nature Conservation Marine Protected Areas (NCMPAs) with cetaceans as a designated feature.

The closest protected site which is designated for marine mammals as a conservation feature is the Southern Trench NCMPA. This site is located 192 km to the northwest of the Project Area. The NCMPA is designated for the protection of minke whales which are frequently sighted in the summer months in the outer Moray Firth. The Southern Trench NCMPA is characterised by having oceanic fronts formed by unique geomorphologies which provide seasonal foraging habitat for minke whales (NatureScot, 2020b; 2020c).

The Southern North Sea SAC is the second closest protected site to the Project Area which lists cetaceans as a feature. This site is located approximately 197 km south from the Project Area and is designated for harbour porpoise. This site includes key winter and summer habitat for this species and was the largest SAC in UK and European waters at the point of designation in 2019. Located to the east of England, this SAC stretches from the Central North Sea (CNS) north of Dogger Bank, to the Straits of Dover in the south, covering an area of 36,951 km^2 (JNCC, 2021a).

Both, the Doggerbank (Germany) and the Doggersbank (Netherlands) SACs, located respectively 203 and 204 km away from the Project Area, are designated for harbour porpoise and seals. Jyske Rev, Lillefiskerbanke in Denmark is the fifth closest protected area with harbour porpoise as a designated feature (approximately 284 km away from the Project Area).

All other UK and international protected sites with cetacean features are located more than 300 km from the Project Area, thus the potential for negative effects to the conservation objectives of these sites due to project activities are considered negligible.

Table 10-13 provides information on the national and international protected sites with cetacean qualifying features, based on their overlap with the key cetacean MUs.

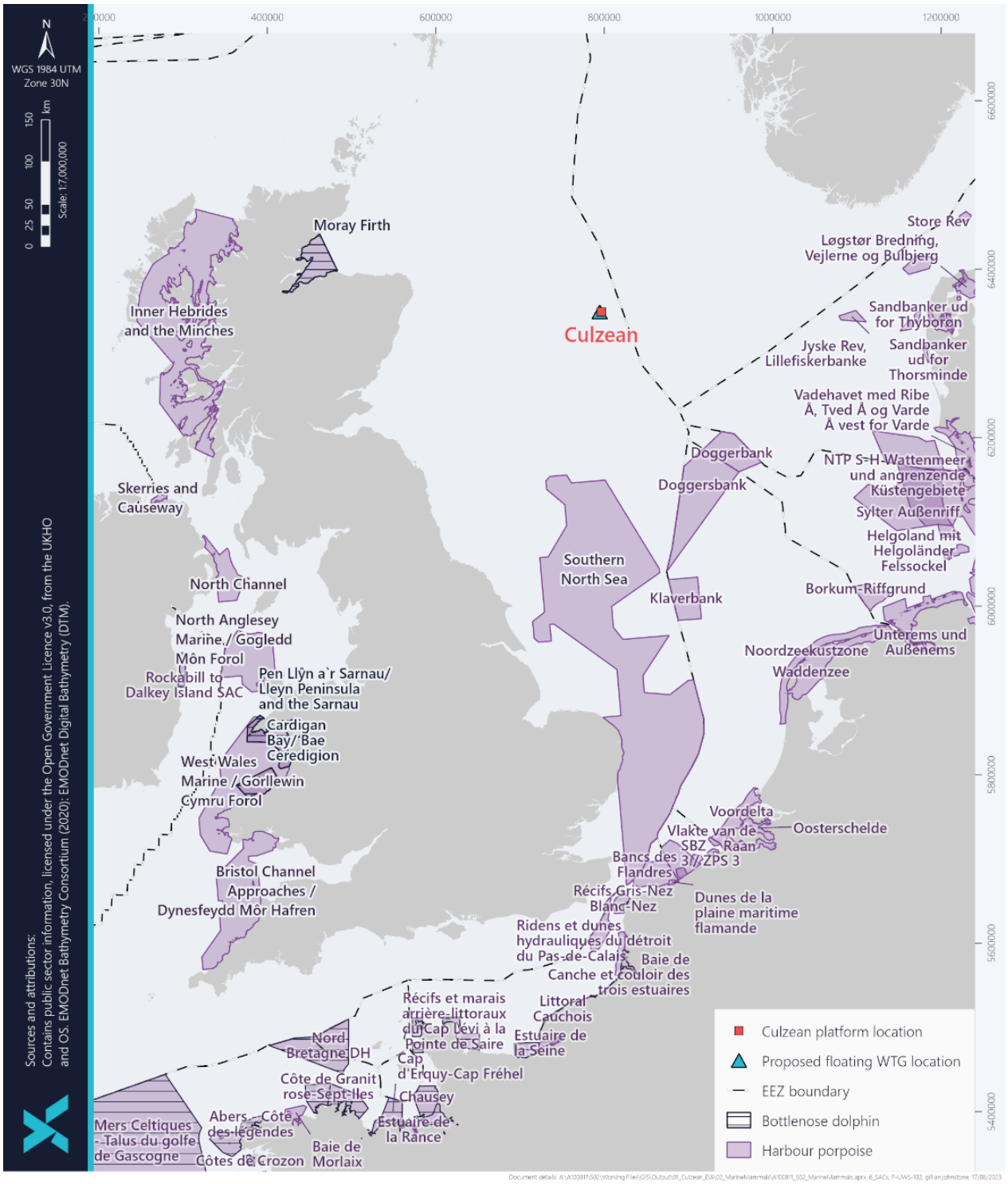

Figure 10-5 SACs with cetaceans as a designated feature

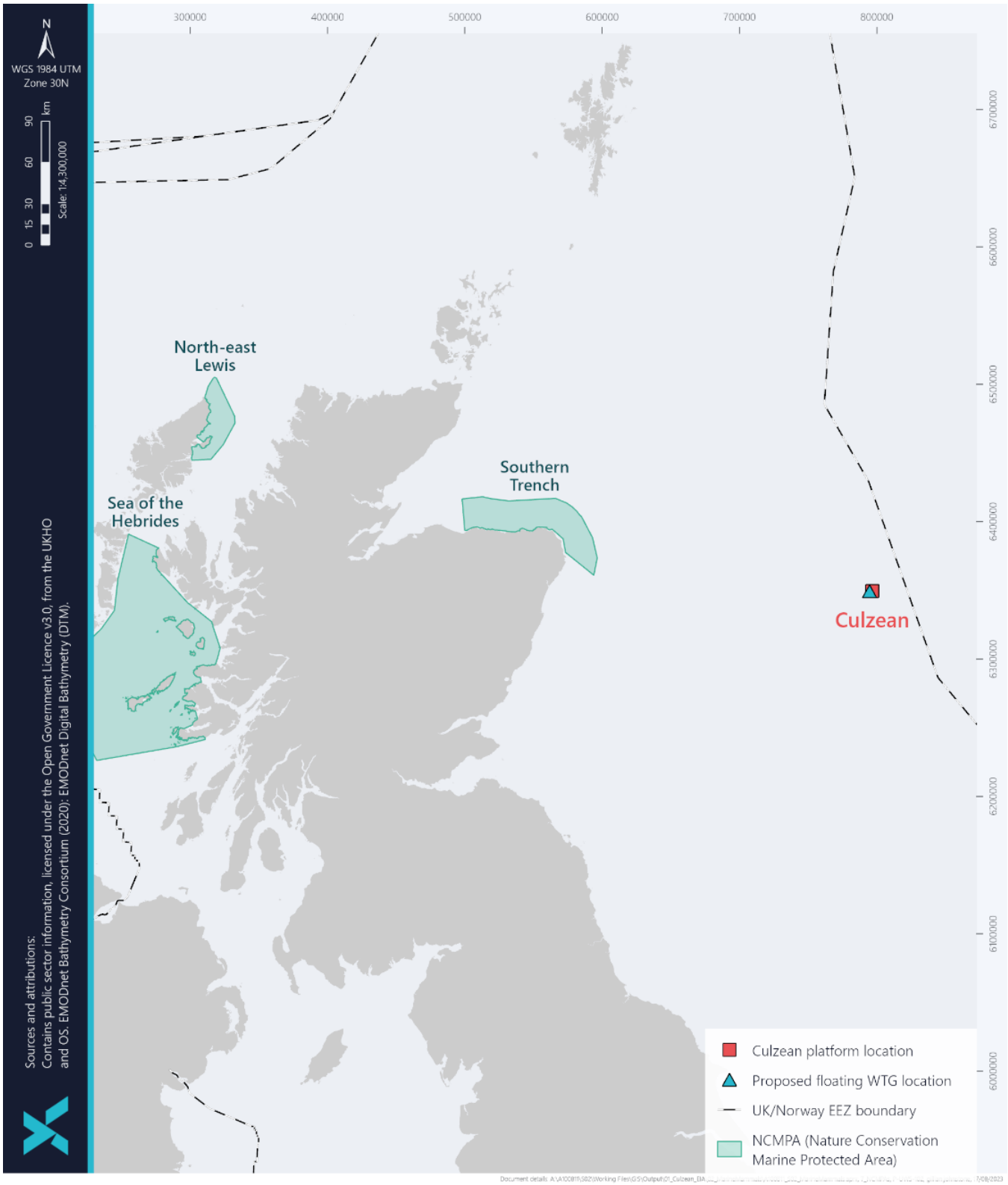

Figure 10-6 NCMPAs with cetaceans as a designated feature

Table 10-13 Protected sites with cetacean features overlapping with the key cetacean MUs relevant for the Project.

SITE NAME	DESIGNATION	QUALIFYING SPECIES OF INTEREST	DISTANCE TO SITE (KM)	AFFILIATED MU
SouthernTrench	NCMPA	Minke whale	192	CGNS
Southern North Sea	SAC	Harbour porpoise	197	NS
Doggerbank			197	
Doggersbank			203	
Jyske Rev, Lillefiskerbanke			204	
Klaverbank			284	
Sydlige Nordsø¸			328	
Thyborøn Stenvolde			353	
Gule Rev			357	
Sylter Außenriff			364	
Sandbanker ud for Thyborøn			374	
Sandbanker ud for Thorsminde			374	
Agger Tange, Nissum Bredning, Skibsted Fjord og Agerø¸			386	
SPA Östliche Deutsche Bucht			393	
Vadehavet med Ribe Å, Tved Å og Varde Å vest for Varde			397	
Store Rev			420	
Borkum-Riffgrund			442	
NTP S-H Wattenmeer und angrenzende Küstengebiete			443	
Lønstrup Rødgrund			450	
Noordzeekustzone			464	
Løgstør Bredning, Vejlerne og Bulbjerg			467	
Skagens Gren og Skagerak			468	

SITE NAME	DESIGNATION	QUALIFYING SPECIES OF INTEREST	DISTANCE TO SITE (KM)	AFFILIATED MU
Knudegrund			484	
Nationalpark Niedersøchsisches Wattenmeer			484	
Helgoland mit Helgoländer Felssockel			486	
Steingrund			499	
Waddenzee			504	
Unterems und Außenems			506	
Hamburgisches Wattenmeer			531	
Unterelbe			537	
Unterweser			566	
Voordelta			570	
Kosterfjorden-Väderöfjorden			594	
Vlaamse Banken			603	
Vlakte van de Raan (NL)			632	
Vlakte van de Raan (BE)			633	
SBZ 3 / ZPS 3			637	
SBZ 2 / ZPS 2			651	
Bancs des Flandres			653	
SBZ 1 / ZPS 1			656	
Dunes de la plaine maritime flamande			667	
Westerschelde & Saeftinghe			680	
Récifs Gris-Nez Blanc-Nez			684	
Ridens et dunes hydrauliques du détroit du Pas-de-Calais			702	
Falaises du Cran aux Oeufs et du Cap Gris-Nez, Dunes du Chatelet,			713	

SITE NAME	DESIGNATION	QUALIFYING SPECIES OF INTEREST	DISTANCE TO SITE (KM)	AFFILIATED MU
Marais de Tardinghen et Dunes de Wissant				
Baie de Canche et couloir des trois estuaires			714	
Estuaires et littoral picards (baies de Somme et d'Authie)			749	
Littoral Cauchois			770	
Estuaire de la Seine			811	
Baie de Seine orientale			921	
Récifs et marais arrière-littoraux du Cap Lèvi à Pointe de Saire			921	
Baie de Seine occidentale			939	
Récifs et landes de la Hague			940	
Sea of Hebrides	NCMPA	Minke whale	982	CGNS
North-east Lewis	NCMPA	Risso's dolphin	501	CGNS

10.5.4.2 Protected sites with pinnipeds as a feature

A variety of protected sites are designated to protect seals in Scottish and UK waters. These include designated seal haul-outs, Sites of Special Scientific Interest (SSSIs), and SACs.

All UK sites designated for the protection of seals as a primary conservation feature are located over 100 km away from the Project Area. The closest SAC with pinnipeds as a qualifying feature is the Berwickshire and North Northumberland Coast SAC, located approximately 266 km to the southwest, followed by Firth of Tay and Eden Estuary SAC and Isle of May SAC 290 and 293 km away from the Project Area (Figure 10-7).

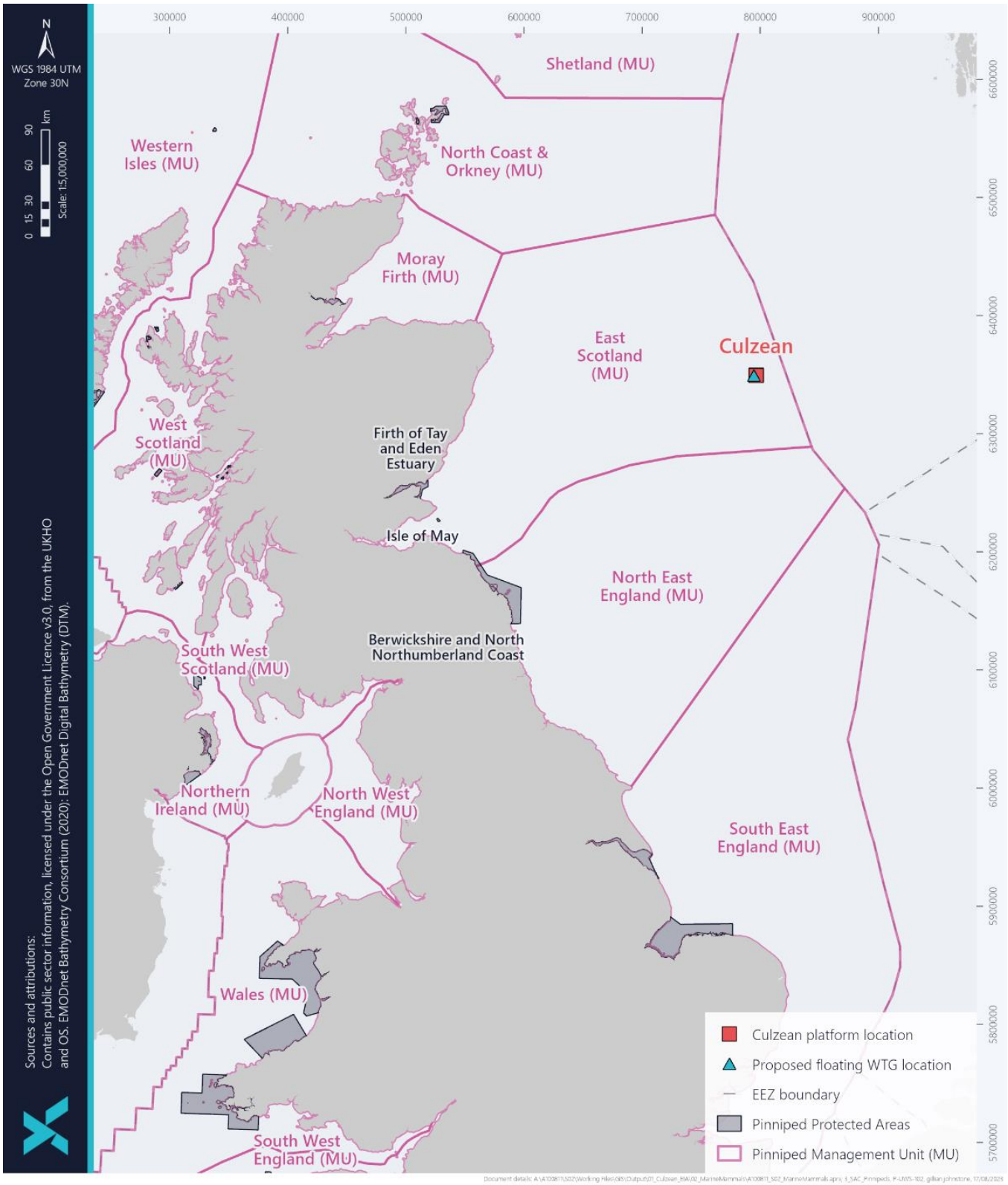

Figure 10-7 SACs with pinniped features

NatureScot advise that protected areas (SACs) for harbour seals within 50 km, and protected areas (SACs) for grey seals within 20 km of the Project Area should be considered to have connectivity. As the closest site is located approximately 266 km to the southwest, connectivity with these sites has not been considered further in this assessment.

10.5.4.3 Protected sites with basking sharks as a feature

The only site in Scotland designated for the protection of basking sharks is the Sea of the Hebrides NCMPA, which is located on the West of Scotland, >500 km from the Project Area. This site covers the seas between the eastern coastline of the Outer Hebrides and the west coast of the Inner Hebrides, including Skye, Mull, and the Ardnamurchan Peninsula. This region forms a key habitat for basking sharks in the UK, particularly between April and October, when regional abundance is highest. This species occurs in very high densities within the Sea of the Hebrides because of prey abundance. Basking sharks also utilise the site to engage in social and courtship behaviours (NatureScot, 2020b), making this region an important area for the conservation of this wide-ranging, oceanic species.

As the protected site is located more than 500 km away from the Project Area, impacts on this site are not considered further within this impact assessment.

10.5.5 Future baseline

The current baseline description for Marine Mammals and Other Megafauna within the Study Area has been detailed in Section 10.5.3. The abundance and distribution of marine megafauna species, including marine mammals and basking sharks, continue to change in response to environmental and anthropogenic pressures, including resource competition (either with other marine species or commercial fisheries), broad-scale habitat change, coastal development, and climate change. These pressures may alter future marine mammal and basking shark distributions across the Study Area. Resource competition has mediated habitat use and distribution in the UK's harbour and grey seal populations, and current trends are likely to continue for the immediate future. Annual count data indicate that harbour seal populations have declined along the east coast of Scotland and in Orkney, but have nearly doubled in West Scotland (SCOS, 2021). Areas experiencing decline of this species are also the areas with an increase of grey seal numbers, which have moved northward into Scotland to replace harbour seals along the eastern coastline (SCOS, 2021). Continued competition with humans for resources, such as commercially fished prey species or access to coastal habitats which may be marginalised through coastal development, is also likely to continue to shape harbour porpoise, dolphin, and seal distributions around the UK. The future baseline for commercial fishing activity is described in Chapter 12: Commercial Fisheries.

Similarly, changes in prey species distributions may mediate changes to marine mammal and basking shark distributions over the Project's lifecycle. Increase in warmer-water fish species have been documented within the region in past years, as well as shifts in the timing of fish spawning, which may have important implications for the timing and occurrence of marine predators within the Study Area (Mitchell *et al.*, 2020). Additionally, climate-mediated changes to marine mammal distributions have been observed in recent decades with northward shifts of warmer-water species, such as short-beaked common dolphins, becoming more common in the northern part of UK waters (Evans *et al.*, 2011).

Due to the complex and often compounding nature of environmentally- and anthropogenically mediated pressures on marine mammal and basking shark habitat, it is not possible to make accurate predictions on changes to the current baseline over the anticipated life cycle of the Project.

10.5.6 Summary and key issues

In summary, multiple marine megafauna receptors have potential sensitivities to the Project which have been identified as requiring further consideration within this impact assessment. The key megafauna receptor species which have been taken forward for assessment include:

- Harbour porpoise;
- Bottlenose dolphin;
- White-beaked dolphin;
- Minke whale;
- Harbour seal;
- Grey seal;

In accordance with the Scoping Report and received Scoping Opinion the assessment to receptors mentioned above will consider noise-related impacts to marine mammals associated with construction and decommissioning noise, including the risk of injury and disturbance/displacement. Potential impacts scoped out for further assessment are listed in Section 10.3.

10.5.7 Data gaps and uncertainties

As part of the methodology, an extensive literature review was undertaken to define marine mammal and basking shark presence within the Study Area. Combined with the data collected during the site-specific aerial surveys (as detailed in full within Appendix F), a robust baseline is available for the assessment of impacts to key megafauna receptors from activities associated with the Project.

Waggitt et al. (2020) collated a wide array of data on varying temporal and spatial scales for twelve cetacean species and then used species distribution models to standardise the data such that monthly distribution maps could be generated. The outputs of this modelling were monthly predicted density surfaces at a 10 km resolution. Within the study, however, the standardisation of cetacean aerial survey data was limited by the correction of data against 'availability bias (i.e., how detectable animals were during survey), which can vary with observer technique, and aircraft speed and height, as well as 'perception bias' (i.e., visible cues by animals which are missed by observers) (Waggitt et al., 2020; Pike et al., 2011). In the absence of consistent characterisations of survey methods which influence these biases across these datasets, the correction factor utilised was distilled down to the proportion of time each species spends at the sea surface and was based on previously published data. The authors note that this is a simplistic approach to aerial survey data correction, and it introduces the need for a balanced interpretation of the resulting modelled distributions. Therefore, whilst the density estimates obtained from these maps are representative of relative density across the United Kingdom Continental Shelf (UKCS), they should not be interpreted as absolute density estimates for use in strictly quantitative assessments of habitat use, instead most recent SCANS IV survey results were used to inform the baseline (Gilles *et al.*, 2023), or SCANS III results where SCANS IV data were not available

(Hammond *et al.*, 2021). Although SCANS surveys take place only during summer months, the reported results of these surveys are considered to be the best source of information available.

10.6 Key parameters for assessment

As detailed in Chapter 4: Project Description, this assessment considers a PDE, which encompasses a Maximum Design Scenario (MDS) or a worst-case scenario. The MDS scenario represents, for any given receptor and potential impact on that receptor that would result in the greatest potential for change. Given that the MDS is based on the design option (or combination of options) that represents the greatest potential for change, confidence can be held that development of any alternative options within the design parameters will give rise to no worse effects than assessed in this impact assessment.

Table 10-13 presents the worst-case scenario for potential impacts on Marine Mammals and Other Megafauna during construction and decommissioning. As discussed in Section 10.3, all operation and maintenance impacts have been scoped out of the assessment.

Table 10-14 Worst case scenario specific to Marine Mammal and Other Megafauna impact assessment

POTENTIAL IMPACT	WORST CASE SCENARIO	JUSTIFICATION
Construction		
Noise-related impacts to marine mammals associated with construction noise, including the risk of injury and disturbance/displacement	Vessels A maximum of four vessels working simultaneously at any time with a total of 54 vessel days across the vessel spread. Export cable Installation Several different approaches are available for installation of the export cables laid on the seabed and these include: • Pre-lay trenching using a displacement plough to create a pre-lay trench which the cable is then installed into. A separate backfill plough may then be used to push the spoil heaps created by trenching over the cable, thus creating the required cable cover; • Post-lay trenching using a variety of tools including: - Jet trenchers; - Mechanical trenchers; - Non-displacement ploughs; and - Simultaneous cable lay and burial, using a jet trencher or non-displacement plough. • Remedial protection of the cable may be required in the form of rock placement. As a worst case it is assumed that 50% of the cable on the seabed (1000 m) may require rock protection. Pre-construction surveys: Pre-installation surveys will be undertaken in 2024/25. These will consist of visual inspections (using Remote Operated Vehicles (ROVs)) of the mooring locations and cable routes to confirm the exact routing and determine the need for any seabed preparation. These surveys are likely to take up to one day. All survey equipment will utilise Ultra-Short Baseline (USBL) positioning equipment to ensure precise subsea locations. Construction Period The construction period itself is anticipated to be approximately 1 month.	During the construction phase, there is potential for underwater sound emissions to generate physiological impacts, barrier effects and displacement to marine megafauna receptors. The activities which have been identified as being possible sources of disturbance and/or injury include construction activities such as vessel noise from installation works including cable laying, trenching, and rock placement. No UXO clearance activities or geophysical surveys are required for the Project. If this requirement should change then these activities will be subject to separate marine licences and associated EPS and Basking Shark licences. As such, these activities are not considered for the assessment of underwater noise.

POTENTIAL IMPACT	WORST CASE SCENARIO	JUSTIFICATION
Decommissioning		
Noise-related impacts to marine mammals associated with decommissioning noise, including the risk of injury and disturbance/displacement	In the absence of detailed information regarding decommissioning works, the impacts during the decommissioning are considered analogous with, or likely less than, those of the construction stage. Therefore, the worst-case parameters defined during the construction stage also apply to the decommissioning stage.	During the construction phase, there is potential for underwater sound emissions to generate physiological impacts, barrier effects and displacement to Marine Mammals and Other Megafauna receptors. The activities which have been identified as being possible sources of disturbance and/or injury include decommissioning activities such as vessel noise from decommissioning works.

10.7 Methodology for assessment of effects

The assessment for marine mammals is undertaken following the principles set out in Chapter 6: EIA Methodology. The sensitivity of the receptor is combined with the magnitude to determine the impact significance. Topic-specific sensitivity and magnitude criteria are assigned based on professional judgement, as described in Table 10-15 and Table 10-16 with the proposed outline for each discussed below:

- Receptor sensitivity - the sensitivity of a marine mammal can be viewed as the ability of that species to tolerate change. The sensitivities of the marine mammal species under consideration have been delineated using available data. The approach taken in this assessment is that a marine mammal considered to be of high sensitivity is one which has no ability to adapt, tolerate or recover from any potential environmental changes arising due to impacts from the project activities. If a marine mammal is of low sensitivity, works associated with the project are not anticipated to result in any important effect on individuals of that species. The approach taken within this assessment aims to determine the sensitivity of individual marine mammals (and their supporting habitats) to any possible impacts arising as a result of the proposed project activities. Table 10-15 summarises the criteria used to define receptor sensitivity for the marine mammal assessment.

- Receptor value - the value or importance of a marine mammal is based on a pre-defined judgement based on legislative requirements, guidance, or policy, which are shaped by the views of key stakeholders, experts, and specialists. All marine mammal receptors are of intrinsically 'high' conservation value due to their inclusion in Annex IV of the Habitats Directive as an EPS and/or as qualifying interests of UK and European protected sites (i.e., SACs). All marine mammal species considered in this assessment are listed as PMFs in Scotland. For this reason, receptor value has not been used to differentiate impact outcomes to the marine mammal populations considered as part of this assessment. Rather, the assessment considered individual species' sensitivities to the impact pathways being assessed.

- Impact magnitude – the impact magnitude for the marine mammal assessment requires that consideration of how the following factors will impact on baseline conditions and is defined by the extent of the impact outcomes and their duration and take into account:

  - Spatial Extent: The area over which the impact will occur;
  - Duration: The period of time over which the impact will occur;
  - Frequency: The number of times the impact will occur over the Project life cycle;
  - Intensity: The severity of the impact;
  - Likelihood: The probability that the impact will occur and the probability that the receptor will be present; and
  - Reversibility: The ability for the receiving environment / exposed receptor to return to baseline conditions.

Based on these parameters and expert judgement, a summarised description of impact magnitude is provided in Table 10-16.

The benchmark conservation status for the assessment of impacts to marine mammal sensitivity is 'Favourable Conservation Status', as defined within the 'Favourable Conservation Status: UK Statutory Nature Conservation Bodies Common Statement' (JNCC, 2018). The impact magnitude is defined by the extent of the impact outcomes and the duration of the impacts on marine mammal populations, and whether activities will consequentially impact the conservation status of those populations. A high impact magnitude relates to an irreversible change to a marine mammal population or its habitat area. A low impact magnitude is defined as a minor shift from established baseline conditions for a marine mammal species, including short-term changes, which will not result in an overall change to the character, nature or conservation status of the marine mammal receptor.

Table 10-15 Sensitivity criteria

SENSITIVITY OF THE RECEPTOR	DEFINITION
High	• Receptor has no ability to tolerate a particular effect causing a significant change in individual vital rates (survival and reproduction); • Receptor has no ability to recover from any effect on vital rate (survival and reproduction); and/or Receptor has no ability to adapt behaviour so that individual vital rates (survival and reproduction) are highly likely to be significantly affected.
Medium	• Receptor has a limited ability to tolerate a particular effect which may cause a significant change in individual vital rates (survival and reproduction); • Receptor has a limited ability to recover from any effect on vital rates (survival and reproduction); and/or • Receptor has a limited ability to adapt behaviour so that individual vital rates (survival and reproduction) may be significantly affected.
Low	• Receptor has some tolerance to a particular effect with no significant change in individual vital rates (survival and reproduction); • Receptor is able to recover from any effect on vital rates (survival and reproduction); and/or • Receptor has a limited ability to adapt behaviour so that individual vital rates (survival and reproduction) may be affected, but not at a significant level.
Negligible	• Receptor is able to tolerate a particular effect without any impact on individual vital rates (survival and reproduction); • Receptor is able to return to previous behavioural states / activities once the impact has ceased; and/or • Receptor is able to adapt behaviour so that individual vital rates (survival and reproduction) are not affected.

Table 10-16 Magnitude criteria

MAGNITUDE CRITERIA	DEFINITION
High	Total loss of, or major alteration to conservation status or integrity of a marine mammal receptor with likely long-term of irreversible results. Fundamental alteration to the character and composition of any proposed or designated protected sites.
Medium	Observed effect on the conservation status or integrity of a marine mammal receptor over the short to medium term. For this assessment the duration of a medium magnitude of impact is considered to be no more than two breeding cycles of an individual of a species. This impact is likely to be reversible in the longer term through replacement.
Low	A minor shift away from baseline conditions. The effect may be detectable, but any impacts are unlikely to be on a scale or for a duration that would result in a significant effect on the conservation status or integrity of the marine mammal receptor, and would be reversible in the short term i.e., within one breeding cycle of an individual of a species.
Negligible	A very slight change from baseline conditions. Any effects are likely to be reversible either immediately following (or soon after) the cessation of the impact and will not affect the conservation status or integrity of the marine mammal receptor.

The consequence and significance of effect is then determined using the matrix provided in Chapter 6: EIA Methodology.

10.8 Embedded mitigation

As described in Chapter 6: EIA Methodology, certain measures have been adopted as part of the Project development process to reduce the potential for impacts to the environment, as presented in Table 10-17. These have been accounted for in the assessment presented below. The requirement for additional mitigation measures (secondary mitigation) will be dependent on the significance of the effects on Marine Mammal receptors. These measures are considered standard industry practice for this type of the Project.

Table 10-17 Embedded Mitigation relevant for marine mammal and megafauna receptors

MITIGATION MEASURE	DESCRIPTION	FORM (PRIMARY OR TERTIARY)	HOW MITIGATION WILL BE SECURED
Micro-siting of WTG and associated offshore infrastructure including cable route	The final Project layout will be presented within the Cable Plan (CaP) and Development Specification and Layout Plan (DSLP) and conditions of the marine licence. The final placement of anchors and export cable will be informed through micro siting based on available site survey data to ensure avoidance of sensitive habitats, archaeological and other structures where possible. Where this is not possible, the route will take the shortest distance possible through the sensitive areas to reduce environmental effects.	Primary	Secured through conditions attached within the Marine Licence.
Reducing localised habitat loss	Best practice will be followed to ensure that potential habitat loss is minimised throughout the proposed works (e.g., Micro-siting and minimising the benthic footprint of the Project). The amount of rock used to protect the offshore export cable or as scour protection will be kept to a minimum where possible.	Primary	Secured through conditions attached within the Marine Licence.
Removal of debris from floating lines and cables	Mooring lines and the floating cable will be inspected with a risk-based frequency during the operational life cycle of the Project, starting at a higher frequency and likely declining after several years, based on evidence gathered during inspections. Any inspected or detected debris on the floating lines and cable will be recovered based on a risk assessment which considers impact on environment, risk to asset integrity and cost of intervention.	Primary	Secured through conditions attached within the Marine Licence.
Nacelle, tower, and rotor design	The nacelle, tower, and rotor are designed and constructed to contain leaks thereby reducing the risk of spillage into the marine environment.	Primary	Secured through conditions attached within the Marine Licence.
Adherence with the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (BWM convention)	Ballast water discharges from vessels will be managed under the BWM Convention which aims to prevent the spread of harmful aquatic organisms from one region to another, by establishing standards and procedures for the management and control of ships' ballast water and sediments. Measures will be adopted to ensure that the risk of invasive non-native species introduction during construction, operation and maintenance, and decommissioning is minimised.	Tertiary	Secured through conditions attached within the Marine Licence.

MITIGATION MEASURE	DESCRIPTION	FORM (PRIMARY OR TERTIARY)	HOW MITIGATION WILL BE SECURED
Adherence to the International Convention for the Prevention of Pollution from Ships (MARPOL)	All vessels will operate in adherence with MARPOL requirements. Accordance with this will help to ensure that the potential for release of pollutants is minimised during operations.	Tertiary	Secured through conditions attached within the Marine Licence.
Environmental Management Plan (EMP)	The EMP will provide the over-arching framework for on-site environmental management during the phases of development as follows: • All construction as required to be undertaken before the commissioning of the Project • The operational lifespan of the Project from Commissioning until the cessation of electricity generation (environmental management during decommissioning is addressed by the Decommissioning Programme). The EMP will be in accordance with the Application insofar as it relates to environmental management measures. The EMP will set out the roles, responsibilities and chain of command in respect of environmental management for the protection of environmental interests during the construction and operation of the Project. It will address (but not be limited to) the following overarching requirements for environmental management during construction: • Mitigation measures as identified in the Application, pre-consent and pre-construction monitoring or data collection • A pollution prevention and control method statement, including contingency plans; • Management measures to prevent the introduction of Invasive Non-Native Species (INNS); • A site waste management plan (dealing with all aspects of waste produced during the construction period), including details of contingency planning in the event of accidental release of materials which could cause harm to the environment. Wherever possible the waste hierarchy of reduce, reuse and recycle will be referred to; and	Tertiary	Secured through conditions attached within the Marine Licence.

MITIGATION MEASURE	DESCRIPTION	FORM (PRIMARY OR TERTIARY)	HOW MITIGATION WILL BE SECURED
	• The reporting mechanisms that will be used to provide the Scottish Ministers and relevant stakeholders with regular updates on construction activity, including any environmental issues that have been encountered and how these have been addressed. The EMP will be regularly reviewed by the Company at intervals agreed by the Scottish Ministers and will be updated based on current information on construction methods and operations. • The EMP will be informed, so far as is reasonably practicable, by the baseline monitoring or data collection undertaken as part of the Application and the Project Environmental Monitoring Programme (PEMP) to ensure that all construction and operation activities are carried out in a manner that minimises their impact on the environment, and that mitigation measures contained in the Application, or as otherwise agreed are fully implemented.		
Project Environmental Monitoring Programme (PEMP)	A PEMP will be developed to provide further evidence to support these conclusions of the EIA and to provide information on the environmental research initiatives for the Project to allow information to be obtained for future offshore wind farm developments.	Tertiary	Secured through conditions attached within the Marine Licence.
Construction Method Statement (CMS)	A CMS will be developed in accordance with the EMP and detail how project activities and plans identified within the EMP will be carried out, whilst also highlighting any possible dangers / risks associated with specific Project activities. The CMS will include the Code of Construction Practice (CoCP) which will set out the approach to how construction activities will be managed and controlled in order to deliver the commitments and mitigation arising from Project.	Tertiary	Secured through conditions attached within the Marine Licence.
CaP and Cable Burial Risk Assessment (CBRA)	A CaP will be provided for the Project which will detail the location, duration / route and cable laying techniques of export cable and detail the methods for cable surveys during its operational life. This will be supported by survey results from the geotechnical, geophysical, and benthic surveys. The CaP will also detail the electromagnetic fields of the cables deployed.	Primary	Secured through conditions attached within the Marine Licence.

MITIGATION MEASURE	DESCRIPTION	FORM (PRIMARY OR TERTIARY)	HOW MITIGATION WILL BE SECURED
	A CBRA will also be undertaken and included within the CaP which will detail cable specifications, cable installation, cable protection, target burial depths / depth of lowering and any hazards the cable will present during the lifetime of the cable.		
Vessel management plan (VMP)	A VMP will be prepared for the Project which will detail the number, type and specification of vessels utilised during construction and operation. This will also detail how vessel management is coordinated and the ports and transit corridors proposed.	Tertiary	Secured through conditions attached within the Marine Licence.
Decommissioning Programme	A Decommissioning Programme will be provided pre-construction to address the principal decommissioning measures for the Project, this will be written in accordance with applicable guidance and detail the management, environmental management, and schedule for decommissioning.	Tertiary	Secured through conditions attached within the Marine Licence.

10.9 Assessment of impacts

The potential impacts arising from the construction and decommissioning phases of the project activities along with the MDS against which each impact has been assessed. An assessment of the significance of effects of the Project on marine mammal receptors caused by each identified impact pathway is given below.

10.9.1.1 Potential effects during construction

During the pre-construction and construction phases of the Project, underwater sound emissions from pre-construction surveys, site preparation and construction activities have the potential to result in acoustic impacts (including injury and disturbance) to marine mammal receptors on an individual or population level. Underwater sound can result from a number of activities, including:

- Vessel movements during construction activities
- Trenching, seabed preparation, cable laying activities and rock protection; and
- Pre-construction visual surveys utilising ultra-short baseline positioning equipment;

The impacts from the different noise-related construction activities will mainly occur in the Project Area, and there is limited scope for noise impacts within the wider vicinity when considering the worst-case realistic scenarios for the construction phase of the Project (i.e., no piling activities and pre-construction geophysical surveys will be undertaken). As such no noise modelling has been undertaken.

The potential impacts of anthropogenic underwater sound on marine mammals are influenced by the nature of the sound source (i.e., the frequency and intensity of the sound), the duration of the sound against baseline background levels and the sensitivity of the marine mammal receptor. Underwater sounds can either be impulsive (for example, geophysical survey equipment); or non-impulsive (or continuous) in nature (such are those generated by trenching and from vessel movements).

The principal metrics used to describe the intensity of underwater sound are the sound pressure level (SPL) and sound exposure level (SEL). The SPL is a measure of the amplitude or intensity of a sound and, for impulsive sounds, is measured as a peak value. The SEL is a time-integrated measurement of sound energy which considers the intensity as well as the duration of the sound. The sound characteristics of activities associated with the construction phase of the Project have been presented in Table 10-18 and are based on the existing literature. Where a range of sound source levels were identified for an activity, a reasonable, realistic worst-case level has been assumed for the assessment.

Table 10-18 Characteristics of underwater sound sources generated during project construction phase

UNDERWATER SOUND GENERATING ACTIVITY	FREQUENCY RANGE OF GENERATED SOUND (KHZ)	SOURCE LEVEL SPL (SPLPEAK[1]/SPL RMS[2] DB RE 1µPA) AT 1 M OF EXEMPLAR EQUIPMENT/ACTIVITIES
USBL positioning equipment	20-30	206[1] (Kongsberg HiPAP 602 specification sheet)
Survey vessels and construction vessels	Acoustic energy from vessel is strongest at frequencies <1 kHz	181[2] (Beland *et al*, 2013)
Trenching, rock placement[1]	Acoustic energy from vessel is strongest at frequencies <1 kHz	178[2] (Nedwell *et al*. 2003)
Cable laying[1]	Acoustic energy from vessel is strongest at frequencies <1 kHz	178[2] (Nedwell *et al*. 2003)

10.9.1.2 Sensitivity of receptors to underwater noise

Underwater sound could result in a direct impact to marine mammal species, with animals in the immediate vicinity of the source likely to experience greater exposure to survey and construction sounds than those outside the Project Area. The impact of underwater sound on marine mammals is generally split into the following categories:

- Auditory injury: which results from damage to the inner ear of marine mammals, the organ system most directly sensitive to sound exposure. Auditory injury can result in hearing loss (known as Permanent Threshold Shift (PTS); Southall *et al.*, 2007); and

[1] *Available data suggest that generated underwater noise is emitted by the commercial vessel engaged in the activity rather than the activity itself, which emits sound of less intensity, thus presented SPL levels refer to the vessel generated noise (Jiménez-Arranz et al, 2020)*

- Behavioural responses: which are highly viable and context specific. Responses can include increased alertness, altered vocal behaviour, alteration of movements or diving behaviour or temporary or permanent habitat abandonment. In some circumstances, sound exposure from military sonar has resulted in behavioural responses in marine mammals (Tyack *et al.*, 2011).
- Masking: where underwater sound from anthropogenic sources has the potential to partially, or entirely, reduce the audibility of signals from other animals or prey species.

Each species of marine mammal has a unique hearing range in which it has adapted to be most sensitive to perceived sounds; however, not all species' auditory abilities have been studied in sufficient detail to identify these ranges. Thus, hearing sensitivity has been defined based on established hearing groups for the marine mammal species of interest, presented in Table 10-19.

Table 10-19 Functional marine mammal hearing groups based on Southall et al., 2019, auditory bandwidth and species identified within the Study Area

FUNCTIONAL HEARING GROUP	AUDITORY BANDWIDTH	SPECIES	SPECIES POTENTIALLY PRESENT IN THE STUDY AREA
Low Frequency Cetaceans (LF)	7 Hz to 35 kHz	Baleen whales	Minke whale
High Frequency Cetaceans (HV)	150 Hz to 160 kHz	Dolphins	Bottlenose dolphin White-beaked dolphin
Very High Frequency Cetaceans (VHF)	275 Hz to 160 kHz	True porpoise and some small whales	Harbour porpoise
Phocid Seals in Water (PW)	75 Hz to 100 kHz	Seals	Grey and harbour seals

The currently recommended sound exposure criteria for auditory injury in marine mammals have been published by the US National Marine Fisheries Service (NMFS), often referred to as the National Oceanic and Atmospheric Administration (NOAA) criteria (NMFS, 2018) and updated in a peer-reviewed academic paper (Southall *et al.*, 2019). The thresholds for Permanent Threshold Shift (PTS) are defined on a dual criterion of unweighted, instantaneous peak sound pressure levels (SPL_{peak}; dB re 1µPa) and M-weighted cumulative Sound Exposure Levels (SELcum; dB 1 μPa^2s) and are presented in Table 10-20.

Table 10-20 Quantitative thresholds for auditory effects (PTS) due to impulsive sound in marine mammal species ((Southall et al., 2019)

FUNCTIONAL HEARING GROUP	PTS TRESHOLD SPL_{PEAK}	PTS TRESHOLD SEL_{CUM}
Low Frequency Cetaceans (LF)	219	183
High Frequency Cetaceans (HF)	230	185
Very High Frequency Cetaceans (VHF)	202	155
Phocid Seals in Water (PW)	218	185

10.9.1.3 Noise-related impacts to marine mammals associated with construction noise from vessels including the risk of injury and disturbance/displacement

Magnitude

The underwater sound pressure levels associated with survey and construction vessel activities are likely to be too low to result in injury to marine mammal species and will be temporary and transient, thus not to result in significant disturbance. There will be a limited number of vessels associated with the survey and construction phase, although it is expected that vessel generated noise will exceed the threshold for behavioural effects from continuous sound (120 dB rms re 1 µPa); the "Level B harassment" threshold (NMFS, 2005). However, the associated underwater sound is not considered to represent a material change from baseline conditions in the context of existing shipping and navigation activities throughout the North Sea. Moreover, survey and construction activities will be of a short duration. As a result of the minor contribution of vessel noise associated with the project activities to the soundscape, and the short-duration (~ 1 month), transience of vessel operations, the magnitude of impact from vessel noise is considered to be negligible.

Sensitivity

Based on the sensitivity criteria set out above in Section 10.9.1.2, the sensitivity of white-beaked and white-sided dolphin, bottlenose dolphin, minke whale, harbour porpoise and two species of seals is assessed as negligible.

Evaluation of significance

Taking the negligible sensitivity of the marine mammal receptors and the negligible magnitude of the impact, the overall effect of underwater noise from vessels during construction is considered to be negligible and not significant in EIA terms.

RECEPTOR	SENSITIVITY	MAGNITUDE OF IMPACT	CONSEQUENCE
White-beaked and white-sided dolphin	Negligible	Negligible	Negligible
Bottlenose dolphin	Negligible	Negligible	Negligible
Minke whale	Negligible	Negligible	Negligible
Harbour porpoise	Negligible	Negligible	Negligible
Grey and harbour seal	Negligible	Negligible	Negligible

Impact significance - NOT SIGNIFICANT

10.9.1.4 Noise-related impacts to marine mammals associated with construction noise from trenching, rock placement and cable lying activities including the risk of injury and disturbance/displacement

Magnitude

Trenching and rock placement and cable lying activities will introduce short term anthropogenic noise to the environment. Although the sound associated with trenching by Nedwell *et al.* (2003) is of a level which could cause disturbance to marine mammals, the SPL is broadly comparable to other shipping noise (Simard *et al.*, 2016; in Jiminez-Arranz *et al.* 2020). It is therefore probable that vessel noise, rather than the mechanical action itself, likely dominates the acoustic signal. A SPL of 172 dB re. 1µPa was measured during the operation of the fall pipe vessel MV Rollingstone during rock placement activities (Nedwell & Edwards, 2004). Rock placement itself was not thought to give a noticeable rise in noise over background levels. This is indicative of the fact that the sound levels were dominated by vessel noise and not the rock-placement activities. Nedwell & Edwards, 2004 and Nedwell *et al.*, 2012 showed, that during rock placement activities there was no noticeable sound level increase, which suggests that sound levels are dominated by vessel noise. Although sound pressure levels associated with these activities would be above the Level B harassment threshold for continuous sounds, and as such could cause behavioural changes in marine mammal species, the activities mentioned above will be transient and of a short duration. It is therefore unlikely they will have any significant impacts on acoustically sensitive animals such as marine mammals beyond those experienced through baseline conditions (i.e., levels of shipping in the Study Area). Therefore, the magnitude of impact from these activities is considered to be negligible.

Sensitivity

Based on the sensitivity criteria set out above in Section 10.9.1.2, the sensitivity of white-beaked and white-sided dolphin, bottlenose dolphin, minke whale, harbour porpoise and two species of seals is assessed as having a negligible sensitivity.

Evaluation of significance

Taking the negligible sensitivity of the marine mammal receptors and the negligible magnitude of the impact, the overall effect of underwater noise from trenching, rock placement and cable laying activities during construction is considered to be negligible and not significant in EIA terms.

RECEPTOR	SENSITIVITY	MAGNITUDE OF IMPACT	CONSEQUENCE
White-beaked and white-sided dolphin	Negligible	Negligible	Negligible
Bottlenose dolphin	Negligible	Negligible	Negligible
Minke whale	Negligible	Negligible	Negligible
Harbour porpoise	Negligible	Negligible	Negligible
Grey and harbour seal	Negligible	Negligible	Negligible
Impact significance - NOT SIGNIFICANT			

10.9.1.5 Noise-related impacts to marine mammals associated with pre-construction visual surveys utilising USBL equipment including the risk of injury and disturbance/displacement

Magnitude

Acoustic impacts arising from the project preconstruction surveys and construction activities are highly influenced by both the nature of the works and the receiving environment. Sound attenuates as it propagates throughout the water column and the magnitude of impact will be influenced by local oceanographic conditions (influencing both the path of the sound into the water column and how much sound is transmitted).

Pre-construction visual surveys with the use of USBL subsea positioning equipment will introduce underwater noise of relatively high intensity but of a short duration (expected survey duration is no longer than 1 day). Additionally, sounds with a frequency of ca. 20-30 kHz, such as these emitted by USBL attenuate more quickly than lower frequency sounds, such that an animal would need to be very close to the sound source for there to be a realistic possibility of acoustic injury. Sound propagation loss would cause a peak sound pressure level of 207 dB re 1 µPa at 1 metre (typical

of a USBL transponder) to reduce to <200 dB re 1 µPa within 10 metres of the source, estimated using a simple geometric spreading equation (i.e., $15 \cdot \log_{10} \cdot R$).

The likelihood of an animal being this close to operational equipment is extremely unlikely when considering that the source is deployed from a moving vessel travelling at more than 2 m/s (i.e., 4 knots) and, in some cases, is being towed at depth (e.g., a USBL may be mounted on a towed device within a few metres of the seabed). Taking the above operational details into account there is no realistic injury risk due to the USBL use, although the equipment might cause disturbance to marine mammals.

The sound produced by USBL devices is generally considered to be impulsive in character, with a rapid rise time and short pulse duration (Hastie *et al.* 2019). However, the relatively low amplitude of the sound compared to common geophysical sound sources, such as sub-bottom profilers and seismic airguns, indicates that any disturbance would be highly localised and temporary, and ceasing when the USBL operation ends. As a comparison, Thompson *et al.*, (2013) found that the short-term disturbance effect of a significantly louder seismic survey does not lead to long-term displacement of harbour porpoises, thus it is likely that any disturbance of cetaceans from USBL operations would be of an even lower magnitude.

Impacts of disturbance from underwater noise will represent only a minor shift away from baseline conditions, for the short duration of the activities that would generate significant levels of sound. While any effects could be detectable, they are unlikely to result in any significant impacts on the conservation status of any marine mammal species beyond short term behavioural impacts or the temporary masking of biologically relevant sounds. While any impact will affect the receptor directly, the impact is predicted to be of regional special extent, short term duration, and will be intermittent and highly reversible (i.e., impacts will cease when the activity ceases). The magnitude of impact is therefore considered to be **negligible**.

Sensitivity

Based on the sensitivity criteria set out above in Section 10.9.1.2, the sensitivity of white-beaked and white-sided dolphin, bottlenose dolphin, minke whale, and two species of seals is assessed as **negligible** and **low** for high frequency cetacean: harbour porpoise.

Evaluation of significance

Taking the **negligible to low** sensitivity of the marine mammal receptors and the **negligible** magnitude of the impact, the overall effect of underwater noise from pre-construction surveys utilising USBL equipment is considered to be negligible and not significant in EIA terms.

RECEPTOR	SENSITIVITY	MAGNITUDE OF IMPACT	CONSEQUENCE
White-beaked and white-sided dolphin	Negligible	Negligible	Negligible
Bottlenose dolphin	Negligible	Negligible	Negligible

Minke whale	Negligible	Negligible	Negligible
Harbour Porpoise	Low	Negligible	Negligible
Grey and harbour seal	Negligible	Negligible	Negligible
Impact significance - NOT SIGNIFICANT			

10.9.2 Potential effects during operation and maintenance

Potential effects during operation and maintenance have been scoped out of the assessment and as such have not been considered further.

10.9.3 Potential effects during decommissioning

The targeted scenario for decommissioning is a clear seabed and decommissioning will involve the dismantling and removal of the WTG and associated substructures, anchoring systems and the removal of the subsea cables. It should be noted that the decommissioning options for the export cable removal will be subject to comparative assessment of options at the end of the installation life. This will involve assessing the potential removal of artificial hard structures associated with the Project. A Decommissioning Programme will be developed pre-construction to address the principal decommissioning measures for the Project. This will be developed in accordance with applicable guidance and detail the management, environmental management, and schedule for decommissioning. The decommissioning programme will be reviewed and updated throughout the lifetime of the Project to account for changing best practices.

Given the nature of the decommissioning activities, which will largely be a reversal of the installation process, the impacts during decommissioning are expected to be similar to or less than those assessed for the construction phase. Therefore, the magnitudes of impact assigned to marine mammals during the construction stage are also applicable to the decommissioning stage. It is also assumed that the receptor sensitivities will not materially change over the lifetime of the Project. Therefore, the decommissioning effects are not expected to exceed those assessed for construction.

10.9.4 Summary of potential effects

A summary of the outcomes of the assessment of potential effects from the construction and decommissioning of the Project is provided in Table 10-21. No significant effects on Marine Mammals and Other Megafauna receptors were identified. Therefore, mitigation measures in addition to the embedded mitigation measures listed in Section 10.8 are not considered necessary.

Table 10-21 Summary of potential effects

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF IMPACT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANCE OF EFFECT)
Construction and decommissioning						
Noise-related impacts to marine mammals from vessel noise	White-beaked and white-sided dolphin	Negligible	Negligible	Negligible (not significant)	None above embedded mitigation	Negligible (not significant)
	Bottlenose dolphin	Negligible	Negligible	Negligible (not significant)	None above embedded mitigation	Negligible (not significant)
	Minke whale	Negligible	Negligible	Negligible (not significant)	None above embedded mitigation	Negligible (not significant)
	Harbour porpoise	Negligible	Negligible	Negligible (not significant)	None above embedded mitigation	Negligible (not significant)
	Grey and harbour seal	Negligible	Negligible	Negligible (not significant)	None above embedded mitigation	Negligible (not significant)
Noise-related impacts to marine mammals from trenching, rock placement and cable laying activities	White-beaked and white-sided dolphin	Negligible	Negligible	Negligible (not significant)	None above embedded mitigation	Negligible (not significant)
	Bottlenose dolphin	Negligible	Negligible	Negligible (not significant)	None above embedded mitigation	Negligible (not significant)
	Minke whale	Negligible	Negligible	Negligible (not significant)	None above embedded mitigation	Negligible (not significant)

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF IMPACT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANCE OF EFFECT)
	Harbour porpoise	Negligible	Negligible	Negligible (not significant)	None above embedded mitigation	Negligible (not significant)
	Grey and harbour seal	Negligible	Negligible	Negligible (not significant)	None above embedded mitigation	Negligible (not significant)
Noise-related impacts to marine mammals from pre-construction surveys utilising USBL equipment	White-beaked and white-sided dolphin	Negligible	Negligible	Negligible (not significant)	None above embedded mitigation	Negligible (not significant)
	Bottlenose dolphin	Negligible	Negligible	Negligible (not significant)	None above embedded mitigation	Negligible (not significant)
	Minke whale	Negligible	Negligible	Negligible (not significant)	None above embedded mitigation	Negligible (not significant)
	Harbour porpoise	Low	Negligible	Negligible (not significant)	None above embedded mitigation	Negligible (not significant)
	Grey and harbour seal	Negligible	Negligible	Negligible (not significant)	None above embedded mitigation	Negligible (not significant)

10.10 Proposed Monitoring

With consideration of the embedded mitigation measures for the Project, the assessment has concluded no significant impacts to any marine mammal species, and therefore there is no requirement for additional mitigation over and above the embedded measures. It is anticipated that any monitoring that may be proposed by TEPNSUK to support the EIA conclusions and provide supporting information for future floating offshore wind farm developments will be established through consent conditions and the development of a PEMP in consultation with relevant stakeholders. All qualifying activities (i.e., those generating impulsive noise) will be submitted to the Marine Noise Registry.

This chapter has used the best available evidence to inform the assessment of potential effects on Marine Mammal and Other Megafauna receptors. The potential impacts of EMF have been scoped out of this assessment however, EMF recorders will be implemented as part of the scientific Research and Development (R&D) programme in conjunction with the Technical University of Denmark (DTU) and the Marine Alliance for Science and Technology for Scotland (MASTS). This programme will provide knowledge and experience on offshore wind turbine construction, integration, installation, operations and maintenance. In line with NatureScot (2022) Guidance on securing positive effects for biodiversity from local development, this project will also provide vital information to inform Nature Inclusive Design (NID) and the impacts on the biodiversity around WTGs and cable routes.

A full list of sub-projects is provided in Chapter 1: Introduction. Aspects relevant to Marine Mammals and Other Megafauna include:

- Environmental Deoxyribonucleic Acid (eDNA) -based monitoring;
- Biodiversity and ecosystem indicators; and
- Active acoustics and optics monitoring development.

The programme provides an opportunity for real-time environmental monitoring in the offshore environment and will provide a basis from which to assess the functionality of the floating WTG and the overall design of the project in the environmental setting of the CNS, which will inform similar developments in the future.

10.11 Cumulative Effects Assessment

Any potential impacts from the Project could interact with impacts from other developments, plans and activities, resulting in a cumulative effect on Marine Mammals and Other Megafauna. The general approach to the cumulative effects assessment is described in Chapter 6: EIA Methodology and further detail is provided below.

The marine mammal Zone of Influence (ZoI) has been defined by a 20 km buffer around the Project Area. This is due to localised nature of the underwater noise arising from construction activities and thus limited and transient nature of expected impacts. Moreover, the consideration of projects which could result in potential cumulative effects is based on the results of the Study Area specific impact assessment, together with the expert judgement of specialist consultants.

10.11.1 Cumulative noise related impacts from pre-construction and construction activities

Screening revealed several projects within the ZoI, although estimated construction start date for these developments fall after the end of construction works for the Project, thus no cumulative impacts are expected. A search of the Marine Noise Registry for planned/proposed activities was conducted to identify any planned activities within the ZoI that might involve undertaking seismic surveys or UXO clearance (i.e., activities generating significant underwater noise). No activities overlapping with the ZoI and construction window for the Project have been identified.

As the Projects own impacts during the construction stage are found to be negligible and not significant and no cumulative plans or projects have been identified, there is considered to be no potential for significant cumulative effects to occur throughout the construction stage of the Project.

10.11.2 Cumulative noise related impacts from decommissioning activities

At the end of the operation and maintenance phase of the Project, the options for decommissioning works will be assessed, taking into consideration constraints (e.g., safety and liability) and the potential environmental impacts associated with decommissioning works will be assessed. As the complete removal of the turbine and the cable would have the most significant effects on marine mammal receptors, any other decommissioning option, such as leaving infrastructure in situ, would result in no more significant cumulative effects than complete removal.

At this point in time, it is difficult to ascertain the likely cumulative baseline within the Study Area. Nonetheless, as the Projects own decommissioning impacts are anticipated to be analogous with those during construction, there are not anticipated to be any significant effects from the Project alone. As such, it is likely that any cumulative impacts during the construction period would not give rise to significant cumulative effects.

10.12 Inter-Related Effects

Interrelated effects describe the potential interaction of multiple offshore development impacts upon one receptor which may interact to create a more significant impact on a receptor than when considered in isolation. Interrelated effects may have a temporal or spatial element and may be short-term, temporary, or longer-term over the lifetime of the Project.

Inter-relationships are defined as the interaction between the impacts assessed within different topic assessment chapters on a receptor. The chapters and impacts related to the assessment of potential effects on Marine Mammals and Other Megafauna are provided in Table 10-22.

In line with the Scoping Opinion received, this chapter has assessed all impacts that are relevant to Marine Mammals and Other Megafauna receptors during the construction and decommissioning phases of the Project. Therefore, it is considered that the assessment and conclusions presented provide a complete and robust assessment of all potential impacts relevant to Marine Mammals and Other Megafauna. The assessment has also considered the potential for inter-related effects in relation to Marine Mammals and Other Megafauna, and no additional effects beyond those presented in Section 10.6 have been identified.

Where the assessment contained in this chapter is considered within other assessment chapters, a summary of these inter-relationships is presented below in Table 10-22.

Table 10-22 Marine mammal inter-relationships

CHAPTER	IMPACT	DESCRIPTION
Benthic Ecology	Indirect impacts to marine mammals through long-term benthic habitat change, including the potential for changes to habitat quality.	Long-term changes to benthic habitats can indirectly impact Marine Mammals and Other Megafauna due to changes in the availability of prey species. Fish species which exploit benthic habitats may be impacted by loss or disturbance of that habitat and this can impact habitat use in higher trophic species, such as seals and certain species of dolphins, which rely on those fish species as prey resources. Direct impacts to benthic habitats from the Project are assessed in Chapter 8: Benthic Ecology, whilst impacts on fish distributions are discussed in Chapter 9: Fish and Shellfish Ecology. Impacts on Marine Mammals and Other Megafauna from long-term habitat are not assessed in this chapter as they have been scoped out.
Fish and Shellfish Ecology	Indirect impacts to marine mammals through long-term habitat change which may result in changes to prey availability in terms of fish and shellfish abundance and distribution.	Long-term changes to habitat quality may influence the abundance and distribution of fish and shellfish, and consequently the marine mammal species which prey upon them. Impacts to fish and shellfish from the Project are assessed in Chapter 9: Fish and Shellfish Ecology. Impacts on marine mammals as a function of long-term habitat change, including changes to prey availability are not assessed in this chapter as they have been scoped out.
Commercial Fisheries	In-direct impacts on marine mammals associated with entanglement from secondary interactions with derelict fishing gears.	There is potential for derelict fishing gears to become entangled with infrastructure within the Project Area, which introduces the risk of secondary entanglement with marine mammals. Information about commercial fishing effort and gear types used are integral to characterising the risk of this indirect impact between Marine Mammals and Other Megafauna and the Project. These data are characterised in Chapter 12: Commercial Fisheries. Impacts on marine mammals due to entanglement risk are not assessed in this chapter, as they have been scoped out.

10.13 Transboundary Effects

Impacts on Marine Mammals and Other Megafauna from the construction and decommissioning of the Project will be localised to the extent of the Study Area and its immediate surroundings, which are all within UK waters. The Study Area is approximately 23 km from the UK to Norway boundary line, which is the nearest international boundary which could be crossed.

Whilst several of the cetacean species are part of MUs with ranges which extend into international waters (e.g., harbour porpoise), none of these populations will be significantly impacted by any of the proposed activities during any phase of the Project.

Moreover, in EIA terms there will be no significant effects on marine mammal qualifying features of protected sites in European waters due to their distance from the Project, with all Project alone and cumulative impacts assessed as not significant. An assessment under the Habitats Regulations for these sites is provided in the Combined HRA Screening and RIAA Report (Doc Reference: GB-CZN-00-XODUS-000023) submitted alongside the marine licence application, whereby there was found to be no potential for LSE for any SAC considered, these conclusions were also in agreement with NatureScot advice (see Table 10-2).

Overall, the limited and localised nature of the impacts anticipated from the Project precludes them from generating transboundary effects.

10.14 Summary of impacts and mitigation measures

Information on Marine Mammals and Other Megafauna within the Study Area was collected through a desk-based review of publicly available data, APEM aerial surveys and informed by consultation with key stakeholder.

Potential impacts resulting from the Project include injury and disturbance to marine mammal species due to underwater sound; however, given the small-scale of the Project and the short timeline of the construction phase, all associated impacts are expected to be of negligible consequence and therefore not significant. Additionally, it is concluded that there will be no significant cumulative or transboundary effects from the Project alongside other developments/plans.

No secondary mitigation, over and above the embedded mitigation measures committed to is either required or proposed in relation to the potential effects of the Project on Marine Mammals and Other Megafauna, as no significant effects are predicted.

REFERENCES

Anderwald, Anderwald, P., Evans, P.G.H, Canning, C., Hepworth, K., Innes, M., Macdonald, P., Sim, I., Stockin, K. and Weir, C. (2010). Cetaceans of the East Grampian Region. Sea Watch Foundation, Aberdeen. 68pp.

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

Arso Civil, M.; Louis, M.; Hague, E.; Hammond, P. (2019). Improvingg understanding of bottlenose dolphin movements along the east coast of Scotland (Interim Report 2019). Available online at: https://tethys.pnnl.gov/publications/improving-understanding-bottlenose-dolphin-movements-along-east-coast-scotland-interim [Accessed 01/08/2023]

Austin, R., Hawkes, L., Doherty, P., Henderson, S., Inger, R., Johnson, L., Pikesley, S., Solandt, J-L., Speedie, C. and Witt, M. (2019). Predicting habitat suitability for basking sharks (Cetorhinus maximus) in UK waters using ensemble ecological niche modelling. Journal of Sea Research, 153: 101767. 10.1016/j.seares.2019.101767.

Banhuera-Hinestroza, E., Galatius Jørgensen, G., Kinze, C., Rasmussen, M. & Evans, P. (2009). White beaked dolphin, In Report of ASCOBANS/HELCOM Small Cetacean population structure workshop Held 8-10 October 2007, ASCOBANS, Bonn, Germany. April 2009.

BEIS (2022). UK Offshore Energy Strategic Environmental Assessment Future Leasing/Licensing for Offshore Renewable Energy, Offshore Oil & Gas and Gas Storage and Associated Infrastructure: OESEA4 Environmental Report. March 2022. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1061670/OESEA4_Environmental_Report.pdf [Accessed 01/08/2023]

Bloomfield, A. and Solandt, J.L. (2006). The Marine Conservation Society Basking Shark Watch 20-year report (1987-2006). Ross on Wye, UK: Marine Conservation Society.

Booth, C.G., Embling, C., Gordon, J., Calderan, S.V., and Hammond, P.S. (2013). Habitat preferences and distribution of the harbour porpoise Phocoena phocoena west of Scotland. Marine Ecology Progress Series, 478: 273-285. Available online at: https://doi.org/10.3354/meps10239 [Accessed 01/08/2023]

Bowen, D. (2016). *Halichoerus grypus*. The IUCN Red List of Threatened Species (2016): e.T9660A45226042. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T9660A45226042.en [Accessed 01/08/2023]

Carter, M. and Russel, D. (2020). At-Sea Density Maps for Grey and Harbour Seals in the British Isles (2020) dataset. Available online at https://risweb.st-andrews.ac.uk/portal/en/datasets/atsea-density-maps-for-greyand-harbour-seals-in-the-british-isles-2020-dataset(dcebb865-3177-4498-ac9d-13a0f10b74e1).html [Accessed 01/08/2023]

Carter, M.I., Boehme, L., Cronin, M.A., Duck, C., James Grecian, W., Hastie, G.D., Jessopp, M.J., Matthiopoulos, J., McConnell, B.J., Morris, C.D. and Moss, S.E. (2022). Sympatric seals, satellite tracking and protected areas: habitat-based distribution estimates for conservation and management. Frontiers in Marine Science, 9: 875869. Available online at: https://doi.org/10.3389/fmars.2022.875869 [Accessed 01/08/2023]

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

CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland, Terrestrial, Freshwater, Coastal and Marine. version 1.1. Chartered Institute of Ecology and Environmental Management, Winchester. Available online at: https://cieem.net/wp-content/uploads/2018/08/ECIA-Guidelines-2018-Terrestrial-Freshwater-Coastal-and-Marine-V1.1Update.pdf [Accessed 01/08/2023].

Cooke, J.G. (2018). *Balaenoptera acutorostrata*. The IUCN Red List of Threatened Species 2018: e.T2474A50348265. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T2474A50348265.en [Accessed 01/08/2023]

Culik, B.M. (2010). Odontocetes: the toothed whales: distribution, behaviour, migration and threats. In Compiled for the Convention on Migratory species (CMS/UNEP) Secretariat.

DECC (2016). UK Offshore Energy Strategic Environmental Assessment 3 (OESEA3). Available online at: https://www.gov.uk/government/consultations/uk-offshore-energy-strategic-environmental-assessment-3-oesea3 [Accessed 01/08/2023]

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. and Speedie, C. (2017). Long-term satellite tracking reveals variable seasonal migration strategies of basking sharks in the north-east Atlantic. Scientific Reports, 7(1): 1-10.

Drewery, H.M. (2012). Basking Shark (*Cetorhinus maximus*) Literature Review, Current Research and New Research Ideas. Marine Scotland Science Report 24/12. Available online at: http://marine.gov.scot/datafiles/misc/MREP/Archive/03/Documents/DrewryHelen_Baskingsharks.pdf [Accessed 01/08/2023]

Evans, P.G.H. (2011). A Methodology to Assess the Sensitivity of Marine Mammals to Different Fishing Activities and Intensities. CCW Policy Research Report No. 20.

Gilles, A, Authier, M, Ramirez-Martinez, NC, Araújo, H, Blanchard, A, Carlström, J, Eira, C, Dorémus, G, Fernández-Maldonado, C, Geelhoed, SCV, Kyhn, L, Laran, S, Nachtsheim, D, Panigada, S, Pigeault, R, Sequeira, M, Sveegaard, S, Taylor, NL, Owen, K, Saavedra, C, Vázquez-Bonales, JA, Unger, B, Hammond, PS (2023). Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS-IV aerial and shipboard surveys. Final report published 29 September 2023. 64 pp. Available online at: https://tinyurl.com/3ynt6swa [Accessed 12/02/2024].

Gore, M.A., Rowat, D., Hall, J., Gell, F.R., and Ormond, R. F. (2008). Transatlantic migration and deep midocean

Hague, E. L., Sinclair, R.R. and Sparling, E. (2020). Regional baselines for marine mammal knowledge across the North Sea and Atlantic areas of Scottish waters. Scottish Marine and Freshwater Science Vol 11 No 12. Published by Marine Scotland Science. Available from: MSS Reports Template (marine.gov.scot)

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

Hastie, T., Montanari, A., Rosset, S., and Tibshirani, R. J. (2019), "Surprises in High-Dimensional Ridgeless Least Squares Interpolation," arXiv preprint arXiv:1903.08560.

Haug, T., Gjøs1ter, H., Lindstrøm, U., Nilssen, K.T., and Røttingen, I. (1995). Spatial and temporal variations in northeast Atlantic minke whale Balaenoptera acutorostrata feeding habits. Developments in Marine Biology, 4: 225-239.
HWDT (Hebridean Whale and Dolphin Trust) (2018). Hebridean Marine Mammal Atlas. Part 1: Silurian, 15 years of marine mammal monitoring in the Hebrides. A Hebridean Whale and Dolphin Trust Report (HWDT), Scotland, UK.

IAMMWG (2022). Updated abundance estimates for cetacean Management Units in UK waters (Revised 2022). JNCC
Jimenez, Guillermo, Banda, Nikhil, Cook, Stephen, Wyatt, Roy (2020). Review on existing data on underwater sounds produced by the oil and gas industry. A report prepared by Seiche Ltd for the Joint Industry Programme (JIP) on E&P Sound and Marine. LifeJIP Topic - Sound source characterisation and propagation. Revision 5.1.

Jiménez-Arranz G., Banda N., Cook S., Wyatt R. (2020). "Review on existing data on underwater sounds produced by the oil and gas industry," in JIP topic - sound source characterisation and propagation (Joint Industry Programme (JIP) on E&P Sound and Marine Life). Available at: https://gisserver.intertek.com/JIP/DMS/ProjectReports/Cat1/JIP-Proj1.4.2_Review_on_Noise_from_Industrial_Sources.pdf [Accessed 01/08/2023].

JNCC (2003). Atlas of Cetacean Distribution. Available online at: https://hub.jncc.gov.uk/assets/a5a51895-50a1-4cd8-8f9d-8e2512345adf [Accessed 01/08/2023]

JNCC (2010). Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise. August 2010.

JNCC (2017). JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys. August 2017.

JNCC (2018). Favourable Conservation Status: UK Statutory Nature Conservation Bodies Common Statement 2018. Available online at: https://data.jncc.gov.uk/data/b9c7f55f-ed9d-4d3c-b484-c21758cec4fe/FCS18-InterAgency-Statement.pdf [Accessed 01/08/2023].

JNCC (2021a). Faray and Holm of Faray. Available online at: https://sac.jncc.gov.uk/site/UK0017096 [Accessed 01/08/2023]

JNCC (2022). Article 17 Habitats Directive Report 2019: Species Conservation Status Assessments 2019. Available online at: https://jncc.gov.uk/our-work/article-17-habitats-directive-report-2019-species/#regularly-occurring-species-vertebrate-species-mammals-marine [Accessed 29/09/2023]

Kavanagh, A.S., Kett, G., Richardson, N. et al. (2018). High latitude winter sightings of common minke whale calves (Balaenoptera acutorostrata) in the Northeast Atlantic. Marine Biodiversity Records, 11(22). Available online at: https://doi.org/10.1186/s41200-018-0157-y [Accessed 01/08/2023]

Kiszka, J. & Braulik, G. (2018). *Lagenorhynchus albirostris*. The IUCN Red List of Threatened Species 2018: e.T11142A50361346. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T11142A50361346.en [Accessed 01/08/2023]

Kongsberg HiPAP 602 Soecification sheet. 2024. Available online at: https://www.kongsberg.com/contentassets/16672e966d5e479495cacfc61116d147/476666a-hipap-602-datasheet.pdf [Accessed 01/08/2023].

Kraus, S.D., Kenney, R.D., and Thomas, L. (2019). A framework for studying the effects of offshore wind development on marine mammals and turtles. Report prepared for the Massachusetts Clean Energy Center, Boston, MA, 2110.

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. & Hammond P. S. (2022). Modelled density surfaces of cetaceans in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys. Available online at: https://scans3.wp.st-andrews.ac.uk/files/2022/08/SCANS-III_density_surface_modelling_report_final_20220815.pdf [Accessed 01/08/2023]

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: 857-874. Available online at: https://doi.org/10.1111/mec.12653 [Accessed 01/08/2023]

Lowry, L. (2016). *Phoca vitulina*. The IUCN Red List of Threatened Species 2016: e.T17013A45229114. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T17013A45229114.en [Accessed 01/08/2023]

Marine (Scotland) Act 2010. Available online at: https://www.legislation.gov.uk/asp/2010/5/contents [Accessed 01/08/2023]

Marine (Scotland) Act 2010. Available online at: https://www.legislation.gov.uk/asp/2010/5/contents [Accessed 01/08/2023].

Marine Scotland (2014). Guidance on the Offence of Harassment at Seal Haul-Out Sites. Report to The Scottish Government, June 2014.

Marine Scotland (2017). Designated Haul-Out Sites for Grey and Harbour Seals (Protection of Seals Orders). Available online at: https://marine.gov.scot/maps/446 [Accessed 01/08/2023].

Marine Scotland (2020). The protection of Marine European Protected Species from injury and disturbance, Guidance for Scottish Inshore Waters. July 2020. Available online at: https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2020/07/marineeuropean-protected-species-protection-from-injury-and-disturbance/documents/marine-european-protectedspecies-guidance-july-2020/marine-european-protected-species-guidance-july-2020/govscot%3Adocument/EPS%2Bguidance%2BJuly%2B2020.pdf [Accessed 01/08/2023]

Mitchell MD, Harborne AR. (2020). Non-consumptive effects in fish predator–prey interactions on coral reefs. Coral Reefs. 2020:1–8.

National Biodiversity Network Trust. (2023). NBN Atlas. Available online at: https://nbnatlas.org/ [Accessed 13/02/2024].

NatureScot (2017). Scottish Marine Wildlife Watching Code. Available online at: https://www.nature.scot/sites/default/files/2017-06/Publication%202017%20-%20The%20Scottish%20Marine%20Wildlife%20Watching%20Code%20SMWWC%20-%20Part%201%20-%20April%202017%20%28A2263518%29.pdf [Accessed 01/08/2023]

NatureScot (2020a). Priority Marine Features in Scotland's seas. Available online at: https://www.nature.scot/professional-advice/protected-areas-and-species/priority-marine-features-scotlandsseas [Accessed 01/08/2023]

NatureScot (2020b). Conservation and Management Advice: Sea of the Hebrides MPA. December 2020.

NatureScot (2020c). Conservation and Management Advice: Southern Trench MPA. December 2020.

NatureScot (2022). Developing with Nature Guidance; Guidance on Securing Positive Effects for Biodiversity from Local Development to Support NPF4 Policy 3(c). Available online at: https://www.nature.scot/doc/developing-nature-guidance [Accessed 14/02/2024].

Nedwell, J., Mason, T., Barham, R. and Cheesman, S. (2012). Assessing the environmental impact of underwater noise during offshore windfarm construction and operation. In Proceedings of Acoustics (pp. 1-5).

Nedwell, J.; Langworthy, J.; Howell, D. (2003). Assessment of Sub-Sea Acoustic Noise and Vibration from Offshore Wind Turbines and its Impact on Marine Wildlife; Initial Measurements of Underwater Noise during Construction of Offshore Windfarms, and Comparison with Background Noise (Report No. 544 R 0424). Report by Subacoustech Ltd. Report for The Crown Estate.

Nedwell, J.R. and Edwards, B. (2004). A review of measurement of underwater man-made noise carried out by Subacoustech Ltd, 1993-2003. Subacoustech Rep. 534R0109

NMFS (2005). Scoping Report for NMFS EIS for the National Acoustic Guidelines on Marine Mammals. National Marine Fisheries Service.

NMFS (2018). 2018 Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0). Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. NOAA Technical Memorandum NMFS-OPR-59. April 2018.

NMPi (2023). National Marine Plan Interactive. Available online at: https://marinescotland.atkinsgeospatial.com/nmpi/ [Accessed 01/08/2023]

Pike, N. (2011). Using false discovery rates for multiple comparisons in ecology and evolution. Methods in Ecology and Evolution, 2(3): 278-282.

Priede, I.G. and Miller, P.I. (2009). A basking shark (*Cetorhinus maximus*) tracked by satellite together with simultaneous remote sensing II: New analysis reveals orientation to a thermal front. Fisheries Research, 95(2- 3): 370-372.

Quick, N J, Arso Civil, M, Cheney, B, Islas Villanueva, V, Janik, V, Thompson, P & Hammond, P S 2014. The east coast of Scotland bottlenose dolphin population: improving understanding of ecology outside the Moray Firth SAC. OESEA2 Supporting documents, no. 14D/086, Department of Energy and Climate Change.

Ransijn, J.M., Booth, C. & Smout, S.C. (2019). A calorific map of harbour porpoise prey in the North Sea. JNCC Report No. 633. JNCC, Peterborough, ISSN 0963 8091.

Reid, J.B., Evans, P.G.H. & Northridge, S.P. (2003). Atlas of Cetacean distribution in north-west European waters, JNCC, Peterborough, ISBN 1 86107 550 2.

Report No. 680, JNCC Peterborough, ISSN 0963-8091. Available online at: https://hub.jncc.gov.uk/assets/3a401204-aa46-43c8-85b8-5ae42cdd7ff3 [Accessed 01/08/2023]

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. & Kyne, P.M. (2021). *Cetorhinus maximus* (amended version of 2019 assessment). The IUCN Red List of Threatened Species 2021: e.T4292A194720078. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2021-1.RLTS.T4292A194720078.en [Accessed 01/08/2023]

Risch, D., Castellote, M., Clark, C.W. et al. (2014). Seasonal migrations of North Atlantic minke whales: novel insights from large-scale passive acoustic monitoring networks. Movement Ecology, 2(24). Available online at: https://doi.org/10.1186/s40462-014-0024-3 [Accessed 01/08/2023]

Risch, D., Wilson, S.C., Hoogerwerf, M. et al. Seasonal and diel acoustic presence of North Atlantic minke whales in the North Sea. Sci Rep 9, 3571 (2019). Available online at: https://doi.org/10.1038/s41598-019-39752-8 [Accessed 01/08/2023]

Russell, D. J. F., & Carter, M. I. D. (2021). Estimating the proportion of grey seals hauled out during August surveys. SCOS Briefing Paper 21/03, Sea Mammal Research Unit, University of St Andrews.

Russell, D. J., McConnell, B. J., Thompson, D., Duck, C. D., Morris, C., Harwood, J., & Matthiopoulos, J. (2013). Uncovering the links between foraging and breeding regions in a highly mobile mammal. Journal of Applied Ecology, 50(2), 499-509. Advance online publication. https://doi.org/10.1111/1365-2664.12048

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

SCOS (2021). Scientific Advice on Matters Related to the Management of Seal Populations: 2021 Natural Environment Research Council Special Committee on Seals. Sea Mammal Research Unit, St. Andrews University. Available online at: http://www.smru.st-andrews.ac.uk/files/2022/08/SCOS-2021.pdf [Accessed 01/08/2023].

SCOS (2022). Scientific Advice on Matters Related to the Management of Seal Populations: 2022 Natural Environment Research Council Special Committee on Seals. Sea Mammal Research Unit, St. Andrews University. Available online at: http://www.smru.st-andrews.ac.uk/files/2023/09/SCOS-2022.pdf [Accessed 01/08/2023]

Shark Trust (2020). Basking Shark Project. Available online at: https://www.sharktrust.org/basking-shark-project [Accessed 01/08/2023]

Simard P., Wall K. R., Mann D. A., Wall C. C., Stallings C. D. 2016. Quantification of boat visitation rates at artificial and natural reefs in the eastern Gulf of Mexico using acoustic recorders. PLoS One, 11: e0160695.

Sims, D.W., Fox, A.M., and Merrett, D.A. (2005). Basking shark occurrence off south-west England in relation to zooplankton abundance. Journal of Fish Biology, 51(2): 436-440.

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. Series B: Biological Sciences, 267(1455): 1897-1904.

Skomal, G.B., Zeeman, S.I., Chisholm, J.H., Summers, E.L., Walsh, H.J., McMahon, K.W. and Thorrold, S.R., (2009). Transequatorial migrations by basking sharks in the western Atlantic Ocean. Current Biology, 19(12): 1019-1022.

SMRU (2018). SMRU seal telemetry data holdings: special committee on seals. Available online at: https://risweb.standrews.ac.uk/portal/en/researchoutput/smru-seal-telemetry-data-holdings(758f5208-c2d5-4cae-8508-892204cadc0c).html [Accessed 01/08/2023]

Southall B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J. and others (2007) Marine mammal noise exposure criteria: initial scientific recommendations. Aquatic Mammals, 33: 411–522.

Southall, B.L, Finneran, J.L., Reichmuth, C., Nachtigall, P.E., Ketten D.R., Bowles, A.E., Ellison, W.T., Nowacek, D.P., and Tyack, P. (2019). 'Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects'. Aquatic Mammals, 45:125-232.

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. Marine Biological Association of the United Kingdom. Journal of the Marine Biological Association of the United Kingdom, 85(5): 1083.

Thompson, P.M., Cheney, B., Ingram, S., Stevick, P., Wilson, B., and Hammond, P.S. (Eds) (2011). Distribution, abundance and population structure of bottlenose dolphins in Scottish waters. Scottish Government and Scottish Natural Heritage funded report. Scottish Natural Heritage Commissioned Report No. 354.

Thompson, P.M., Cheney, B., Ingram, S., Stevick, P., Wilson, B. & Hammond, P.S. (Eds) (2011). Distribution, abundance and population structure of bottlenose dolphins in Scottish waters. Scottish Government and Scottish Natural Heritage funded report. Scottish Natural Heritage Commissioned Report No.354.

Tyack, P. L., Zimmer, W. M. X., Moretti, D., Southall, B. L., Claridge, D. E., Durban, J. W., ... Boyd, I. L. (2011). Beaked whales respond to simulated and actual navy sonar. PLoS ONE, 6, e17009.

Tyler-Walters, H., James, B., Carruthers, M. (eds.), Wilding, C., Durkin, O., Lacey, C., Philpott, E., Adams, L., Chaniotis, P.D., Wilkes, P.T.V., Seeley, R., Neilly, M., Dargie, J. & Crawford-Avis, O.T. (2016). Descriptions of Scottish Priority Marine Features (PMFs). Scottish Natural Heritage Commissioned Report No. 406.

Waggitt, J.J., Evans, P.G., Andrade, J., Banks, A.N., Boisseau, O., Bolton, M., Bradbury, G., Brereton, T., Camphuysen, C.J., Durinck, J. and Felce, T. (2020). Distribution maps of cetacean and seabird populations in the North-East Atlantic. Journal of Applied Ecology, 57(2): 253-269.

Webb, A., Irwin, C. & Humphries, G. (2018). Distribution and abundance of basking sharks (*Cetorhinus maximus*) and minke whales (*Balaenoptera acutorostrata*) within the Sea of the Hebrides MPA proposal – a pilot digital aerial survey. Scottish Natural Heritage Research Report No. 974.

Wilson, B., Thompson, P. M., & 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(6), 1365–1374. Available online at: https://doi.org/10.2307/2405254 [Accessed 01/08/2023]

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 from sightings in UK waters. Marine Ecology Progress Series, 459: 121-134. Available online at: https://doi.org/10.3354/meps09737 [Accessed 01/08/2023]