12. MARINE MAMMALS AND OTHER MEGAFAUNA

12.1 Introduction

This chapter of the Environmental Impact Assessment (EIA) Report (EIAR) assesses the abundance and distribution of marine megafauna receptors (mammals, turtles, and basking sharks) of relevance to the Sceirde Rocks Offshore Wind Farm ('the Project') and the likely significant effects from the construction, operation and maintenance, and decommissioning of the Project on these receptors. Where required, mitigation is proposed, and the residual effects and their significance are assessed. Potential cumulative and transboundary impacts are also considered.

Table 12-1 below provides a list of all the supporting studies which relate to and should be read in conjunction with the marine mammals and megafauna impact assessment. These supporting studies have been used to inform the baseline characterisation and impact assessment within this chapter.

Table 12-1 Supporting studies

Details of study	Document Title and Location of Supporting Study
Sceirde Rocks Offshore Wind Farm Benthic Characterisation Survey 2023: Technical Report (Ocean Ecology Limited, 2023)	Appendix 9-1
Sceirde Rocks Offshore Wind Farm: Underwater Noise Modelling and Assessment (Subacoustech, 2024)	Appendix 12-1
Sceirde Rocks Offshore Windfarm digital video aerial survey methodology and marine mammal and other megafauna results: Report (HiDef, 2024)	Appendix 11-7

The impact assessment presented herein draws upon information presented within other impact assessments within this EIAR, including:

- Chapter 9: Benthic Subtidal and Intertidal Ecology – which assesses the potential effects on benthic habitats and species, which may indirectly affect marine mammal and megafauna prey species;
- Chapter 10: Fish and Shellfish Ecology – which assesses the potential effects on key marine mammal and megafauna prey species;
- Chapter 13: Commercial Fisheries – which assesses the potential effects on commercial fishing effort, which may indirectly affect marine mammal and megafauna prey species; and
- Chapter 14: Shipping and Navigation – which characterises the baseline vessel traffic conditions and assesses the effect of additional vessels associated with the Project, which has been used to inform the assessment of vessel collision for marine mammals and megafauna.

12.1.1 Statement of Authority

This Chapter of the EIAR has been prepared and reviewed by Xodus Group Limited (Xodus); the qualifications and relevant experience of the authors and reviewers are detailed in Table 12-2 below.

Table 12-2 Statement of authority

Name	Qualifications	Experience
Dr Ewan Edwards	PhD in Zoology BSc (Hons) in Marine and Environmental Biology	Dr Ewan Edwards, Environmental Specialist at Xodus Group Ltd, is a marine ecological specialist with 16 years professional experience, including extensive experience in marine mammal research including pinniped (seal) telemetry and acoustic studies of cetacean occurrence and distribution. He has published several papers on marine mammal ecology, and is Xodus's marine mammal's topic lead, where he has contributed to the marine mammal impact assessments for West of Orkney offshore wind farm, Cenos offshore wind farm, Culzean Demonstrator offshore wind project and Hornsea Three offshore wind farm marine wildlife licensing, together with numerous other non-offshore wind developments. He was formerly a senior marine mammal and underwater sound adviser within the Scottish Government with extensive experience in the policy, regulation and research into the effects of offshore renewables developments on marine mammals.
Pia Ricca	BSc in Environmental Biology (Specialisation in Wildlife Biology) MSc in Applied Marine and Fisheries Ecology	Pia Ricca is an Environmental Consultant at Xodus Group Ltd. She has over seven years of professional experience in ecological research and conservation policy of migratory species including sharks, sea turtles, and marine mammals. Pia has worked on a range of offshore renewables projects in UK waters, including electrification scopes, offshore wind, and tidal turbines. She has provided technical support through contributions to a number of environmental statement chapters and to Net Positive Impact assessments, as well as providing post-consent support for OWF projects.
Monika Kosecka	MSc in Oceanography	Monika Kosecka, Lead Environmental Consultant at Xodus Group Ltd, is a marine mammal and underwater sound specialist with 14 years of professional experience, including marine mammal and fish acoustic studies, policy and commercial advisory roles. She is a co-author of several peer reviewed publications on marine mammals, underwater sound and its impacts on marine life and specialises in marine mammal ecology within Xodus Ltd. Her past experience includes co-authorship of the EIAR's for the first offshore wind farms in polish Baltic Sea (Baltyk Srodkowy II and Baktyk Srodkowy III). She also contributed to various offshore wind and tidal projects at various phases of development through authorship of EIAR chapters and post consent support.

Additionally, the following specialists have contributed to the assessment in the preparation of supporting studies listed in Table 12-1:

- HiDef Aerial Surveying Ltd (HiDef): Site-Specific Aerial Survey 2024;
- Ocean Ecology Limited: Benthic Characterisation Survey Report 2023;
- Subacoustech: Sceirde Rocks Offshore Windfarm: Underwater Noise Modelling and Assessment 2024.

12.2 Legislation, Policy and Guidelines

Over and above the legislation presented in Chapter 1: Introduction and Chapter 2: Background and Policy, the legislation, policy and guidance relevant to the assessment of potential effects from the Project on marine mammals and megafauna receptors are outlined below:

- Legislation:
  - European Union (EU) Habitats Directive (Council Directive 92/43/EC) as transposed into Irish law by the European Communities (Birds and Natural Habitats) Regulations 2011, as amended (S.I. No. 477 of 2011) and Part XAB of the Planning and Development Act 2000, as amended:
    - European Protected species (EPS) are species listed in Annex IV of the Habitats Directive (and afforded protection under the Habitats Regulations). All cetacean and turtle species found in Irish waters are protected;
    - Annex V of the Habitats Directive defines seals as species of community interest, meaning that any taking of these species in the wild is subject to management measures;
    - Article 12 requires measures for the strict protection of species listed in Annex IV (a), prohibiting all forms of deliberate capture or killing, deliberate disturbance particularly during breeding, rearing, hibernation and migration, and deliberate deterioration and destruction of breeding sites or resting places;
  - Wildlife Act 1976 to 2021 confers specific protection on seals, whales, dolphins, and porpoises, prohibiting hunting, injury, or wilful interference or destruction of the breeding place of a protected species;
  - Whale Fisheries Acts 1937;
  - UN Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention);
  - UN Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention);
  - Agreement on the Conservation of Small Cetaceans in the Baltic and North Seas (ASCOBANS) – amended in 2008 to the Agreement on the Conservation of Small Cetaceans of the Baltic, Northeast Atlantic, Irish and North Seas; and
  - UN Convention for the Protection of the Marine Environment of the Northeast Atlantic (OSPAR Convention).
- Policy:
  - The Offshore Renewable Energy Development Plan (OREDP) (Ireland) (DCCAE, 2014)
  - National Marine Planning Framework (DHLGH, 2021)
  - Marine Planning Policy Statement (Ireland) (DHLGH, 2019)
- Guidance:
  - Environmental Protection Agency - Assessment and Monitoring of Ocean Noise in Irish Waters. STRIVE Report Series No. 120 (Ireland) (Beck *et al.*, 2011);
  - Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (Ireland) (NPWS, 2014a);
  - Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects (International) (Southall *et al.*, 2019);
  - Chartered Institute of Ecology and Environmental Management (CIEEM) - Guidelines for EIA in Britain and Ireland. Marine and Coastal, Final Document (UK and Ireland) (CIEEM, 2018);

    - Centre for Environment, Fisheries and Aquaculture Science (CEFAS) – Guidance Note for Environmental Impact Assessment in Respect of Food and Environmental Protection Act (FEPA) and Coast Protection Act (CPA) Requirements (UK) (Cefas, 2004);
    - Cefas - Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy Projects (UK) (Judd, 2012);
    - OSPAR - Guidance on Environmental Considerations for Offshore Wind Farm Development (UK and Ireland) (Ospar, 2008);
    - Guidance on Marine Baseline Ecological Assessment and Monitoring Activities for Offshore Renewable Energy Projects (Part 1 and 2). (Ireland) (DCCAE, 2018a; DCCAE, 2018b);
    - Guidance on Environmental Impact Statement (EIS) and Natura Impact Statement (NIS) Preparation for Offshore Renewable Energy Projects (Ireland) (DCCAE, 2017); and
    - Decommissioning of Offshore Renewable Energy Installations: Guidance Notes for Industry (UK) (BEIS, 2019).
- Other Documents:
    - Policy on Offshore Windfarm Development (Ireland) (Irish Whale and Dolphin Group) (IWDG, 2020).

12.3 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 distributed to key stakeholders in September 2023. The scoping responses received relevant to marine mammals and megafauna are provided in Table 12-2 below, which provides a high-level response on how these comments have been addressed within the EIAR.

Further consultation has been undertaken throughout the pre-application stage. The list below summarises the consultation activities carried out relevant to marine mammals and megafauna:

- Meeting with Irish Whale and Dolphin Group (IWDG) on 11 November 2023 discussion on available sightings data was held. Xodus have incorporated publicly available sightings data from the IWDG Sightings website[1] from the year 2023 (see Section 12.5.2); and
- Meetings with An Bord Pleanála (ABP) on 19 September 2023, 18 December 2023 and 26 July 2024 – some discussion took place regarding the use of other monitoring methods and data sets in addition to digital aerial surveys (DAS). The datasets, information sources for this chapter, and justifications for their use, are outlined in Sections 12.4.1 and 12.4.2.

Table 12-3 Scoping responses relevant to marine mammals and megafauna

Consultee	Comment	Where the comment has been addressed in the EIAR
Irish Wildlife Trust	No response.	N/A

[1] *https://iwdg.ie/browsers/sightings.php*

National Parks and Wildlife Service	No response of relevance to marine mammals and megafauna.	N/A
Irish Whale & Dolphin Group	Policy and Guidance: Reference is made to the document Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (DAHG, 2014). This guidance is currently under review and the updated guidance is likely to take a significantly different form.	Noted. In the absence of the updated guidance at the time of writing, the 2014 guidance has been used.
	Impacts of operational noise should be taken into account in the EIAR when the specifications of the proposed turbines are finalized, and operational noise scoped in for assessment if necessary.	Impacts from operational sound have been considered in Section 12.6.3.2.
	The IWDG recommended that the Project collects some background underwater noise data prior to commencement of construction.	The Project intends to undertake baseline underwater sound measurements pre- and post-construction. The assessment of the effects of operational sound has been considered in Section 12.6.3.2.

12.4 Assessment Methodology

12.4.1 Data and Information Sources

The existing datasets and literature with relevant coverage of the Project, which have been used to inform the baseline characterisation for the EIA, are outlined in Table 12-4. The limitations and uncertainties associated with the datasets are discussed in Section 12.4.2 below.

Table 12-4 Publicly available data and information sources to inform the marine mammals and megafauna baseline

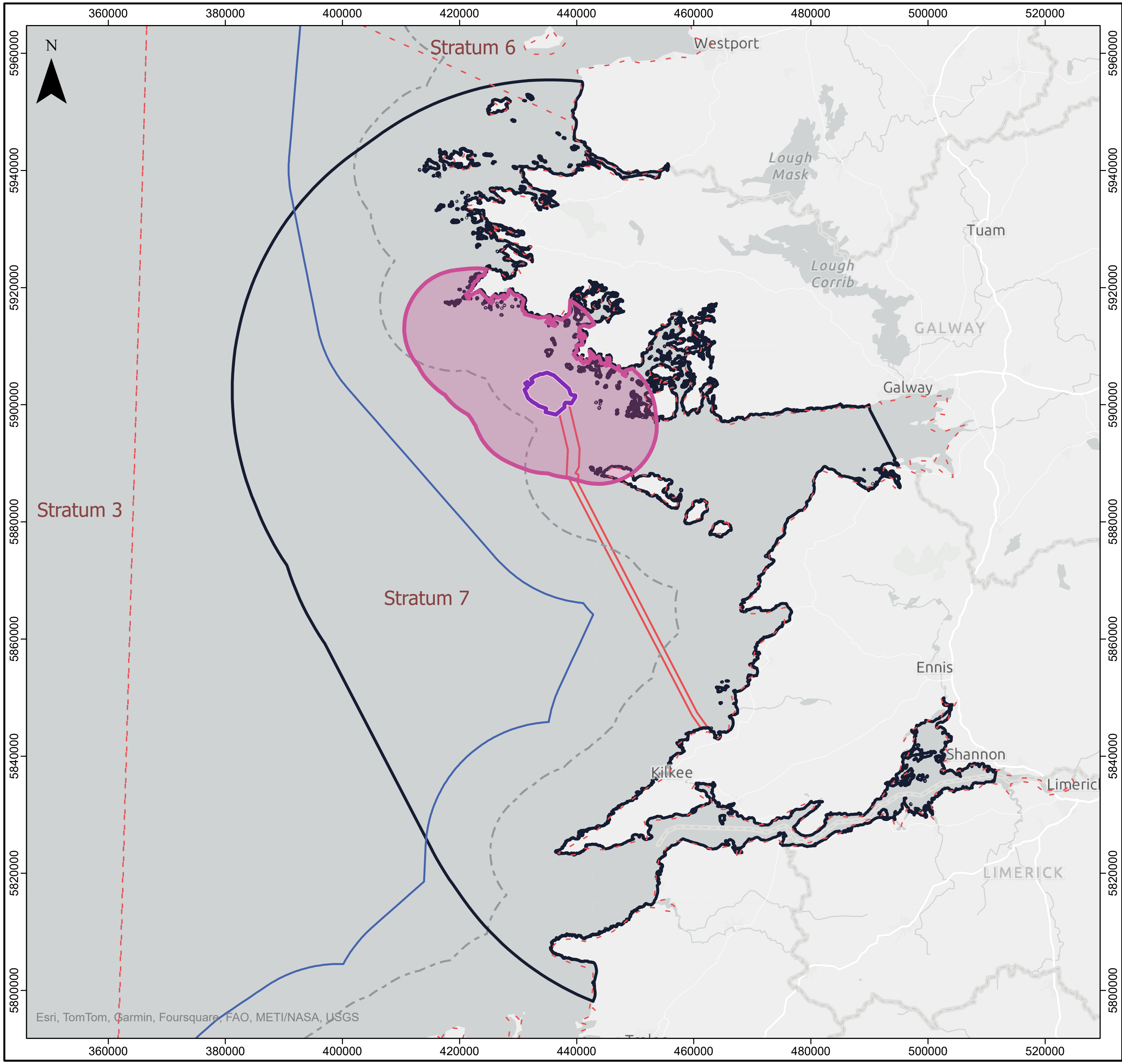
Title	Description/Source	Author	Publication Year
Aerial surveys of cetaceans and seabirds in Irish waters: Occurrence, distribution and abundance in 2015-2017	Distribution and occurrence of cetaceans in Irish waters from the ObSERVE programme.	Rogan et al.	2018a

National Otter Survey of Ireland 2010/12	Distribution and diet of European otter in Ireland	Reid et al.	2013
National Parks and Wildlife Service: Maps and Data	Designated sites and NPWS Designations Viewer	National Parks and Wildlife Service (NPWS)	2024
Publicly available marine mammal sightings and strandings data		IWDG	2024
Cetacean Offshore Distribution and Abundance (CODA) in the European Atlantic		CODA	2009
Atlas of the distribution and relative abundance of marine mammals in Irish offshore waters 2005 – 2011		Wall et al.	2013
A Framework for Studying the Effects of Offshore Wind Development on Marine Mammals and Turtles		Kraus et al.	2019
Harbour Porpoise Response to Pile-Driving Diminish Over Time		Graham et al.	2019
Avoidance of Wind Farms by Harbour Seals is Limited to Pile Driving Activities		Russell et al.	2016
Aerial thermal-imaging survey of seals in Ireland 2017 to 2018. Irish Wildlife Manuals, No. 111, National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Ireland		Morris and Duck	2019
Sympatric Seals, Satellite Tracking and Protected Areas: Habitat-Based Distribution Estimates for Conservation and Management		Carter et al.	2022
Distribution maps of cetacean and seabird populations in the North-East Atlantic		Waggitt et al.	2019
Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles. Sea Mammal Research Unit, University of St Andrews, Report to BEIS, OESEA-16-76/OESEA-17-78		Carter et al.	2020
Special Committee on Seals (SCOS), Scientific Advice on Matters Related to the Management of Seal Populations. 2020 to 2022		Special Committee on Seals (SCOS)	2021, 2022, 2023
Bycatch of marine turtles in UK and Irish waters, Joint Nature Conservation Committee (JNCC) Report No. 310		Pierpoint	2000

Biodiversity Maps	National Biodiversity Data Centre	2023
Marine Mammal Monitoring Services at the Galway Bay Marine and Renewable Energy Test Site to the Marine Institute, Rinville, Oranmore, Co. Galway	O'Brien et al.	2019

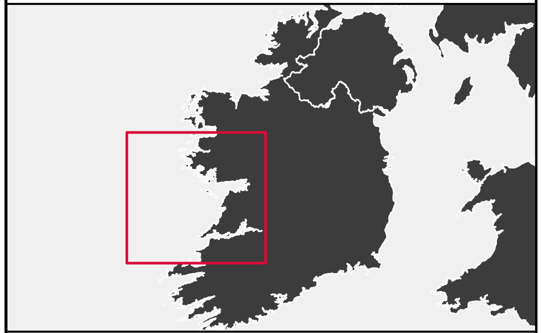
12.4.2 Site-specific Surveys

Site-specific DAS were undertaken to inform the at-sea distribution and abundance of marine mammals and seabirds associated with the Offshore Array Area (OAA). Two years of monthly DAS were undertaken from October 2021 to September 2023 by HiDef Aerial Surveying Limited on behalf of Fuinneamh Sceirde Teoranta (HiDef, 2024). These surveys were designed using expert recommendations and were undertaken in accordance with industry best practice in Ireland (DCCAE, 2018a) and elsewhere around the NE Atlantic (NatureScot, 2023). A series of 32 strip transects were flown monthly, orientated approximately north-west to south-east (i.e. perpendicular to the coastline) to reduce variation in bird and mammal abundance along the depth gradients. The survey design consisted of 1 kilometre (km) spaced transects across the OAA and a surrounding 4 km buffer, and 2 km spaced transects across the 10 km buffer around the OAA, covering a total survey coverage area of 947 km^2 (Figure 12-1). Surveys were flown at a flight height of 500 – 550 m above sea level to avoid disturbance of marine mammals based on Hammond et al. (2013).



SCEIRDE ROCKS WINDFARM

Feirm Ghaoithe Charraigeacha Sceirde



LEGEND

- Offshore Array Area
- Offshore Export Cable Corridor
- Study Area
- Ireland 6 NM limit
- Ireland 12 NM Limit
- ObSERVE Strata Boundaries
- Site-specific aerial survey area

0 6 12 nm

0 10 20 km

Data Source: Contains public sector information, licensed under the Creative Commons licence v4.0; the Open Government Licence v3.0.

PROJECT TITLE

Sceirde Rocks

MAP TITLE

Survey Areas

VER	REMARKS	DATE	Drawn	Approved
1	DRAFT	06/12/2024	BQ	EE

DRAWING NO

Figure 12-1

SCALE	PAPER SIZE	DATUM	PROJECTION
1:950,000	A4	WGS 84	UTM 29N

This map is produced by Fuinneamh Sceirde Teoranta (FST).
No reproduction may be made in whole or in part without permission.

Ocean Ecology Limited was contracted by Fuinneamh Sceirde Teoranta (FST) to undertake a baseline benthic characterisation survey in October 2023 (Ocean Ecology Limited, 2023). The outcome of these surveys is summarised in Chapter 9: Benthic Ecology and detailed in full in Benthic Survey Report Appendix 9-1. As part of these surveys, mammal environmental deoxyribonucleic acid (eDNA) metabarcoding was undertaken on water samples collected within the OAA and Offshore Export Cable Corridor (OECC).

Three water samples were collected, one near the seabed, one at mid-water depth, and one near the surface, at 10 stations, giving a total of 30 samples. The samples were analysed for the presence of marine vertebrates, excluding sharks and rays. Of the 30 samples, 18 of them identified marine mammal species. The use of eDNA for surveying and monitoring species is rapid and cost effective, although it is dependent on factors including water condition, water movement, and the specific deoxyribonucleic acid (DNA) present at the time of sampling. Therefore, this information is only used to indicate species presence throughout the Offshore Site.

12.4.3 Consideration of data sources and quality

To provide a robust and detailed baseline characterisation, a DAS campaign and published data sources from an extensive literature review was undertaken to define marine mammal, turtle, and basking shark presence within the Offshore Site and its surrounding marine environment. This includes data from 24 monthly DAS across a two-year period (i.e., capturing two full years of data), together with existing regional data sets (e.g. ObSERVE) and IWDG observations presented in this chapter, as well as records of seal presence from NPWS data. Acoustic monitoring

Neither towed nor static passive acoustic monitoring data were used to characterise the baseline. Acoustic monitoring can be useful in detecting species that vocalise or echolocate, such as toothed whales (e.g. dolphins and harbour porpoise), some species of baleen whales (e.g. humpback whale) and even some pinnipeds (e.g. grey seal). However, the principal limitation of acoustic monitoring methods is the lack of an established methodology to estimate the density of animals detected, and thus the inability to determine the number of animals that are being detected. As such, acoustic methods themselves have limited utility in determining at-sea densities of animals.

Some methods of passive acoustic detection (e.g. Chelonia C-PODs and F-PODs) can be used to distinguish between the narrow-band, high-frequency cetacean clicks produced by harbour porpoise, and the broadband, mid-frequency echolocation clicks produced by dolphin species. Moreover, to date there are no well-developed, automated detection methods available to distinguish between marine mammal species and results are obtained by manual data analysis. This makes the analysis time consuming, and most importantly obtained results cannot be comparable between different studies, due to potential differences in manual analysis skills.

In summary, although passive acoustic monitoring (PAM) could present information on species present within area, passive acoustic detections alone cannot be used to determine absolute density of animals. This means that passive acoustic monitoring would provide limited additional information to inform the impact assessment.

While visual survey methods have their own limitations, one factor that can be obtained from DAS as used in this Project, is marine mammal group size, i.e. whether a single animal, or a group of animals, is present. DAS data, corrected to produce absolute densities where possible, provides a useful representative characterisation of the marine mammals and other megafauna baseline at the Offshore Site. This has been supplemented with other existing data sets, e.g. seal density maps produced by Carter *et al.* (2022), regional densities obtained by large-scale monitoring (e.g. Rogan *et al.*, 2018a), and publicly available data from IWDG, to adequately characterise the baseline. Where two or more data sets have presented density estimates for marine mammal and other megafauna species, the highest density value has been used in implementing a precautionary approach.

12.4.3.1 Basking sharks

Low frequency sounds have the potential to be audible to basking sharks. However, limited studies have been carried out on the hearing physiology and audition of this species, and conclusions are generally inferred using knowledge from other elasmobranch species or species with similar physiology (Corwin, 1981; Casper & Mann, 2010; Popper *et al.*, 2014). Given this uncertainty, a precautionary approach based on the best available evidence has been adopted with respect to basking sharks, in Sections 12.6.2 and 12.6.3.

12.4.3.2 Data summary

The data assimilated are sufficient to provide clear information on the density and abundance of relevant species and enables a thorough assessment of likely significant effects on all relevant species. As discussed further in Section 12.6, significant effects to marine mammals and other megafauna are not likely to arise due to activities associated with the Offshore Site.

12.4.4 Impact Assessment Methodology

12.4.4.1 Impacts requiring assessment

All potential effects that have been considered within the marine mammals and megafauna impact assessment are detailed in Table 12-5 below.

Table 12-5 Potential effects scoped into the marine mammal and megafauna impact assessment

Potential effect	Description	Nature of effect
Construction/decommissioning[2]		
Injury and disturbance due to underwater sound emissions associated with construction (including pre-construction)	Underwater sound associated with construction activities can have an impact on marine mammal and megafauna receptors, including the risk of injury, and on habitat use and distribution, due to barrier effects and displacement. Evidence suggests that potential impacts include short term or temporary displacement of mammals and megafauna. The effects of underwater sound on protected species require further consideration.	Direct
Underwater construction sound effects on the prey species of marine megafauna	Underwater sound generated during construction may cause disturbance to fish populations, including disturbance to migratory fish and spawning fish species, which might result in the change of prey availability to megafauna species. This will be informed by assessments as presented in Chapter 10: Fish and Shellfish Ecology.	Indirect

[2] *The potential effects during the decommissioning of the Project are considered analogous with, or likely less than, those of the construction phase. Where this is not the case, decommissioning impacts have been listed separately and have been assessed in section 12.6.4.*

Disturbance due to the physical presence of vessels	Vessel traffic (passenger, cargo and other vessel activities) within the Study Area forms part of the existing baseline. Increased vessel traffic during construction and decommissioning may increase the risk of disturbance to marine mammals and megafauna.	Direct
Risk of injury resulting from collision of marine mammals and megafauna with installation/decommissioning vessels	Vessel traffic (passenger, cargo and other vessel activities) within the Study Area forms part of the existing baseline. Increased vessel traffic during construction and decommissioning may increase the risk of injury to marine megafauna.	Direct
Impacts associated with effects upon marine water quality, particularly due to any disturbed sediments affecting turbidity	Activities taking place during construction and decommissioning of the Project may influence water quality as a result of sediment disturbance. This can increase suspended sediment concentration (SSC), which can result in reduced foraging success of visual predators due to decreased visibility.	Direct/Indirect
Impacts associated with effects upon marine water quality due to any accidental release of pollutants	Accidental releases of pollutants may arise as a result of accidental spills from vessels or other equipment and have detrimental effects on marine mammals and megafauna.	Direct
Operation and maintenance		
Risk of injury due to collision of marine megafauna with WTG foundations	The presence of submerged foundations and other infrastructure may result in increased collision risk to marine megafauna	Direct
Disturbance due to WTG operational sound	Underwater sound generated from the moving mechanical parts within the WTG may cause increase in underwater ambient sound levels, resulting in short term or temporary displacement or other behavioural effects on marine megafauna.	Direct
Displacement or barrier effects caused by the physical presence of WTG and associated infrastructure	The introduction of new infrastructure into the marine environment can potentially result in displacement or exclusion of marine megafauna from the habitat.	Direct
Disturbance due to the physical presence of vessels	Vessel traffic (passenger, cargo and other vessel activities) within the Study Area forms part of the existing baseline. Increased vessel traffic during operation and maintenance may increase the risk of disturbance to marine megafauna.	Direct

Risk of injury resulting from collision of marine megafauna with operation and maintenance vessels	Vessel traffic (passenger, cargo and other vessel activities) within the Study Area forms part of the existing baseline. Increased vessel traffic during operations and maintenance may increase the risk of injury to marine megafauna.	Direct
Risk associated with electromagnetic fields (EMFs) emissions associated with subsea cabling	EMFs may impact sensitive species (such as elasmobranchs) by changing their foraging behaviour. The potential impacts of thermal load and EMFs on sensitive species is not well understood and the level of exposure will depend on the cable burial depth and cabling protection methods used.	Direct
Impacts associated with effects upon marine water quality due to any accidental release of pollutants	Accidental releases of pollutants may arise as a result of accidental spills from vessels or other equipment and have detrimental effects on marine mammals and megafauna. Accidental release of pollutants can occur from pollutants contained within the WTGs. The accidental release of pollutants is limited to oils and fluids contained within the WTGs. These fluids have the potential to interact with marine mammals and megafauna and may have a detrimental physiological effect.	Direct/Indirect
Habitat change, including the potential for change in foraging opportunities	Changes in prey abundance and distribution resulting from operation and maintenance activities may impact foraging success. This potential effect will be informed by assessments in Chapter 9: Benthic Ecology, Chapter 10: Fish and Shellfish Ecology, and Chapter 13: Commercial Fisheries.	Direct/Indirect

12.4.4.2 Assessment Methodology

12.4.4.2.1 *Characterisation of Impacts and Effects*

An assessment of likely significant effects is provided for the construction (including pre-construction), operation and maintenance, and decommissioning phases of the Project. The assessment for marine megafauna is undertaken following the principles set out in Chapter 4: Environmental Impact Assessment Methodology, in line with the Environmental Protection Agency (EPA) EIAR Guidelines (EPA, 2022) and also European Commission (2017) Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU). Potential likely significant effects are characterised based on the following:

- Quality of effects: Whether an effect results in a change that improves (positive) or reduces (negative) the quality of the environment;
- Extent: Describes the size of the area, the number of sites and the proportion of a population affected by an effect;
- Context: Describes whether the extent, duration or frequency will conform or contrast with established (baseline) conditions;

- Probability: Describes if effects are likely or unlikely;
- Duration: Describes the length of time an impact is expected to occur based on the set definitions within the guidelines;
- Frequency: Describes how often the effect will occur (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, annually, etc.); and
- Reversibility: Whether an effect can be undone, through remediation or restoration.

The criteria for the sensitivity of marine mammal and other megafauna receptors are presented inTable 12-6, and the magnitude of the effect in Table 12-7.

All marine mammal and other megafauna receptors are included in Annex IV of the EU Habitats Directive, are qualifying interest of European and UK protected sites, and/or protected under the Wildlife Act 1976 to 2021, meaning they are of intrinsically 'high' conservation value. All species of turtles potentially found in Irish waters are listed as 'Vulnerable' or lower on the International Union for the Conservation of Nature (IUCN) Red List, equating to a 'high' receptor value designation. The approach of the assessment is to determine the value of the Offshore Site to each species and the nature of the use of the habitat, rather than defining the overall conservation value of the species. As such, the assessment does not use the receptor value to differentiate impact outcomes, and rather has focused on the individual species' sensitivities to the impact pathways assessed. A Natura Impact Statement has been prepared which assesses the effects of the Project on marine mammal receptors identified as qualifying interests of Special Areas of Conservation (SACs) and considers in full the biodiversity conservation importance of each species. The conservation importance of species remains an important factor in the evaluation process of impact significance as defined in Section 12.4.3.2.2.

Table 12-6 Receptor sensitivity criteria

Sensitivity of Receptor	Definition
High	› Very limited capacity to accommodate or adapt behaviour to a particular effect causing a significant change in individual vital rates (survival and reproduction); and/or › Very limited ability to tolerate or recover from the effect, causing a significant change in individual vital rates.
Medium	› Low capacity to accommodate or adapt behaviour to a particular effect causing a significant change in individual vital rates (survival and reproduction); and/or › Limited ability to tolerate or recover from the effect, such that individual vital rates may be significantly affected.
Low	› Some tolerance to the effect with no significant change in individual vital rates; › Receptor is able to accommodate or adapt behaviour to a particular effect, which may affect individual vital rates (survival and reproduction), but not significantly; and/or › Ability to recover from any effects on individual vital rates.
Negligible	› Receptor is tolerant and can accommodate or adapt behaviour to a particular effect without impact to individual vital rates (survival and reproduction); and/or › Receptor is able to return to previous behavioural states once the effect has ceased.

Table 12-7 Receptor magnitude criteria

Magnitude criteria	Definition
High	• Effects are of medium (7-15 years) to permanent duration and/or occurring at a high frequency (frequently or constantly); • Effects occur over a large spatial extent (i.e. regional) that has the potential to impact a large proportion of the features/key elements of the baseline conditions; and/or • Effects cause a total change or major alteration to the integrity or conservation status of a receptor or key elements / features of the baseline conditions.
Medium	• Effects are of short term (1-7 years) duration and/or occurring occasionally; • Effects occur at a local level (i.e. Study Area) that has the potential to impact one or more key elements/features of the baseline conditions; and/or • Effects cause a partial change or alteration the integrity or conservation status of a receptor or key elements / features of the baseline conditions.
Low	• Effects are temporary (<1 year) or short-term (1-7 years) and/or occurring at a low frequency (rarely or occasionally); and/or • Effects occur over a small spatial extent (i.e. site specific) that causes a detectable but not material change to the baseline conditions, where the minor shift is unlikely to have a significant effect on the conservation status or integrity of the receptor.
Negligible	• Effects are momentary or brief (less than a day) and/or imperceptible; and/or • Very slight change from baseline condition that will not affect the conservation status or integrity of the receptor.

12.4.4.2.2 Determining Significance of Effects

The EPA guidelines definitions for describing significance of effect have been used for the marine mammal and megafauna impact assessment (Table 12-8).

Table 12-8 Significance of effect

Magnitude criteria	Definition	Significance
Imperceptible	An effect capable of measurement but without significant consequences.	Not Significant.
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.	
Slight Effects	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.	
Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.	

Significant Effects	An effect which, by its character, magnitude, duration or intensity, alters a sensitive aspect of the environment.	Significant; not tolerable. Mitigation measures must be in place to prevent, reduce, or avoid the impact, and if not possible then compensatory measures are proposed.
Very Significant	An effect which, by its character, magnitude, duration or intensity, significantly alters most of a sensitive aspect of the environment.	
Profound Effects	An effect which obliterates sensitive characteristics.	

12.4.4.3 Design Parameters

Table 12-9 summarises the design parameters that are used for the assessment of potential effects on marine mammal and megafauna receptors during construction (including pre-construction), operation and maintenance and decommissioning. The full Offshore Site design is detailed in Chapter 5: Project Description.

Note that the durations of Project activities presented in this EIAR are estimates only and will depend on many factors including weather and availability of vessels.

Table 12-9 Project design parameters relevant to marine mammals and other megafauna receptors

Potential effect	Design Scenario	Requirement
Construction/decommissioning		
Acoustic impacts to marine mammals and megafauna associated with construction sound, including the risk of physiological impacts, barrier effects and displacement	A total of four years of construction (including pre-construction activities), including the following activities: › Pre-construction activities over four months › Geophysical, geotechnical, and Unexploded Ordnance (UXO) surveys expected to take four months; › Seabed preparation including boulder clearance, ground preparation (e.g. stonebed placement, dredging and controlled flow excavation), and pre-lay grapnel runs. › Construction activities over 18 months › Installation of 31 no. Gravity Base (GBS) foundations expected to take approximately 14 months; › Construction of 30 no. WTGs, expected to take three months; › Construction of 1 no. OSP expected to take 11 months; › Cable installation via surface lay (protection via cast-iron shell or rock/concrete mattress placement) or buried (jet-trenched) of the following: › A network of up to 73 km of inter-array cables within the OAA, expected to take 16 months;	Duration and nature of the sound generated during pre-construction and construction activities

	• A single Offshore Export Cable (OEC) of maximum total length of 63.5 km expected to take 15 months. A total of 23 construction support vessels, with a maximum of 11 present within the Offshore Site at any one time.	
Indirect impacts of construction sound on the prey species of marine mammals	As above.	
Disturbance due to the physical presence of vessels	23 construction vessels are expected to operate at the site: • 3 no. vessels for seabed preparation; • 2 no. vessels for OSP Topside installation; • 4 no. vessels for inter-array cable (IAC) installation; • 5 no. vessels for EC installation; • 4 no. vessels for GBS foundation installation; • 3 no. vessels for WTG installation; and • 2 no. vessels for construction and major maintenance operations. Temporary anchorage of GBS foundations: • 1 no. semi-submersible heavy transport vessel (HTV) to transport the GBS foundations from the manufacturing point to the temporary anchorage area.	Number of installation vessels present.
Risk of injury resulting from collision of marine mammals and megafauna with installation vessels		
Impacts associated with effects upon marine water quality, particularly due to any disturbed sediments affecting turbidity	Pre-construction activities over four months: • Total volume of seabed sediment required to be dredged: 150,000 m^3; • Boulder clearance, controlled flow excavation and pre-lay grapnel run – 20 m wide disturbance corridor (no clearance activities required in OECC); • Two disposal sites in OAA (up to 15 disposal events): • Area of Disposal Site 1 = 25,842 m^2 & volume of dredged material to be disposed of at Disposal Site 1: 37,500 m^3. • Area of Disposal Site 2 = 78,229 m^2 & volume of dredged material to be disposed of at Disposal Site 2: 112,500 m^3. WTG and GBS installation over 14 months: • 30 WTG GBS Foundation and one OSS GBS; and • Floating installation (no drilling etc).	The maximum spatial extent of seabed preparation and installation activities, including maximum dimensions of foundations, representing the greatest potential for suspended sediment. The maximum volumes of sediment to be cleared and rock protection to be used are also provided.

	Inter-array (16 months) and export cable (15 months) installation: - Total length of the IAC = 73.0 km; - Total length OEC = 63.5 km; - Burial trench using jet trencher, mechanical cutting trencher and/or CFE, to a target depth of lowering of 1 m; and - Total seabed temporary disturbed by cable installation: 996,950 m^2. Landfall – Horizontal Directional Drilling (HDD) install (3 months) - HDD duct = 0.9 km length / volume of exit pit = 2000 m^3; and - Area of disturbance due to side casting dredged materials = 1000m^3. Sum total temporary seabed disturbance = 1,132,151 m^2.	
Operation and maintenance		
Risk of injury resulting from collision of marine mammals or megafauna with WTG foundations	- Operation of 30 no. WTGs and 1 no. OSS; - 31 no. GBS foundations (30 no. for WTGs and 1 no. for OSS); - Minimum spacing of 1,017 m; and - Operational life of 38 years.	Duration and nature of operation.
Impacts of operational sound	- Operation of 30 no. WTGs and 1 no. OSS; - 31 no. GBS foundations (30 no. for WTGs and 1 no. for OSS); - Minimum spacing of 1,017 m between WTGs; and Operational life of 38 years.	Physical presence of structures (WTG and OSP) and underwater sound emissions from WTGs.
Displacement or barrier effects resulting from the physical presence of devices and infrastructure	- Operation of 30 no. WTGs and 1 no. OSS; - 31 no. GBS foundations (30 no. for WTGs and 1 no. for OSS); - Minimum spacing of 1,017 m between WTGs and 600 m between WTG and OSS; and Operational life of 38 years.	Physical presence of structures (WTG and OSS) and underwater sound emissions from WTGs.
Disturbance due to the physical presence of vessels Risk of injury resulting from collision of marine	Estimated number of maintenance vessels expected for routine inspections, repairs and replacement: - Two CTVs per day with up to four daily return vessel movements; - One SOV per day;	Number of maintenance vessels present.

mammals and megafauna with operations and maintenance vessels	- Two annual jack up intervention campaigns (may cover more than two locations); - One repair platform per year; - One drone campaign per year; - Five unscheduled cable repair vessels over the lifetime; - Cable survey vessels required annually for the first 5 years, and one every 5 years thereafter; and - Oil exchange vessels required once every 10 years. Operational life of 38 years.	
Risk associated with EMFs associated with subsea cabling	IACs: - Network of HVAC cables with a length of 73 km; - Minimum depth of lowering of 1.0 m; - 1,282,082 m^2 cable protection; and - Minimum cable protection height of 1.6 m. OEC: - One HVAC cable (220 kV) (single export circuit) with a length of 63.5 km; - Minimum depth of lowering of 1.0 m; and - 0.20 km^2 cable protection with a minimum cable protection height of 1.56 m. Operational life of 38 years.	Potential for EMF emissions.
Impacts associated with effects upon marine water quality due to any accidental release of pollutants	- Operation of 30 no. WTGs and one OSS and associated maintenance; - Cable maintenance and repairs may also be required during the lifetime of the Project. Interventions required could include increasing the cable depth of lowering in locations along the cable route where a mobile seabed may lead to cable exposure risk. If a need for cable maintenance or repair is identified, the location, scale and type of damage will determine the repair methodology and timing. The affected area may require cable cutting, replacement and/or jointing of the cable sections and installation of additional cable protection. Major repair works may also be required throughout the operational and maintenance phase; and - Operation and maintenance vessel activity: - Two CTVs per day with up to four daily return vessel movements; - One SOV per day; - Two annual jack up intervention campaigns (may cover more than two locations); - One repair platform per year; - One drone campaign per year;	Potential sources of pollutants.

	- Five unscheduled cable repair operations over the lifetime; - Cable survey vessels required annually for the first 5 years, and one every 5 years thereafter; and - Oil exchange vessels required once every 10 years.	
Habitat change, including the potential for change in foraging opportunities	Total 1,675,691 m^2 of long-term habitat loss associated with: - 30 WTGs and one OSS with a GBS foundations atop of stonebed material = 117,604 m^2 total; - Up to 110,187 m^2 of stonebed material required for jack-up vessels; - IACs: - Cable protection footprint of 1,282,082 m^2; - OEC: - Cable protection footprint of 165,818 m^2; and - Operational life 38 years.	Parameters by which loss of habitat would occur.

12.4.4.4 Mitigation by Design

Certain measures have been adopted as part of the Project design in order to reduce the potential for effects to the environment and specifically to marine mammal and megafauna receptors. These measures will follow best practice and are outlined in Table 12-10.

Table 12-10 Mitigation by design and management plans relevant to marine mammals and megafauna

Mitigation measures	Justification
Cable burial	Cable burial to increase distance between cable and electro-sensitive species to EMF. However, where burial is not possible; cable protection, rock placement or other similar established techniques, increases the distance between marine species sensitive to EMF and the EMF source. The use of cable protection will be minimised as far as practicable, and only used where required. Additional external cable protection (e.g. rock placement) will only be used where the minimum target burial depth cannot be achieved, for example in areas of hard ground or at third-party crossings.
Marine Mammal Mitigation Protocol (MMMP)	Implementation and adherence to a Marine Mammal Mitigation Protocol (MMMP; Appendix 5-6) during construction in accordance with Department of Arts, Heritage and the Gaeltacht (DAHG) 2014 guidance. This MMMP describes measures which will reduce impacts to marine mammals during activities that generate high-amplitude underwater sound, including UXO clearance and geophysical surveys. These measures include the use of visual observers to ensure no marine mammals are nearby at the commencement of activities, and the use of Acoustic

	Deterrent Devices to deter animals from the zone of greatest risk. The intention is to reduce the risk of injury to zero, and to limit disturbance to only incidental levels.
Vessel Management Plan (VMP)	Implementation and adherence to the Vessel Management Plan (Appendix 5-10) during all phases of the Project. This VMP describes measures which will reduce environmental impacts (including impacts to marine mammals) during Project activities involving vessels. Additionally, vessels engaged in construction works will typically be travelling at slow (<6 kts) speeds. This will reduce sound emissions relative to high-speed transiting. All vessels associated with the Project will comply with the provisions of the International Regulations for the Prevention of Collision at Sea (COLREGs) and the International Regulations for the Safety of Life at Sea (SOLAS).
Reducing habitat loss	The Project has completed a pre-construction benthic survey and habitat mapping to inform habitat distribution and identify potential spawning or nursery habitats. Particularly sensitive habitats have been avoided during cable route and WTG location selection.
UXO clearance	A preliminary assessment has been undertaken to be able to avoid UXO during Project planning. The preliminary assessment has not identified any UXO throughout the Offshore Site. Should a UXO be identified during further pre-construction surveys, the primary mechanism to mitigate impacts is to avoid the necessity to clear the UXO (e.g. avoidance within the cable corridor). Should avoidance not be possible. the preferred method of clearance would be low-order deflagration, which results in reduced sound levels compared to high order clearance. The assessment presented in sections 12.6.2.1.3 and 12.6.2.1.4 reflects the very low risk of encountering, and needing to clear a UXO *in situ*.

12.4.5 Annex IV Species – requirement for Regulation 54 derogation

As described in the species accounts within section 14.5.2, all cetaceans (dolphins, whales and porpoises), marine turtle species and Eurasian otter are listed on Annex IV(a) to the EU Habitats Directive which requires their strict protection in their natural range. Having considered the impacts arising from the Offshore Site, and the likelihood of significant effects, it is concluded that there is no requirement to apply for a derogation licence under Regulation 54 of the European Communities (Birds and Natural Habitats) Regulations 2011 (the "Habitats Regulations") because the Project will comply with the requirements of Regulation 51 of the Habitats Regulations. This is on the basis that the Marine Mammal Mitigation Protocol (Appendix 5-6) will be implemented and adhered to, and on the basis of the very low likelihood that any UXO will need to be cleared in situ, as assessed in sections 12.6.2.1.3 and 12.6.2.1.4. Guidance issued by the Maritime Area Regulatory Authority will be followed should any UXO be discovered.

12.5 Baseline Conditions

This section summarises current knowledge on abundance and distribution of marine mammal and other megafauna species within the Study Area, as detailed in Section 12.5.1 below. The characterisation of the current environment is established from a combination of a site-specific survey results, desk-based studies and consultation with key stakeholders.

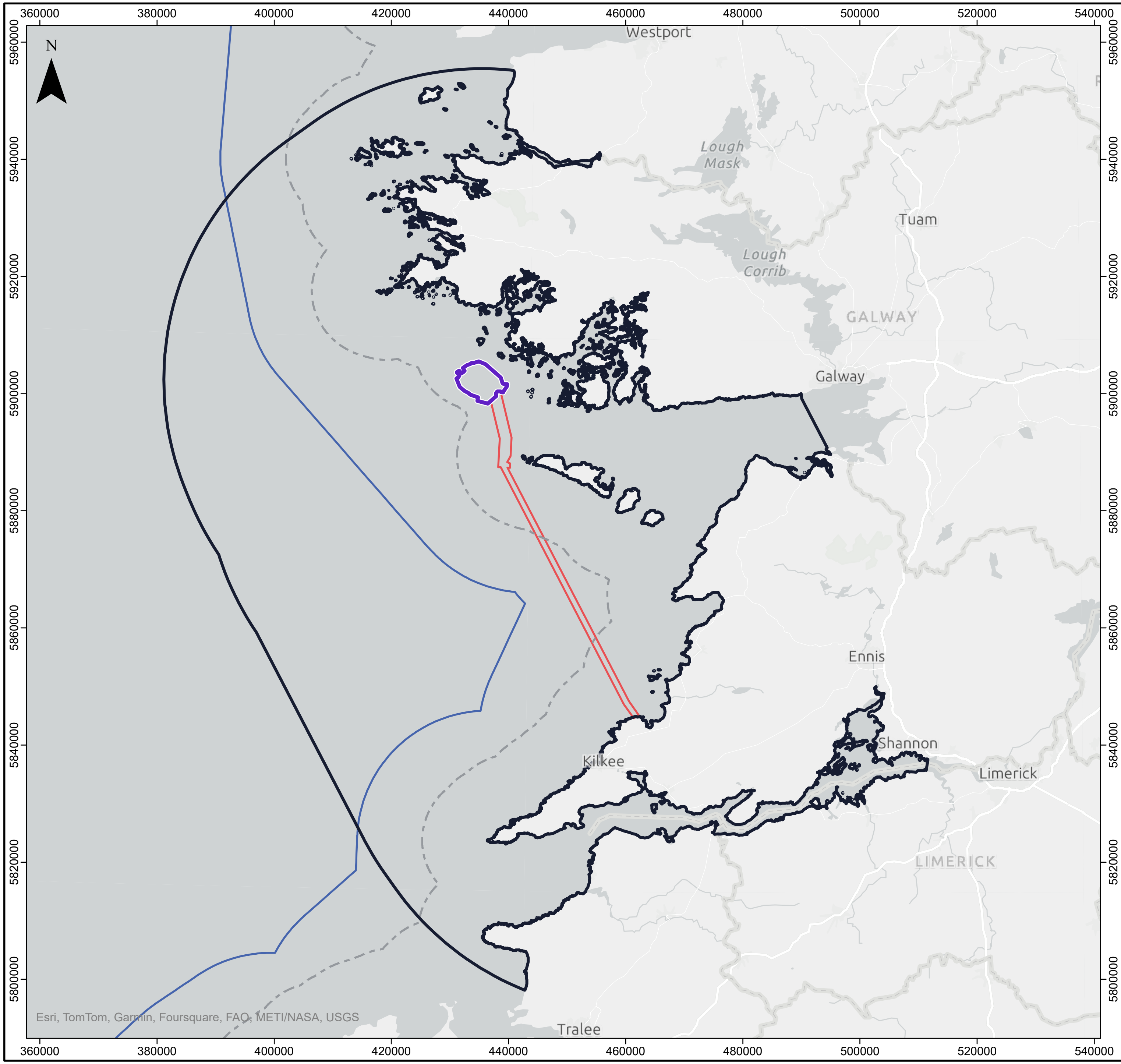
The objective of this section is to present the best available understanding of the current baseline for marine mammals and other megafauna species including identification and description of key marine mammals and megafauna species, information on their ecology and conservation, and their wider distribution in the Study Area. Sections below include information on marine mammals, including cetaceans and pinnipeds together with semi aquatic species of Eurasian otter, turtle species and one fish species - basking shark, which might be present within the Study Area.

12.5.1 Study Area

The marine mammals and megafauna Study Area is defined as the Sceirde Rocks OAA and OECC plus a 50 km buffer zone (Figure 12-2). The baseline characterisation is based on both Study Area and the wider North Atlantic Ocean and Irish Sea to account for the wide degree of spatial and temporal variation in abundance and distribution, and high mobility, of key marine mammals and other megafauna receptors.

This Study Area also captures the Shannon estuary, including the maritime transport routes to and from Shannon-Foynes Port, which may act as the temporary anchorage location for the gravity-based structure (GBS) foundations during construction.

Where relevant, cetacean impact assessments are concluded at the scale of the relevant species Management Unit (MU) (IAMMWG, 2022). For seals, which do not have designated management units in Ireland, the area of relevance to the Project is the marine mammal Study Area, although as a precautionary approach Special Areas of Consevation (SAC) designated for harbour seals have been considered if they lie on the west coast of Ireland between Cape Clear Island (Co. Cork) and Malin Head (Co. Donegal).



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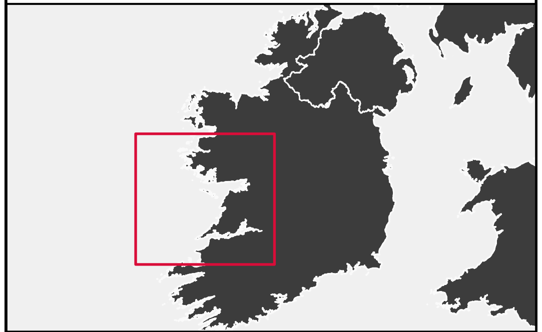

LEGEND

- Offshore Array Area
- Offshore Export Cable Corridor
- Study Area
- Ireland 6 NM limit
- Ireland 12 NM Limit

0 6 12 nm
0 10 20 km

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PROJECT TITLE
Sceirde Rocks

MAP TITLE
Marine Mammals Study Area

VER	REMARKS	DATE	Drawn	Approved
1	DRAFT	06/12/2024	BQ	EE

DRAWING NO
Figure 12-2

SCALE	PAPER SIZE	DATUM	PROJECTION
1:950,000	A4	WGS 84	UTM 29N

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12.5.2 Baseline Environment

12.5.2.1 Cetaceans

Twenty-six cetacean species have been identified within Irish waters (NBDC, 2022). Through a desk-based baseline study conducted by Rogan *et al.* (2018a), eight of these species were identified within the waters of the Irish Shelf and could potentially occur in or near the Study Area, and thus are taken into consideration in further assessment: common dolphin *Delphinus delphis*, bottlenose dolphin *Tursiops truncatus*, harbour porpoise *Phocoena phocoena*, minke whale *Balaeonoptera acutorostrata*, Risso's dolphin *Grampus griseus,* striped dolphin *Stenella coeruleoalba*, long-finned pilot whale *Globicephala melas,* and fin whale *Balaenoptera physalus*. The Project DAS campaign did not detect any other cetacean species during 24 monthly surveys, and nor did the eDNA survey.

The most widespread and frequently encountered species in the region are common dolphin, harbour porpoise, and bottlenose dolphin, occurring regularly throughout the year. These species are considered to be the key species within the marine mammals and megafauna Study Area. A resident bottlenose dolphin population can be found in the River Shannon estuary and around the western coast of Ireland, while the deeper offshore waters support a population of the offshore ecotype bottlenose dolphins. Minke whales are recorded as seasonal visitors, with highest relative abundances during the autumn months (IWDG, 2015c).

Risso's dolphins are recorded on an infrequent basis around the entire Irish coast, largely over the Irish shelf and off the southwest and southeast coasts (Wall *et al.,* 2013). Their presence is reported throughout the year, with peak sightings in the summer months. Risso's dolphins are managed under the Celtic and Greater North Seas (CGNS) Management Unit (MU), with an estimated abundance of 12,262 individuals (IAMMWG, 2022). Abundance estimates from the 2016 ObSERVE surveys across the entire survey area (339,377 km^2 across Ireland's waters) was 2,629 individuals, with an average density of 0.0033 individuals/km^2 (Rogan *et al.*, 2018a), although there were no observations within the Offshore Site. Additionally, marine mammal monitoring within Galway Bay between September 2018 and August 2019 did not observe any Risso's dolphins (O'Brien *et al.,* 2019), which is consistent with the past ten years of observational data from IWDG (2024). Therefore, it is not expected that Risso's dolphins will be present within the Offshore Site, and this is supported by the absence of detection of Risso's dolphin in the eDNA and DAS surveys (see Appendix 9-1 and Appendix 11-7 Ocean Ecology Limited, 2023; HiDef, 2024). Therefore, this species is not considered further within this chapter; nevertheless, any measures designed to mitigate the risk to other cetaceans apply equally to Risso's dolphin.

Striped dolphins have a global distribution in tropical and warm temperate waters, preferring deep waters beyond the shelf edge (Wall *et al.*, 2013). Sightings of striped dolphins are rare in inshore Irish waters. Only two confirmed striped dolphin sightings were recorded during the ObSERVE survey, both within the deep waters of the continental shelf (Rogan *et al.,* 2018a). The low number of confirmed sightings may be due to the difficulty in differentiating striped dolphins from common dolphins. Based on the understanding of striped dolphin habitat preferences and the low numbers of confirmed sightings, it is not likely that striped dolphins will be present within the Offshore Site, and this is supported by the absence of detection of striped dolphin in the eDNA and DAS surveys (see Appendix 9-1 and Appendix 11-7; Ocean Ecology, 2023; Hidef, 2024). Therefore, this species is not considered further within this chapter; nevertheless, any measures designed to mitigate the risk to cetaceans apply equally to striped dolphin.

Long-finned pilot whales are recorded relatively frequently around the deep waters to the west of Ireland (> 500 m depth), with population estimates of around 20,000 individuals in northwest Europe (CODA, 2009; Wall *et al.,* 2013). They are occasionally sighted in waters over the Irish shelf, but these are mostly stranding events (Berrow *et al.,* 2010). Site-specific aerial surveys (Appendix 11-7, HiDef,

2024) did not observe any long-finned pilot whales, and this species was not detected in the eDNA surveys (Appendix 9-1, Ocean Ecology, 2023). Therefore, based on available data and behavioural information, long-finned pilot whales are not likely to be present within the Offshore Site and not considered further within this chapter; nevertheless, any measures designed to mitigate the risk to other cetaceans apply equally to long-finned pilot whale.

Fin whales have been sighted around all coasts of Ireland, with highest sightings around the northwest continental shelf slopes and the south coast waters. Inshore sightings are only recorded along the southernmost point of Ireland as fin whales migrate north, but typically remain further offshore, favouring the edge of the continental shelf. They are generally absent from Irish waters from winter to early spring, with peak abundances in the late summer and autumn during migration (Wall *et al.*, 2013; Rogan *et al.*, 2018a). Fin whales were not observed during site-specific aerial surveys (Appendix 11-7, HiDef, 2024), were not detected during the eDNA surveys (Appendix 9-1, Ocean Ecology, 2023) and no sightings have been recorded around the Offshore Site in the last year (IWDG, 2024). It can be concluded that fin whales are not likely to be found within the Offshore Site, and therefore, are not considered further within this chapter; nevertheless, any measures designed to mitigate the risk to other cetaceans apply equally to fin whale.

In addition to these species, several other cetacean species have been recorded in surrounding waters on an infrequent basis, including killer whale *Orcinus orca*, humpback whale *Megaptera novaeangliae*, sei whale *Balaenoptera borealis*, sperm whale *Physeter macrocephalus*, northern bottlenose whale *Hyperoodon ampullatus*, white-beaked dolphin *Lagenorhynchus albirostris,* Atlantic white-sided dolphin *Lagenorhynchus acutus* and beaked whale spp. The occurrence of these species is considered unpredictable and rare within the Study Area (Wall *et al.*, 2013; Rogan *et al.*, 2018a), and none of these species were observed during the site-specific aerial surveys (Appendix 11-7, HiDef, 2024) or through eDNA sampling (Appendix 9-1; Ocean Ecology Limited, 2023). It is therefore concluded that these species do not form a key part of the baseline and are not considered further within this assessment; nevertheless, any measures designed to mitigate the risk to other cetaceans apply equally to these uncommon species.

The most recent report on cetacean MUs by the Inter-Agency Marine Mammal Working Group (IAMMWG) (2023) has been used in this assessment to estimate marine mammal abundances and densities. The MUs of the cetacean species considered in this assessment are outlined in Table 12-11. The spatial context of MUs in relation to the Project are shown in Figure 12-3.

Table 12-11 Cetacean species, MU and reference populations identified as important to the Offshore Site (IAMMWG, 2023)

Species	MU	MU abundance
Common dolphin	Celtic and Greater North Seas (CGNS)	102,656
Harbour porpoise	Celtic and Irish Seas (CIS)	62,517
Bottlenose dolphin	Coastal Ecotype: West Coast of Ireland (WCI) Offshore Ecotype: Oceanic Waters (OW)	WCI: 189[1] OW: 70,249
Minke whale	CGNS	20,118
[1]Abundance estimates are taken from Nykanen, *et al.* (2015) as estimates from IAMMWG (2023) were not available for this MU.		

SCEIRDE ROCKS WINDFARM
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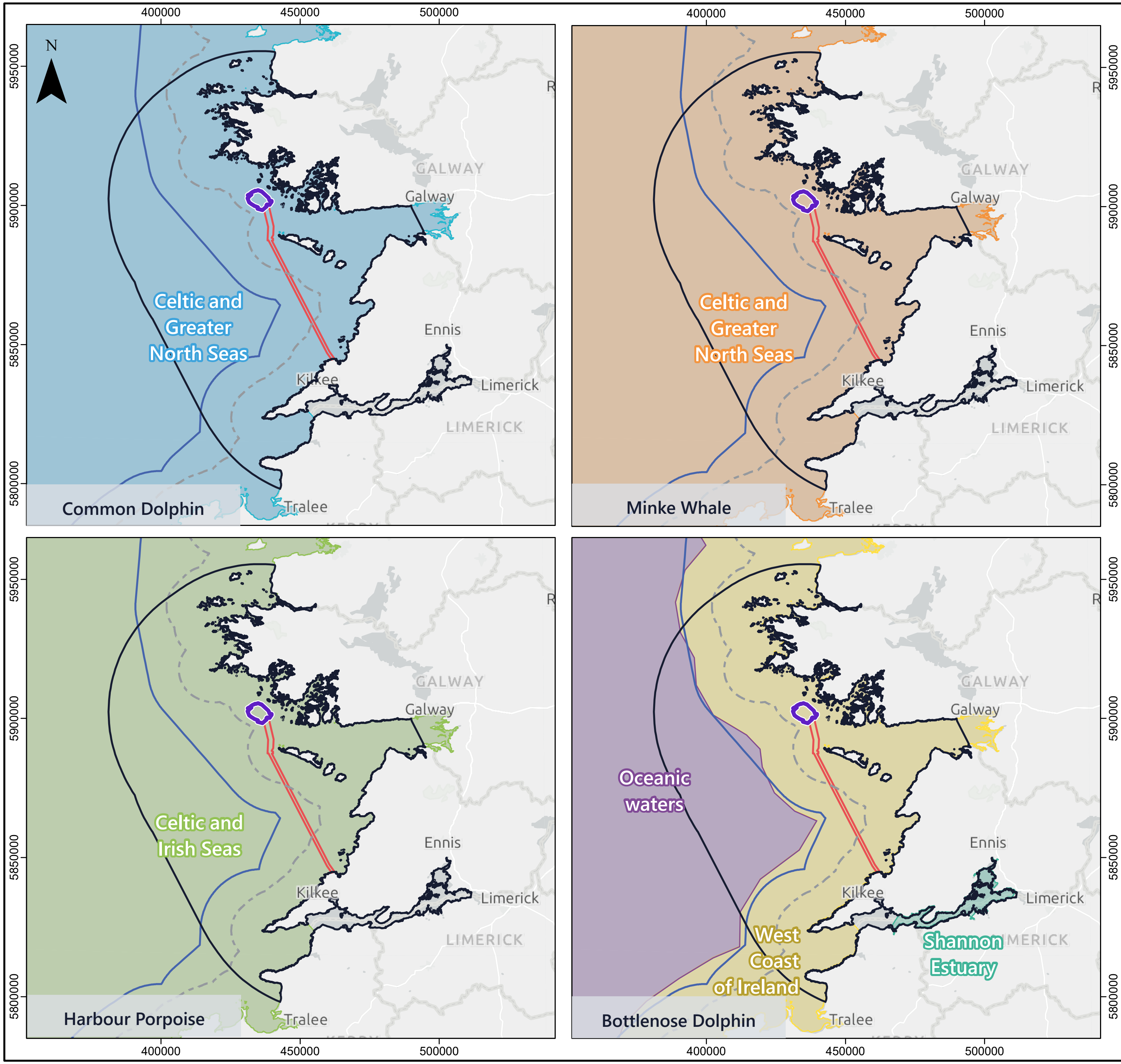

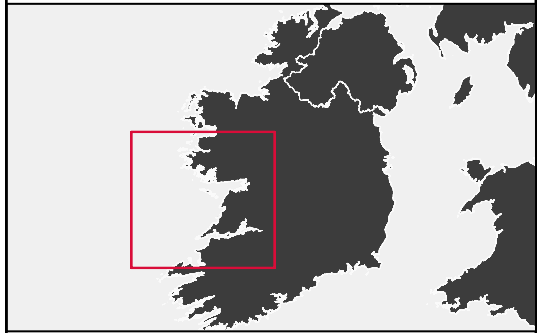

LEGEND

- Offshore Array Area
- Offshore Export Cable Corridor
- Study Area
- Ireland 6 NM limit
- Ireland 12 NM Limit
- Common Dolphin Management Units
- Minke Whale Management Units
- Harbour Porpoise Management Units

Bottlenose Dolphin Management Units

- Oceanic Waters
- Shannon Estuary
- West Coast of Ireland

0 10 20 nm

0 25 50 km

Data Source: Contains public sector information, licensed under the Creative Commons licence v4.0; the Open Government Licence v3.0. IAMMWG. 2023. Review of Management Unit boundaries for cetaceans in UK waters (2023). JNCC Report 734, JNCC, Peterborough, ISSN 0963-8091.

PROJECT TITLE
Sceirde Rocks

MAP TITLE
Cetacean Management Units

VER	REMARKS	DATE	Drawn	Approved
1	DRAFT	06/12/2024	BQ	EE

DRAWING NO
Figure 12-3

SCALE	PAPER SIZE	DATUM	PROJECTION
1:2,000,000	A4	WGS 84	UTM 29N

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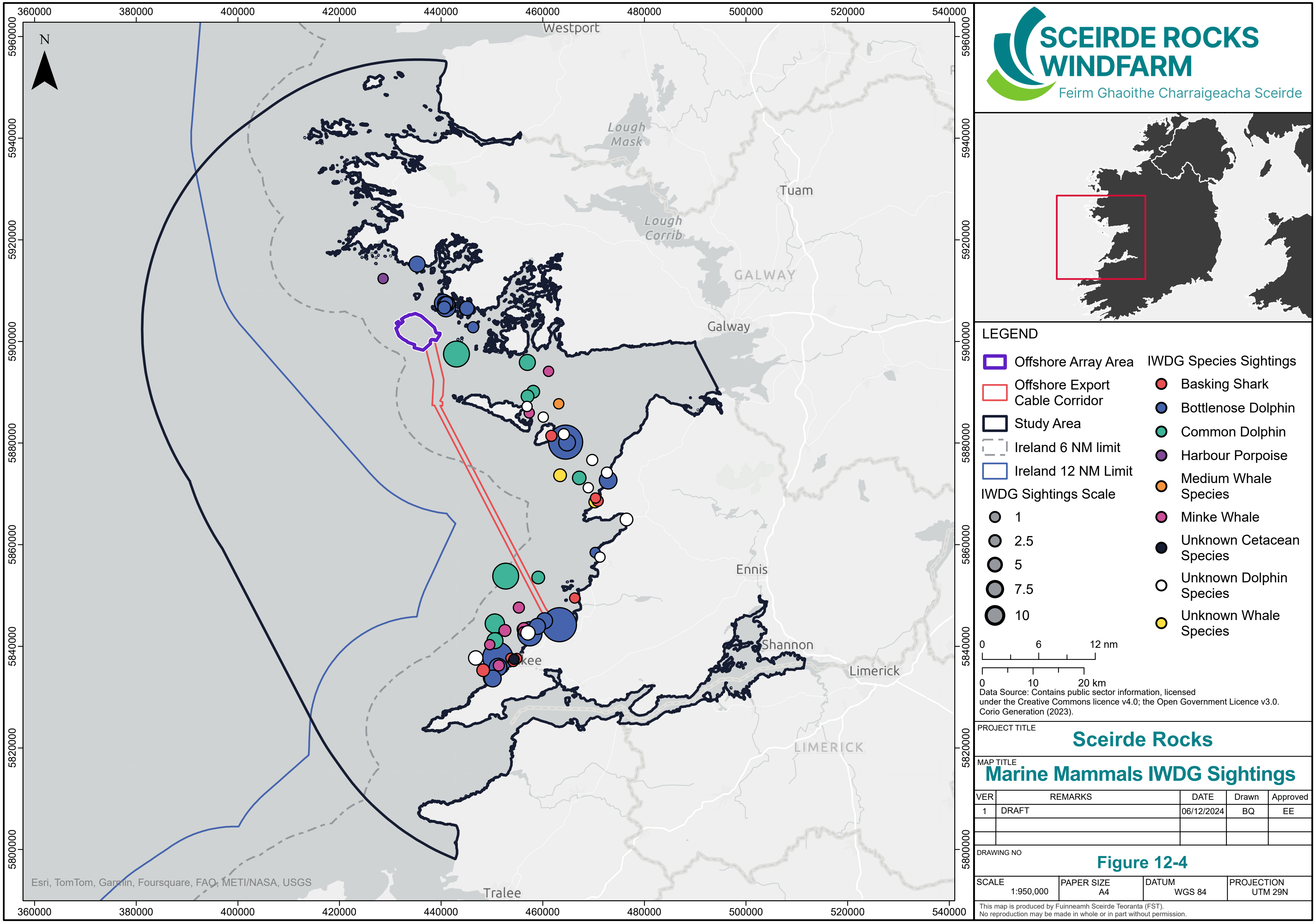
Several other data sources have been used in this assessment to estimate species abundances and densities, including the ObSERVE Programme aerial surveys data from the Government of Ireland (Rogan *et al*., 2018a), and aerial surveys commissioned for the Sceirde Rocks Offshore Wind Farm (OWF) undertaken by HiDef (Appendix 11-7; HiDef, 2024) (Figure 12-1). Sightings data from the IWDG was used to obtain baseline information on species presence between September 2022 – September 2023 in the Offshore Site, including a 20 km buffer to utilise publicly available sightings data in the vicinity of the Offshore Site (Figure 12-4). Further details are provided under the species accounts.

Of the key cetacean species considered further for the assessment, three were identified during the site-specific aerial surveys (Appendix 11-7, HiDef, 2024): harbour porpoise, common dolphin, and bottlenose dolphin (Figure 12-5 a&b; Table 12-11).



SCEIRDE ROCKS WINDFARM
Feirm Ghaoithe Charraigeacha Sceirde
Westport
Lough Mask
Tuam
Lough Corrib
GALWAY
Galway
Ennis
Shannon
Limerick
LIMERICK
Tralee
Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS
LEGEND
Offshore Array Area
Offshore Export Cable Corridor
Study Area
Ireland 6 NM limit
Ireland 12 NM Limit
IWDG Sightings Scale
1
2.5
5
7.5
10
IWDG Species Sightings
Basking Shark
Bottlenose Dolphin
Common Dolphin
Harbour Porpoise
Medium Whale Species
Minke Whale
Unknown Cetacean Species
Unknown Dolphin Species
Unknown Whale Species
0 6 12 nm
0 10 20 km
Data Source: Contains public sector information, licensed under the Creative Commons licence v4.0; the Open Government Licence v3.0. Corio Generation (2023).
PROJECT TITLE
Sceirde Rocks
MAP TITLE
Marine Mammals IWDG Sightings
VER
REMARKS
DATE
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Approved
1
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06/12/2024
BQ
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DRAWING NO
Figure 12-4
SCALE 1:950,000
PAPER SIZE A4
DATUM WGS 84
PROJECTION UTM 29N
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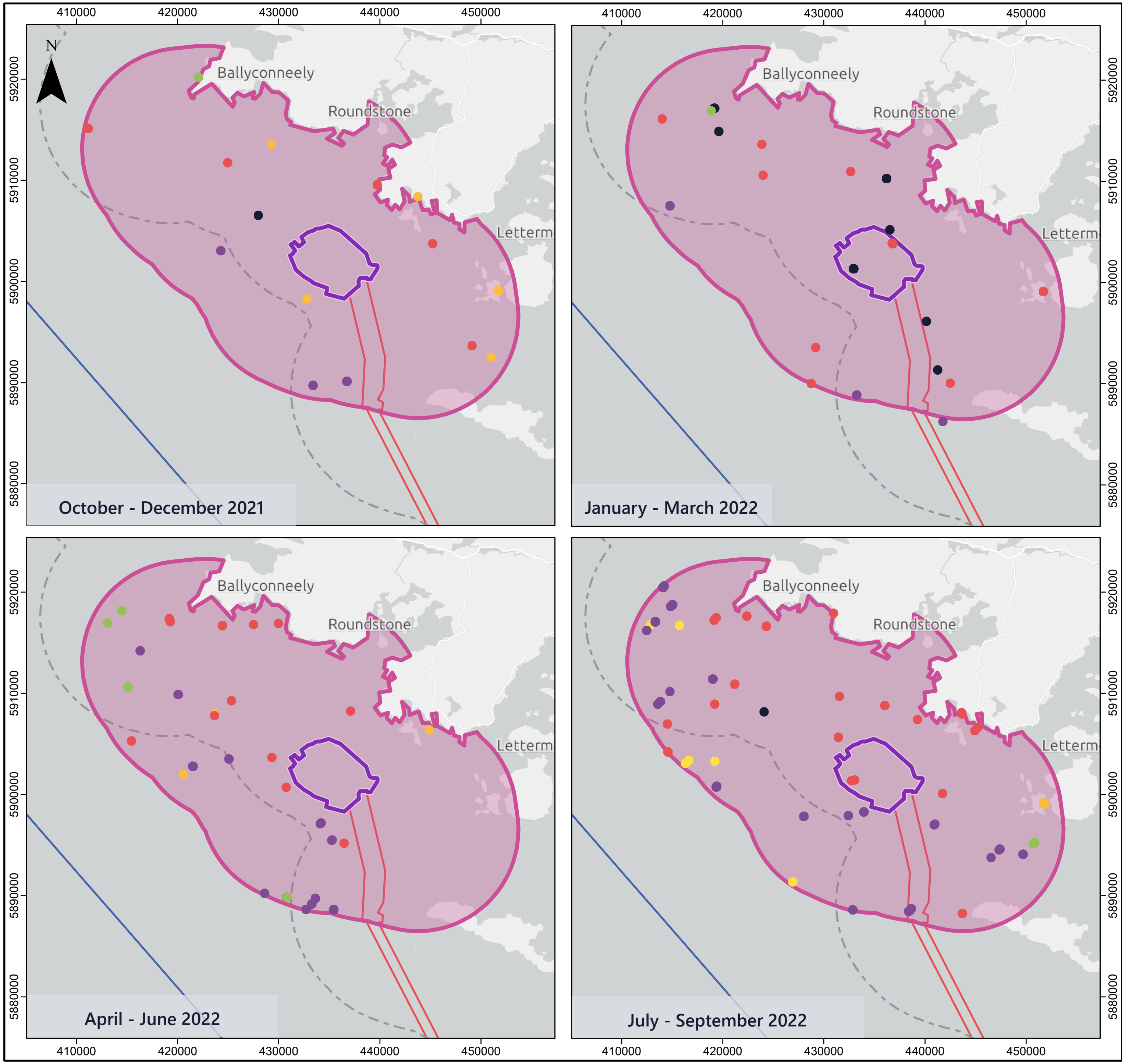
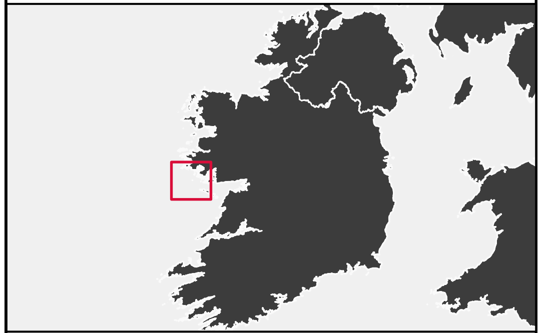


SCEIRDE ROCKS WINDFARM

Feirm Ghaoithe Charraigeacha Sceirde



LEGEND

- Offshore Array Area
- Offshore Export Cable Corridor
- Study Area
- Ireland 6 NM limit
- Ireland 12 NM Limit
- Site-specific aerial survey area

Important Marine Mammal Sightings

- Blue shark
- Bottlenose Dolphin
- Cetacean species
- Common dolphin
- Grey seal
- Harbour porpoise
- Harbour seal
- Seal species

0 3.5 7 nm

0 7 14 km

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PROJECT TITLE

Sceirde Rocks

MAP TITLE

Hi-Def Sightings 2021-2022

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1	DRAFT	06/12/2024	BQ	EE

DRAWING NO

Figure 12-5 (a)

SCALE	PAPER SIZE	DATUM	PROJECTION
1:550,000	A4	WGS 84	UTM 29N

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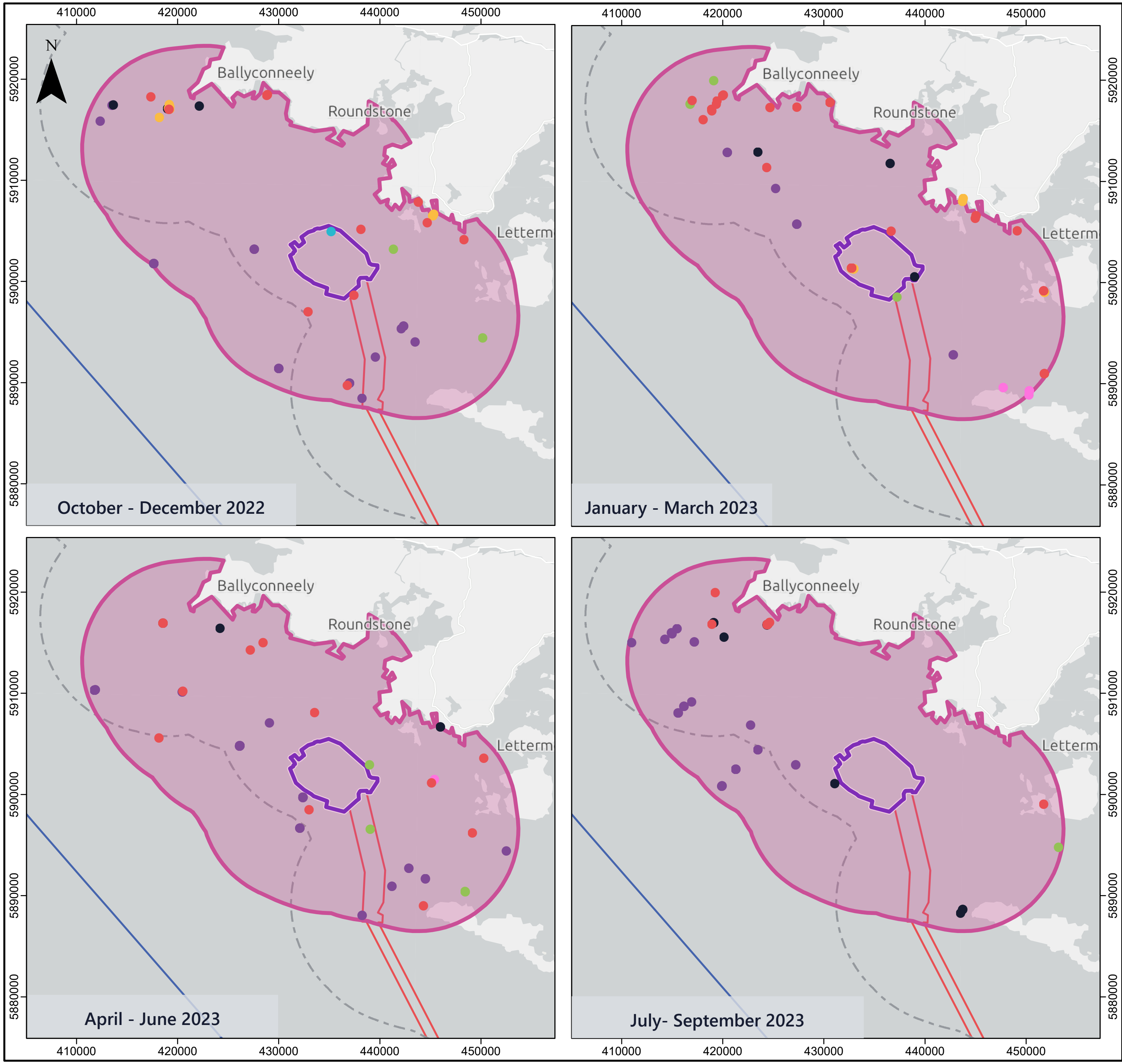

SCEIRDE ROCKS WINDFARM
Feirm Ghaoithe Charraigeacha Sceirde

LEGEND

- Offshore Array Area
- Offshore Export Cable Corridor
- Study Area
- Ireland 6 NM limit
- Ireland 12 NM Limit
- Site-specific aerial survey area

Important Marine Mammal Sightings

- Blue shark
- Bottlenose Dolphin
- Cetacean species
- Common dolphin
- Grey seal
- Harbour porpoise
- Harbour seal
- Seal species

0 3.5 7 nm

0 7 14 km

Data Source: Contains public sector information, licensed under the Creative Commons licence v4.0; the Open Government Licence v3.0. Corio Generation (2023).

PROJECT TITLE
Sceirde Rocks

MAP TITLE
Hi-Def Sightings 2022-2023

VER	REMARKS	DATE	Drawn	Approved
1	DRAFT	06/12/2024	BQ	EE

DRAWING NO
Figure 12-5 (b)

SCALE	PAPER SIZE	DATUM	PROJECTION
1:550,000	A4	WGS 84	UTM 29N

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Table 12-12 Cetacean sightings during aerial surveys of the site-specific DAS area (HiDef, 2024)

Species Name	Number of Animals Sighted	Month(s) of Sighting(s)
Harbour Porpoise	22	January, March, April, May, June, July, September, November, December
Common Dolphin	292	January, February, March, April, May, June, July, August, September, November, December
Bottlenose dolphin	10	March, May

Irish territorial waters are designated as a whale and dolphin sanctuary, which, in addition to the Whale Fisheries Act, 1937 and the Wildlife Act 1976 to 2021, provides a complete ban of hunting for all cetacean species. The Whale and Dolphin Sanctuary declaration came into effect in June 1991, making Irish waters the first sanctuary in Europe and recognized the importance of the habitat for whales and dolphins (IWDG, 1993). This protection is coupled with the EU Habitats Directive, where all cetaceans are included in Annex IV of the Directive, as well as other conservation agreements, such as the OSPAR Convention for the Protection of the Marine Environment of the northeast Atlantic (1992), the Bonn Convention on Migratory Species (CMS) (1983), and the Bern Convention on Conservation of European Wildlife and Natural Habitats (1979). The most recent assessment of conservation status for the relevant cetacean species in Ireland (NPWS, 2019b) showed stable populations with favourable statuses in all categories (Table 12-13).

Table 12-13 Conservation status of key cetacean species in Ireland (NPWS, 2019b)

Species	Range	Population	Habitat	Future prospects	Conservation status	Overall trend
Harbour porpoise	FV	FV	FV	FV	FV	Stable
Common dolphin	FV	FV	FV	FV	FV	Stable
Bottlenose dolphin	FV	FV	FV	FV	FV	Stable
Minke whale	FV	FV	FV	FV	FV	Stable
Key: FV = Favourable						

The following sections provide further details on the cetacean species which require further consideration in the assessment of potential impacts, including their biology, habitat use, and distribution.

12.5.2.1.1 Harbour Porpoise

Ecology and distribution

Harbour porpoises are found across the continental shelf of north-western Europe and are the most abundant cetacean to occur in the North Sea (Hammond *et al.,* 2021). Harbour porpoise is the most frequently reported cetacean in Ireland, regularly sighted in shallow waters less than 200 m deep around the entire Irish coast, with the highest densities around the southwest and the Irish Sea (Wall *et al.*, 2013; IWDG, 2015b). Harbour porpoises are generally seen year-round with little seasonal variation apart from a reduced observance rate between March and June, suggesting an offshore movement for calving and breeding, as most calves are first sighted in June and July (IWDG, 2015b; NPWS, 2023c). Harbour porpoises play an important ecological role as top predators, particularly being the most abundant small cetacean in the northeast Atlantic. They generally feed in demersal and pelagic habitats, targeting small shoaling fish such as whiting and sand eel (Santos & Pierce, 2003).

Seventeen SACs are designated for harbour porpoise in Irish waters: Roaringwater Bay and Islands SAC, Rockabill to Dalkey Island SAC, Blasket Islands SAC, Inishmore Island SAC, Kilkieran Bay and Islands SAC, West Connacht Coast SAC, Bunduff Lough and Machair/Trawalua/Mullaghmore SAC, St. John's Point SAC, Gweedore Bay and Islands SAC, Lough Swilly SAC, Lambay Island SAC, Codling Fault Zone SAC, Blackwater Bank SAC, Carnsore Point SAC, Hook Head SAC, Kenmare River SAC, and Belgica Mound Province SAC. Distances from relevant protected sites to the Project are given in section 12.5.2.4.1.

Population estimates and density

Harbour porpoises are managed under three MUs, with one overlapping with the Project, the Celtic and Irish Seas (CIS) MU. Estimated abundance and density is provided in Table 12-14. Density estimates from the ObSERVE surveys across the entire survey area vary from 0.0169 to 0.0293 individuals/km^2. The estimated abundance from IAMMWG (2023) has shown a decrease compared to the estimate from 2015, going from 104,695 no. individuals down to 62,517 no. individuals.

Sightings data from IWDG (2024) around the Offshore Site and a 20 km buffer showed only one confirmed harbour porpoise sighting in 2023 (Figure 12-4). Site-specific sampling for marine mammal eDNA did not identify any harbour porpoise within the survey area (Appendix 9-1, Ocean Ecology Limited, 2023). Site-specific aerial surveys (Appendix 11-7, HiDef, 2024) identified relatively low numbers of harbour porpoise, with only 22 observations across the entire survey period (Figure 12 5a&b).

Table 12-14 Abundance and density estimates for harbour porpoise

Data source	Temporal Scale	Area	Abundance (CV)	95% Confidence Interval (CI)	Density (Animals/km^2) (CV)
Site-specific surveys (HiDef, 2024)	2021 – 2023	Offshore Site	0 – 111	0 – 405	0.00 – 0.11
IAMMWG	Spring 2005[3]	CIS MU	98,807 (0.30)	57,315 – 170,336	N/A
	2015[4]	CIS MU	104,695 (0.32)	56,774 - 193,065	N/A

[3] *Recalculations of SCANS-II data following methodology from Hammond et al. 2021.*
[4] *(Hammond et al., 2013; Macleod et al., 2009)*

	2023[5]	CIS MU	62,517 (0.13)	48,324 – 80,877	N/A
ObSERVE survey (Mark-recapture distance sampling)	2015-2017	West of Ireland	Summer: 9,949 (0.13)	7,821 - 12,656	0.0293
			Winter: 5,739 (0.23)	3,651 - 9,021	0.0169
			All: 7,785 (0.12)	6,144 - 9,866	0.0229
ObSERVE survey (Abundance estimate using Generalised Additive Models)	2015-2017	West of Ireland	7,523 (0.84)	6,518 - 8,525	0.0222
IWDG sightings database	2023	OECC + 20 km buffer	Sightings: 1	N/A	N/A

12.5.2.1.2 Common dolphin

Ecology and distribution

The common dolphin is one of the most widespread and abundant cetacean species in the northeast Atlantic Ocean, both in offshore waters and on the continental shelf (Murphy *et al.,* 2021) and preferring shelf waters and upwelling regions of high productivity (Braulik *et al.,* 2021). Common dolphins generally feed on schooling fish such as herring *Clupea harengus* and sprat *Sprattus sprattus*, as well as squids and cod *Gadidae* (Braulik *et al.,* 2021; IWDG, 2015a). Common dolphin sightings concentrate around the southwest waters of the UK, most commonly in the Hebridean Sea, Celtic Sea, and Irish Sea (Hammond *et al.*, 2021) but are also seen quite regularly around the entire Irish coast. The largest concentrations of common dolphins in Ireland are located over the continental shelf, but they have also been frequently observed in the southern Irish Sea, around the Aran Islands, and in shallow inshore waters of the south, southwest, and western Ireland coasts (Reid *et al.*, 2001; Wall *et al.,* 2006; Wall *et al.*, 2013; IWDG, 2015a). The highest densities around the southwest coast were recorded during summer and autumn (Wall *et al.,* 2013), due to aggregations of pelagic schooling fish (Saunders *et al.*, 2010). Abundance in the Irish Sea generally peaks in the autumn but is also high in May and June (Paxton *et al.,* 2011; Paxton *et al.,* 2016), with lower numbers observed from late spring to late summer. Common dolphins mating and calving takes place between May to September (Murphy *et al.,* 2005; Murphy *et al.,* 2013).

Population estimates and density

Common dolphins are managed under a singular MU with white-beaked dolphins and Risso's dolphins, the CGNS MU. Abundance and density estimates are shown in Table 12-15. Based on reported sightings, common dolphin is expected to be present year-round in the Study Area, particularly in the summer and autumn. The average density estimates from ObSERVE surveys range from 0.01 to 0.12 individuals/km^2 (Table 12-15).

[5] *SCANS-III and oBSERVE surveys (Hammond, et al., 2021 and Rogan, et al., 2018a)*

Sightings data from IWDG (2024) around the OAA, including the OECC and a 20 km buffer showed 170 confirmed common dolphin sightings in 2023. Most sightings were recorded between May and July, although the largest observation of 50 no. individuals took place in September 2023 around Donegal Point. Site-specific sampling for marine mammal eDNA identified the presence of common dolphin within 12 samples from a total of 30 samples taken across the survey area (Appendix 9-1; Ocean Ecology Limited, 2023), indicating that common dolphin are likely to be present within the Offshore Site.

Common dolphins were the most abundant species observed during site-specific aerial surveys (Appendix 11-7; HiDef, 2024) (Figure 12 5a&b). Expected density estimates peak in May 2023 with a total of 51 no. individuals observed with population estimates ranging from 9 to 391 (up to 0.41 animals/km^2).

Table 12–15 Abundance and density estimates for common dolphins

Data source	Temporal Scale	Area	Abundance (CV)	95% CI	Density (animals/km^2) (CV)
Site-specific surveys (HiDef, 2024)	2021 – 2023	Site-specific aerial survey area	9 – 391	0 – 1,008	0.01 – 0.4
IAMMWG	Spring 2005[6]	CGNS MU	181,880	88,447 – 374,015	N/A
	2015	CGNS MU	56,556 (0.28)	33,014 – 96,920	N/A
	2023[7]	CGNS MU	102,656	58,932 to 178,822	N/A
CODA survey[8]	July 2007	European Atlantic waters (continental shelves of Britain, Ireland, France and Spain)	Design-based estimate: 118,264 (0.38)	56,915 – 246,740	0.12 (0.38)
			Model-based estimate: 116,709 (0.34)	61,397 - 221,849	
	July 2007	Block 1: UK sector	Design-based estimate: 3,546 (0.76)		0.01 (0.76)
			Model-based estimate: 4,216 (0.57)	1,478 - 12,027	
ObSERVE survey (Mark-recapture distance sampling)	2015-2017	West of Ireland	Summer: 11,673 (0.45)	5,028 - 27,100	0.0344
			Winter: 20,548 (0.35)	10,441 - 40,436	0.0605

[6] *Recalculations of SCANS-II data following methodology from Hammond et al., 2021*
[7] *SCANS-III and ObSERVE surveys (Hammond et al., 2021 and Rogan et al., 2018a)*
[8] *Cetacean Offshore Distribution and Abundance (CODA) in European Atlantic Waters Survey*

			All: 16,252 (0.28)	9,440 - 27,981	0.0479
ObSERVE survey (Abundance estimate using Generalised Additive Models)	2015-2017	West of Ireland	15,634 (0.15)	12,600 - 22,005	0.0461
IWDG sightings database	2023	OECC + 20 km buffer	Sightings: 170		N/A

12.5.2.1.3 Bottlenose dolphin

Ecology and distribution

Bottlenose dolphins are found across all oceans in warm and temperate waters, occupying both inshore and offshore areas. In the north-east Atlantic, bottlenose dolphins can be divided into two ecotypes: 1) coastal, where they form small resident groups occupying shallow waters such as river estuaries, headlands, and sandbanks, and 2) pelagic, where wide-ranging mobile groups inhabit open-ocean waters and shelf edges (Reid *et al.,* 2001; Louis *et al.,* 2014). They are generalist predators, feeding on fish and squid, as well as crustaceans and shrimp (Wells *et al.*, 2018).

Bottlenose dolphins are the third most frequently recorded species in Irish waters (Berrow *et al.,* 2010). This species has been recorded in the wider region all year round, predominantly at the shelf break, and waters to the south and southwest of Ireland and further offshore in deep North Atlantic waters. Several localised populations have been documented around the British Isles, including Scotland (the Moray Firth; Wilson *et al.,* 1999), Wales (Cardigan bay; Evans *et al.*, 2003), and Ireland (the Shannon Estuary; Berrow *et al.*, 1996). There is no fixed breeding season, but births are generally documented between May and November in British waters, although this varies from region to region (Harris & Yalden, 2008). The Lower River Shannon SAC is an important site for newborn calves, with indication that calving occurs annually within the same 5-month period (NPWS, 2012b).

Three distinct populations are recognized in Ireland: the Shannon Estuary resident population (as a designated feature of the Lower River Shannon SAC), a coastal population, and an offshore population (Mirimin *et al.*, 2011; Oudejans *et al.,* 2015; Nykänen *et al.,* 2018).

Ten SACs have been designated for bottlenose dolphins as a Qualifying Interest in Irish waters: Lower River Shannon SAC, Slyne Head Islands SAC, Slyne Head Peninsula SAC, Duvillaun Islands SAC, West Connacht Coast SAC, Porcupine Bank Canyon SAC, South-West Porcupine Bank SAC, Belgica Mound Province SAC, St. John's Point SAC, and Hook Head SAC. Distances from relevant protected sites to the Project are given in section 12.5.2.4.1.

Bottlenose dolphins in the Lower River Shannon SAC are genetically distinct from other populations and have been protected under the EU Habitats Directive since 2000. Although the population predominantly uses the Shannon Estuary, photo-identification studies have suggested that the population extends to include Brandon Bay and Tralee Bay (Berrow *et al.,* 2012; Levesque *et al.*, 2016), located around 30 km southwest of the Shannon Estuary mouth.

Population estimates and density

Bottlenose dolphins are managed under 7 MUs across the UK and Ireland, with two that overlap with the Study Area (Figure 12-3). The OW MU, representing the bottlenose dolphin offshore ecotype, encompasses the pelagic waters west of the British Isles. The WCI MU represents the inshore ecotype of bottlenose dolphins, but no data is available for the abundance of this MU population. Nykanen *et al.* (2015) reported that the northwest of Ireland hosted a population of around 189 no. individuals, although this does not represent the whole MU. The Lower River Shannon SAC, which is represented by the Shannon Estuary MU, is located 27.9 kilometres from the Offshore Site, and does overlap with the marine megafauna Study Area due to the potential for Project activities (i.e. temporary anchorage of foundations) to take place in the vicinity of the Port of Shannon Foynes. This distinct inshore population of bottlenose dolphin was estimated at 140 no. individuals in 2006 (NPWS, 2013b) and is currently estimated at 139 no. individuals (95% CI: 121-160; Rogan, et al., 2018b).

Over the Irish shelf slopes and the deeper waters of Porcupine Abyssal Plain and the Rockall trough, Wall *et al.* (2013) estimated a population of around 8,500 animals during the CODA survey (CODA, 2009). This population likely comprises the offshore ecotype of bottlenose dolphins found within the NE Atlantic, rather than a coastal population. Due to the proximity of the SACs and the mobility of bottlenose dolphin around the coasts of Ireland, it is expected that bottlenose dolphins will be present in the Study Area year-round. Density estimates for bottlenose dolphins range from 0.02 to 0.38 individuals/km^2 (Table 12-16). Sightings data from IWDG (2024) around the OAA, including the OECC and a 20 km buffer showed 248 confirmed bottlenose dolphin sightings in 2023. All sightings were recorded during spring and summer, ranging from individual sightings to groups of maximum 30 no. individuals sighted at any one time.

Site-specific surveys (Appendix 11-7, HiDef, 2024) identified relatively low numbers of bottlenose dolphins. Ten individuals were observed across the entire survey period, with a peak observation of nine individuals in March 2023. Population estimates ranged from 8 in May 2023 to 73 in March 2023 (up to 0.08 animals/km^2) (Figure 12-5 a&b).

Table 12-16 Abundance and density estimates for bottlenose dolphins

Data source	Temporal Scale	Area	Abundance (CV)	95% CI	Density (Animals/km^2) (CV)
Site-specific surveys (HiDef, 2024)	2021 – 2023	Offshore Site	9 – 73 (N/A)	25 – 203	0.01 – 0.08
IAMMWG	2015[9]	OW MU	11,923 (0.21)	7,935 - 17,915	N/A
	2023[10]	OW MU	70,249 (0.17)	49,720 – 99,255	N/A
Nykanen *et al.* (2015)	2014	Coastal waters, NW Ireland (Galway, Mayo, Sligo, Leitrim, Donegal)	189 (0.11)	162 – 232	N/A

[9] *Hammond et al., 2013; Macleod et al., 2009*
[10] *SCANS-III and obSERVE surveys (Hammond et al., 2021 and Rogan et al., 2018a)*

CODA survey[11]	July 2007	European Atlantic waters (continental shelves of Britain, Ireland, France and Spain)	19,295 (0.25)	11,842 – 31,440	0.02 (0.25)
	July 2007	Block 1: UK sector	5,709 (0.35)		0.02 (0.35)
ObSERVE survey (Mark-recapture distance sampling)	West of Ireland	2015-2017	Summer: 66,719 (0.23)	42,218 - 105,438	0.1965
			Winter: 127,891 (0.15)	96,262 – 169,912	0.3766
			All: 99,177 (0.13)	76,925 - 127,867	0.2920
ObSERVE survey (Abundance estimate using Generalised Additive Models)	West of Ireland	2015-2017	99,617 (0.084)	87,502 - 116,334	0.2935
IWDG sightings database	2023	OECC + 20 km buffer	Sightings: 248		N/A

12.5.2.1.4 Minke Whale

Ecology and distribution

Minke whales are the most abundant species of baleen whales, found worldwide across deep waters and continental shelves. Minke whales are generally found alone or in pairs but can be sometimes seen in larger groups of 10 to 15 individuals during feeding (Reid *et al.*, 2001). They are the most frequently sighted baleen whale in Irish waters along the entire coastline, with the most sightings around the southern and western coasts between May and October (IWDG, 2015c; Berrow *et al.,* 2018). Generally, sightings occur in waters < 200 m deep, normally at low relative abundances (i.e. sightings involving single animals; Wall *et al.*, 2013). Peaks in abundance in those areas are around autumn, in accordance with large concentrations of pelagic schooling fish (ORCA Ireland, 2023).

Minke whales are largely absent from Irish waters in the winter months, and it is likely that they migrate south to breed during this time. Mating is believed to occur in the winter between October and March, with a peak in February (Kavanagh *et al.*, 2018). Two potential breeding grounds are thought to exist, although their exact location is unknown (Anderwald *et al.,* 2011).

[11] *Cetacean Offshore Distribution and Abundance (CODA) in European Atlantic Waters Survey*

Population estimates and density

Minke whales are managed as a single population within the CGNS MU (Figure 12-3), with an estimated abundance of 20,118 no. individuals in 2016 (95% CI: 14,061 – 28,786; IAMMWG, 2023). The previous estimate from the Small Cetaceans in European Atlantic waters and the North Sea (SCANS) II data in 2005 calculated a population of 20,136 no. individuals, suggesting a stable population trend within MU. Relevant abundance and density estimates are presented in Table 12-17. It is unlikely that minke whale may be present in the Study Area based on no sightings during the site-specific surveys (Appendix 11-7, HiDef, 2024), and an estimated density of 0.0026 to 0.016 individuals/km^2 recorded in other surveys.

Site-specific sampling for marine mammal eDNA identified the presence of minke whale within the survey area in four of the 30 samples analysed (Appendix 9-1, Ocean Ecology Limited, 2023), indicating that minke whale do occur within or around the Offshore Site. Sightings data from IWDG (2024) around the OAA, including the OECC and a 20 km buffer showed 17 confirmed minke whale sightings in 2023. Most sightings were between May and June around Donegal Point and Kilkee, Co. Clare.

Table 12-17 Abundance and density estimates for minke whales

Data source	Temporal Scale	Area	Abundance (CV)	95% CI	Density (Animals/km^2) (CV)
IAMMWG	Spring 2005[12]	CGNS MU	20,136 (0.29)	11,498 – 35,264	N/A
	2015[13]	CGNS MU	23,528 (0.27)	13,989 – 39,572	N/A
	2021[14]	CGNS MU	20,118 (0.18)	14,061 – 28,786	N/A
CODA survey[15]	July 2007	European Atlantic waters (continental shelves of Britain, Ireland, France and Spain)	6,765 (0.99)	1,239 – 36,925	0.007 (0.99)
	July 2007	Block 1: UK sector	5,547 (1.03)		0.016 (1.03)
ObSERVE survey (Mark-recapture distance sampling)	West of Ireland	2015-2017	Summer: 2,601 (0.23)	1,667 - 4,057	0.0077
			Winter: 878 (0.24)	556 - 1,387	0.0026
			All: 1,769 (0.21)	1,176 - 2,662	0.0052
ObSERVE survey (Abundance estimate using Generalised Additive Models)	West of Ireland	2015-2017	1,760 (0.14)	1,508 - 2,140	0.0052
IWDG sightings database	2023	OECC + 20 km buffer	Sightings: 17		N/A

[12] *Recalculations of SCANS-II data following methodology from Hammond et al. 2021.*
[13] *(Hammond et al., 2013; Macleod et al., 2009)*
[14] *SCANS-III and ObSERVE surveys (Hammond, et al., 2021 and Rogan, et al., 2018a)*
[15] *Cetacean Offshore Distribution and Abundance (CODA) in European Atlantic Waters Survey*

12.5.2.2 Pinnipeds

Two species of pinnipeds occur in Ireland, the harbour seal *Phoca vitulina* and the grey seal *Halichoerus grypus* (Cronin, 2011). Both species are coastal phocids, meaning they are adapted to occupy both terrestrial and aquatic environments (Lynch & Bodley, 2007). Harbour seals and grey seals are common in Irish waters and tend to be concentrated in coastal and nearshore waters. Both species have established terrestrial haul-out sites along all coastlines of Ireland, which they leave when foraging and to which they return to rest during the moulting and breeding season.

Outwith the breeding and moulting periods, studies in the UK have shown that both harbour and grey seals will travel significant distances from their colonies, with harbour seals traveling within 40 to 50 km range of their haul-out sites for foraging (SCOS, 2020; Carter *et al.,* 2022). Sightings and satellite tracking shows pinnipeds are mostly either coastal or over the continental shelf within 100 km from the coast, although grey seals range widely, sometimes more than 200 km from their breeding sites (Carter *et al.*, 2022; SCOS, 2023).

Although they are listed as 'Least Concern' on the IUCN Red List (Bowen, 2016; Lowry, 2016), harbour seals and grey seals are Annex II species under the Habitats Directive and sites for their protection have been designated in Ireland, including sites within foraging range of Project Offshore Scoping Area (see section 12.5.2.4.2). They are also protected under The Wildlife Act 1976 to 2021), providing protection of their habitat, protection from hunting, and against 'wilful interference'. The most recent Irish conservation status assessment was carried out in 2019, concluding that both species had a favourable conservation status, with grey seals having an overall trend showing improvement, and harbour seals showing a stable trend (Table 12-18).

Table 12-18 Conservation status of harbour and grey seals in Ireland (NPWS, 2019b)

Species	Range	Population	Habitat	Future prospects	Conservation status	Overall trend
Grey seal	FV	FV	FV	FV	FV	+
Harbour seal	FV	FV	FV	FV	FV	Stable
Key: FV = Favourable, + = Improving						

The key data sources used to establish the environmental baseline and obtain density estimates for seals are: the annual population parameter reports from the SCOS (2020; 2021; 2022); at-sea distribution maps from Russell *et al.* (2017); predicted habitat usage maps from Carter *et al.* (2022). The NPWS has a national monitoring programme for Annex II seal populations and have been conducting surveys of seal colonies since 2009 (Morris & Duck, 2019).

No seal MUs have been designated for Ireland. Under Article 17 reporting of the EU Habitats Directive, data were collected on seal distribution in Irish coastal and marine waters using available population monitoring surveys across the principal seal breeding areas (NPWS, 2019d). However, no density estimates are available for Irish populations of seals, such that this assessment relies on other density estimates available (Carter *et al.*, 2022) and site-specific surveys (HiDef, 2024).

Site-specific sampling for marine mammal eDNA identified the presence of seals in two of the 30 samples (Appendix 9-1; Ocean Ecology Limited, 2023). Both grey and harbour seals were also recorded during the site-specific aerial surveys (Appendix 11-7; HiDef, 2024; Figure 12-5 a&b), although many observations could not be differentiated to species level. A summary of the survey data is presented in Table 12-19.

Table 12-19 Pinniped sightings during aerial surveys of the site-specific aerial survey area

Species Name	Number of Animals Sighted	Month(s) of Sighting(s)
Grey seal	88	January, March, August, October
Harbour seal	31	May, June, July, August, October, November, December
Unidentified seal species	63	January, March, April, May, June, July, August, September, October, November, December

12.5.2.2.1 Harbour seal

Population estimates and density

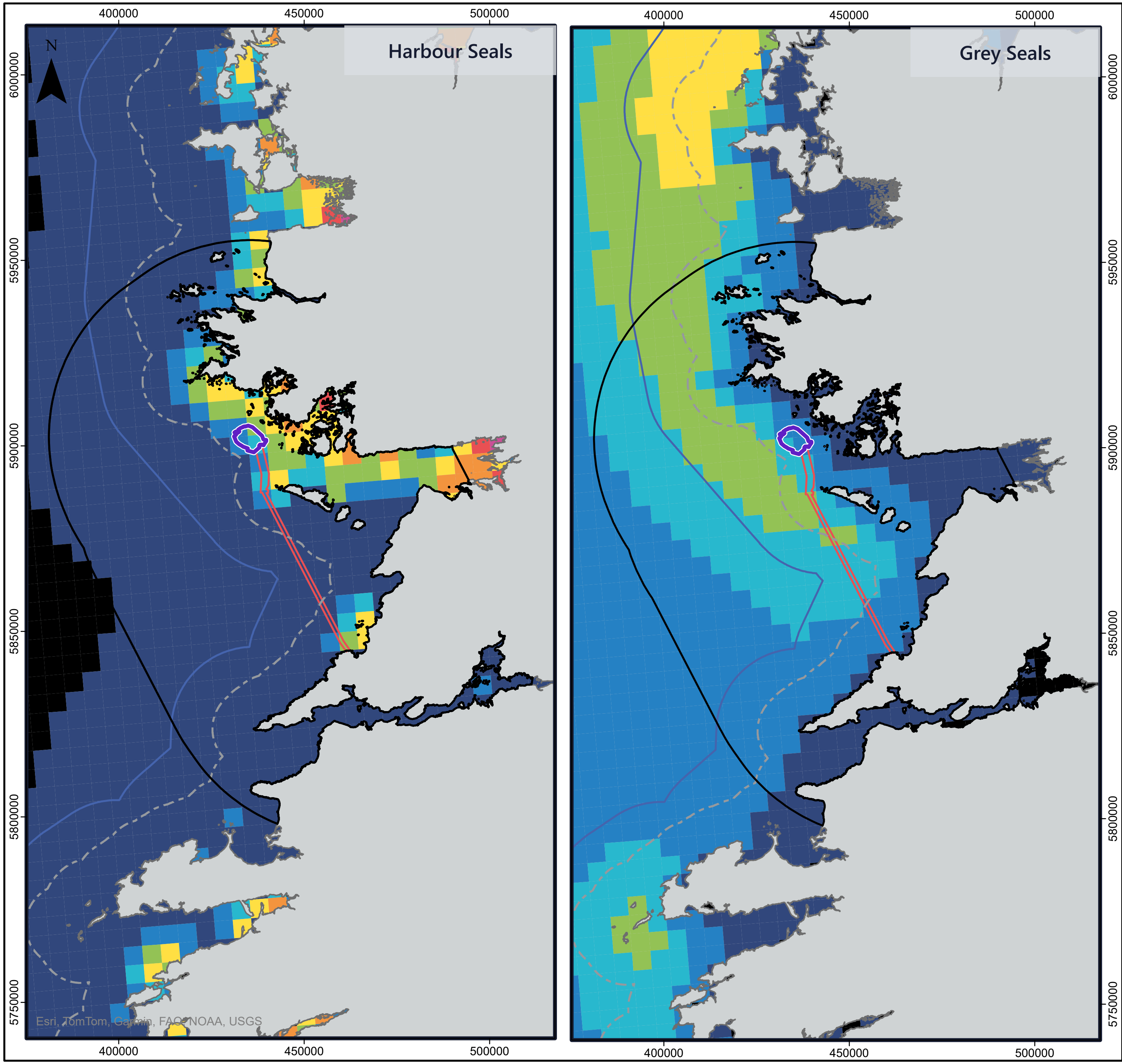
Morris & Duck (2019) undertook aerial thermal-imaging surveys of seals in Ireland as part of the nationwide monitoring of seals in the summer in support of the reporting requirements under Article 17 of the EU Habitats Directive. The coastline was divided into five regions. The Project falls within the West region, which covers area from County Mayo to the tip of Loop Head Peninsula of County Clare, and within the sub-survey areas 1-5.

During the 2017/2018 surveys, 4,007 no. harbour seals were counted around the Ireland coastline (Morris & Duck, 2019), compared to 3,489 no. in 2011/2012 (Duck & Morris, 2012; 2013). Harbour seal counts within the Study Area (sub-survey areas 1-5) recorded 1,142 no. individuals (Table 12-20), accounting for approximately 29% of the Irish harbour seal population.

Table 12-20 Harbour seal counts in West Ireland and sub-survey areas (Morris & Duck, 2019)

Region	Area	2011/12	2017/18
West	1	27	48
	2	53	41
	3	501	570
	4	358	349
	5	106	134
	Total	1,045	1,142

Carter *et al.* (2022) undertook a study of the spatial extent of harbour seals around the UK and Ireland using animal-borne tracking data, providing regional scale estimates of densities and at-sea distribution. Within the Study Area, the at-sea density of harbour seals is approximately 0.090 individuals/km^2 (Carter *et al.,* 2022; Figure 12-6). Harbour seals were the third most numerous marine mammal species observed in the site-specific aerial surveys, although the numbers recorded were markedly lower than observations of grey seals during the aerial surveys. (Appendix 11-7; HiDef, 2024; Figure 12-5 a&b), with a total of 93 no. individuals recorded across the survey period. Population estimates from the site-specific surveys ranged from 9 in November 2021 to 176 in October 2022 (up to 0.19 animals/km^2).



SCEIRDE ROCKS WINDFARM
Feirm Ghaoithe Charraigeacha Sceirde

LEGEND

Offshore Array Area	0 - 1
Offshore Export Cable Corridor	1 - 3
Study Area (50km)	3 - 5
Ireland 6 NM limit	5 - 10
Ireland 12 NM Limit	10 - 25
	25 - 50
	50 - 75
	75 - 100
	100 - 150

UK and Ireland at-sea population density, seals per 25 km^2 cell (Carter et al 2022)

0

0 9.5 19 nm

0 10 20 km

Data Source: Contains public sector information, licensed under the Creative Commons licence v4.0; the Open Government Licence v3.0. Carter MID, Boehme L, Cronin MA, Duck CD, Grecian WJ, Hastie GD, Jessopp M, Matthiopoulos J, McConnell BJ, Miller DL, Morris CD, Moss SEW, Thompson D, Thompson PM and Russell DJF (2022) Sympatric Seals, Satellite Tracking and Protected Areas: Habitat-Based Distribution Estimates for Conservation and Management. Front. Mar. Sci. 9:875869. doi: 10.3389/fmars.2022.875869

PROJECT TITLE

Sceirde Rocks

MAP TITLE

Seal Distribution

VER	REMARKS	DATE	Drawn	Approved
1	DRAFT	06/12/2024	BQ	EE

DRAWING NO

Figure 12-6

SCALE	PAPER SIZE	DATUM	PROJECTION
1:1,500,000	A4	WGS 84	UTM 29N

This map is produced by Fuinneamh Sceirde Teoranta (FST).
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12.5.2.2.2 Grey seal

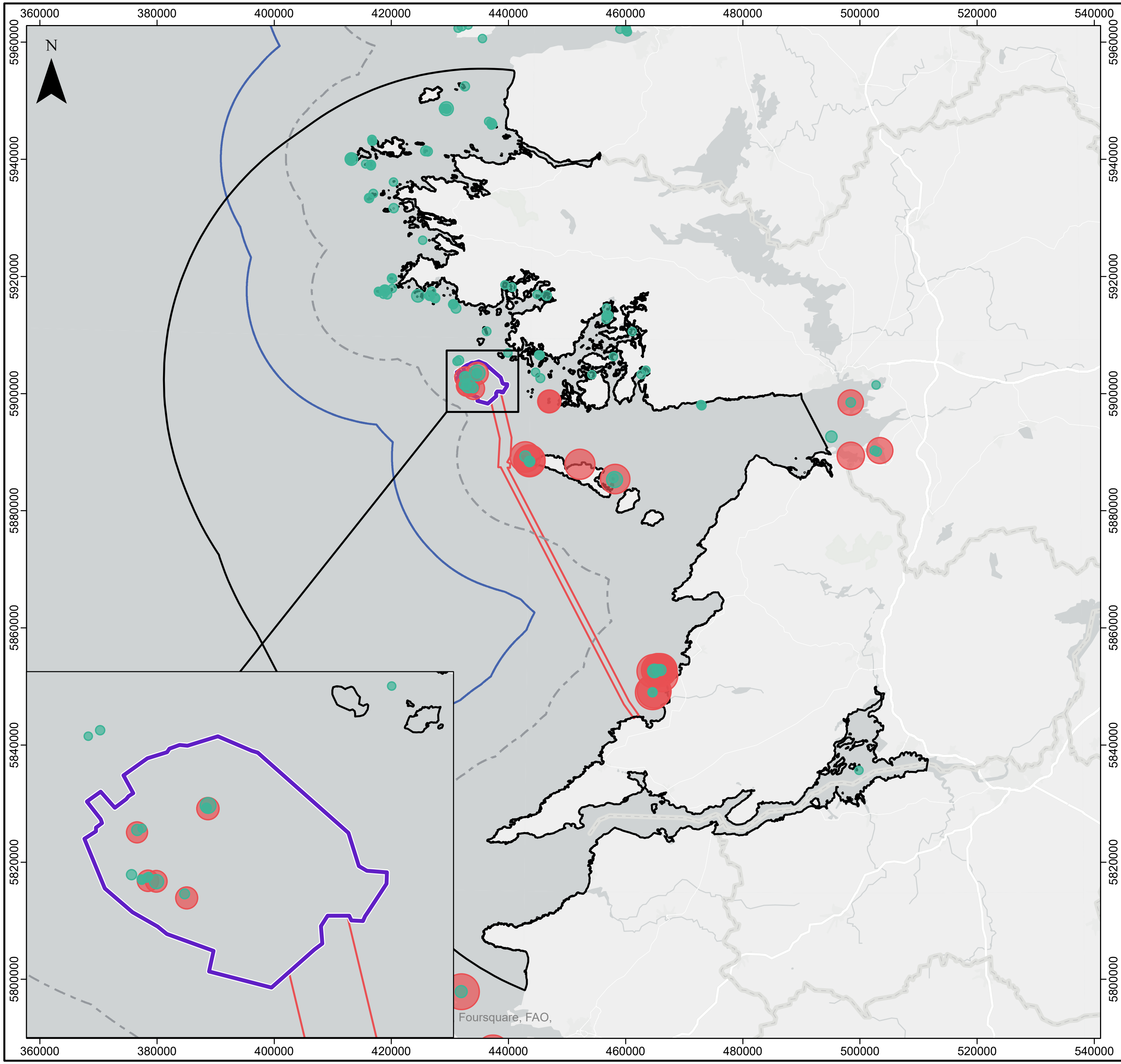
Ecology and distribution

Grey seals are distributed across a much smaller area than harbour seals, residing on the continental shelf of the North Atlantic, with a temperate to sub-arctic distribution. There is one subpopulation that is separate from the northwest and northeast Atlantic population, the Baltic Sea subpopulation (Bowen, 2016). Grey seals are generally found at sea, only hauling out during breeding, weaning, and moulting. They generally moult during the spring months, and breed from September to December (NPWS, 2023b). The UK and Ireland represent approximately 37% of global grey seal pup production (UK: 68,050 pups, Ireland: 2,100 pups; SCOS, 2021). Grey seals do not forage during the lactation periods, meaning they will fast until their pup has weaned, usually after 6 weeks.

Grey seals are primarily generalist demersal feeders, foraging on the seabed at depths of up to 100 m but are capable of deeper foraging dives (Bowen, 2016; SCOS, 2020). Their diet is not necessarily homologous, showing important variations at small spatial scales. Irish grey seals foraging in shallow waters have a high prevalence of demersal and groundfish species in their diet, such as flatfish and cephalopods, whereas seals feeding in deeper waters generally consume pelagic and bentho-pelagic species, such as blue whiting and sand eel (Gosch *et al.,* 2019).

Grey seals are found around the entire coast of Ireland, generally more present on the western side, although significant numbers also occur on the east and southeast coasts (NPWS, 2023b). Their population can be separated into three breeding regions: East, Southwest-West, and West-Northwest. These are further separated into seven principal breeding areas for grey seals (Ó Cadhla *et al.*, 2008). The Project falls within the Slyne Head islands breeding area. They generally prefer remote areas, such as offshore islands, for hauling out and breeding (Figure 12-7). During both 2012 and 2017 aerial surveys, grey seals were observed hauled out on the Sceirde Rocks, within the OAA, although as the surveys were carried out during the summer months and the grey seal breeding season occurs in the autumn, this does not indicate that the rocks themselves are breeding sites. Indeed, it is unlikely that the rocks are suitable breeding locations for grey seals because of their low-lying exposed nature, meaning any newborn pups would be at risk from large waves.

Ten SACs are designated for the protection of grey seals within Ireland, many of them encompassing island groups. Counts of grey seals in designated SACs are presented in section 12.5.2.4.2.



SCEIRDE ROCKS WINDFARM
Feirm Ghaoithe Charraigeacha Sceirde

LEGEND

- Offshore Array Area
- Offshore Export Cable Corridor
- Study Area (50km)
- Ireland 6 NM limit
- Ireland 12 NM Limit

2017 Aerial thermal survey seals sightings

- 1
- 10
- 50
- 100

2012 Aerial survey of seals sightings

- 1
- 10
- 50
- 100

0 6 12 nm

0 10 20 km

Data Source: Contains public sector information, licensed under the Creative Commons licence v4.0; the Open Government Licence v3.0.

PROJECT TITLE

Sceirde Rocks

MAP TITLE

Grey Seal Haul Outs

VER	REMARKS	DATE	Drawn	Approved
1	DRAFT	06/12/2024	BQ	EE

DRAWING NO

Figure 12-7

SCALE	PAPER SIZE	DATUM	PROJECTION
1:950,000	A4	WGS 84	UTM 29N

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Population estimates and density

Around 3,700 grey seals were counted in Ireland in 2017/2018 (Morris & Duck, 2019), compared to almost 3,000 in 2011/2012 (Duck & Morris, 2012; 2013). The 2017/2018 survey had the highest record of seal counts, with an increase of 25% since the 2011/2012 survey, showing that the population is increasing. Grey seal counts within the Study Area (sub-survey areas 1-5) were around 439 (Table 12-21), which accounts for approximately 11.9% of the Irish grey seal population estimated in 2017/2018. The majority of counted seals were in sub-survey area 4, which encompasses the OAA.

Table 12-21 Grey seal counts in West Ireland and sub-survey areas (Morris & Duck, 2019)

Region	Area	2011/12	2017/18
West	1	64	55
	2	73	53
	3	11	32
	4	238	192
	5	100	107
	Total	486	439

Within the Study Area, the at-sea density of grey seals is approximately 0.094 individuals/km^2 (Carter *et al.,* 2022; Figure 12-6). Grey seals were the second most numerous marine mammal species observed in the site-specific aerial surveys (Appendix 11-7, HiDef, 2024; Figure 12-5 a&b), with a total of 146 no. individual sightings recorded across the survey period. Population estimates from the site-specific surveys ranged from 12 in August 2022 to 444 in March 2022 (at densities of up to 0.47 animals/km^2).

12.5.2.3 Other species

12.5.2.3.1 *Marine turtles*

Five species of marine turtles have been recorded in Irish and UK waters, but little information is available on their distribution patterns. The leatherback turtle *Dermochelys coriacea* is the only species reported annually and considered as a regular user of Irish waters. Sightings suggest that they move into Irish waters from the south and west before migrating north, around the west coast of Ireland or through the Irish Sea (Pierpoint, 2000). It is likely that they follow swarms of jellyfish, their main prey species, into Irish waters (Reeds, 2004). Rogan *et al.* (2018a) recorded three leatherback turtles over a two-year period, all in the summer and all over the continental shelf. Leatherback turtles are found circumglobally, comprising of seven subpopulations that are managed as separate Regional Management Units (RMUs). They have large foraging ranges that extend to sub-polar and temperate latitudes, and nest on tropical sandy beaches (Wallace *et al.,* 2013). They are the only marine turtle adapted to cold water, being able to maintain elevated body temperatures of around 25.5°C in cold waters (Paladino *et al.,* 1990).

Loggerhead turtles *Caretta caretta* and Kemp's Ridley turtles *Lepidochelys kempii* occur less frequently, typically thought to be carried north by adverse weather conditions. Most records of this species are from strandings data, most frequently recorded during the winter and spring and appearing cold-stunned (Pierpoint, 2000). A single hawksbill turtle *Eretmochelys imbricata* was recorded during a live stranding event in 1984 (O'Riordan *et al.,* 1984). Green turtles *Chelonia mydas* have rarely been sighted or found stranded in Ireland, although they breed in the eastern Mediterranean (Pierpoint, 2000). No species of marine turtles were observed during the aerial surveys (Appendix 11-7, HiDef, 2024).

12.5.2.3.2 Basking shark

Basking sharks are distributed circumglobally from temperate to boreal waters. They are the largest fish present in British waters, usually sighted in the summer around western Ireland, western Scotland, and the central Irish Sea (Wilson *et al.*, 2020). In Ireland, they are predicted to occur in all coastal waters and the western Irish sea, with their abundance estimated around 2,019 no. individuals (Rogan *et al.,* 2018a). Sightings data from IWDG (2024) around the OAA, including the OECC and a 20 km buffer showed 13 confirmed common basking shark sightings in 2023, displaying feeding behaviour. Basking sharks have also been observed in 2024 around the Aran Islands and around the coast of county Clare (IWDG, 2024), suggesting that basking sharks are likely to be present in the area. Site-specific surveys (Appendix 11-7, HiDef, 2024) identified low numbers of basking sharks, with only two observations made in April and August 2022 (Figure 12-5 a&b).

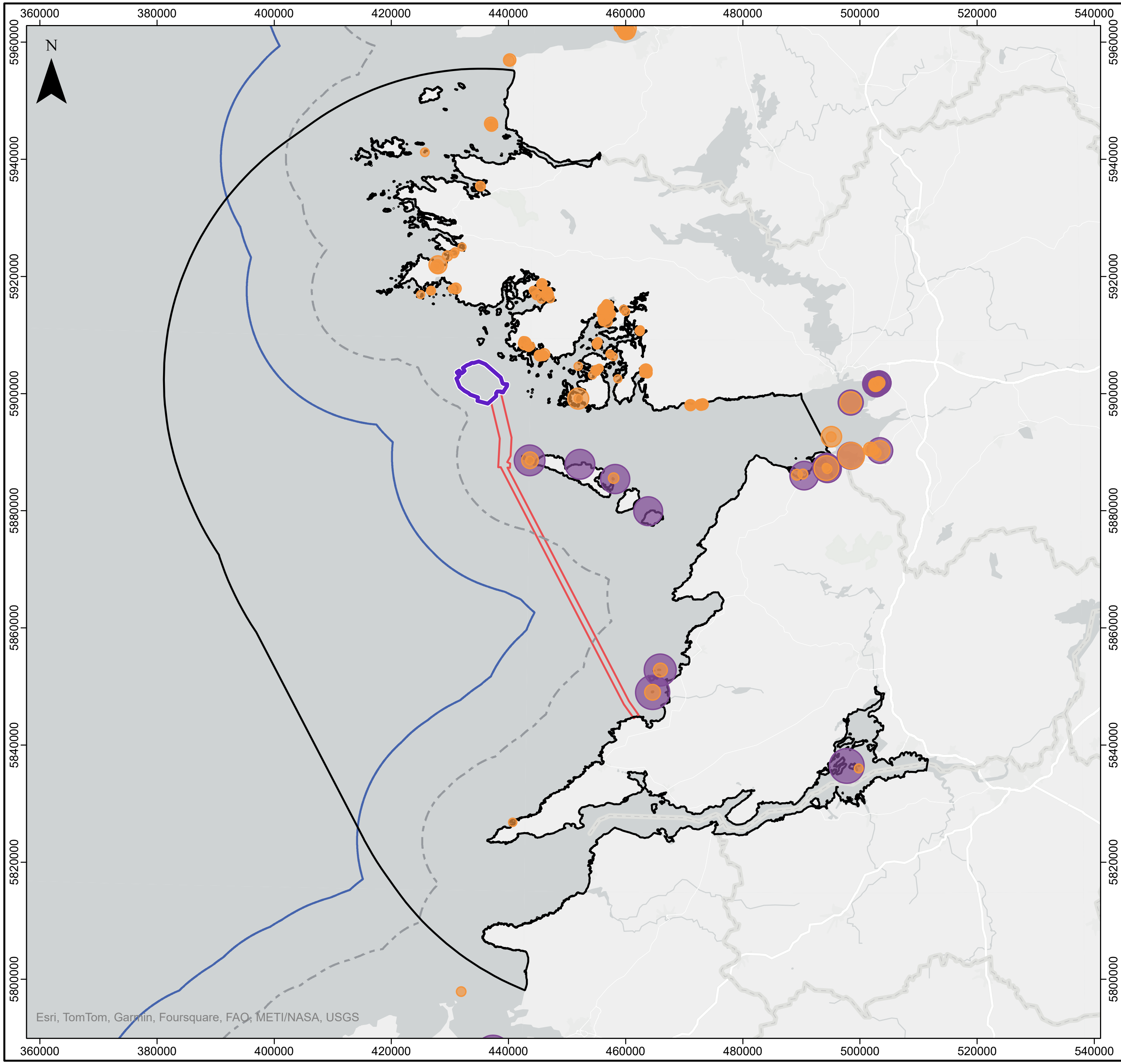
The species have a wide distribution range and move through multiple jurisdictions, meaning varied management strategies are in place. They are protected under Ireland's Wildlife Act 1976 to 2021 and listed in Appendix I and II of the Convention for Migratory Species (CMS).

Ecology and distribution

Harbour seals are distributed widely across the northern hemisphere, from polar to temperate regions. They are one of the most widespread pinnipeds, and are split into five subspecies: Eastern Atlantic, Western Atlantic, Eastern Pacific, Western Pacific, and Ungava harbour seal.

The UK and Ireland represent an important population centre, accounting for approximately 36% of the global pup production of harbour seals (SCOS, 2020). Harbour seals haul out in land during breeding, weaning, and moulting, after which they will largely remain at sea. They have high fidelity to their haul out sites, and most are used daily based on tidal cycles (Lowry, 2016; SCOS, 2021). Birthing happens in June and July, followed by moulting in August (SCOS, 2021). During lactation, harbour seals will undertake foraging trips as their breeding and moult cycles are asynchronous and due to the requirement to provide adequate milk for their pup (Thompson *et al.,* 1994; Bowen *et al.,* 2001). Pups can swim within a few hours of birth but will remain with their mother until they wean after 3 to 4 weeks (Harris & Yalden, 2008). Harbour seals forage at shallow depths of between 10-50 m, mainly over sandy seedbed (Tollit *et al.*, 1998).

Harbour seals are found around the entire coast of Ireland, with the greatest proportion (41%) on the western side, where the key breeding and non-breeding haul-out sites are located (Morris & Duck, 2019; NPWS, 2023a). They prefer sheltered areas that are not subject to human disturbance, such as estuaries and sandflats (Figure 12-8). Thirteen SACs are designated for the protection of harbour seals within Ireland. Counts of harbour seals in designated SACs are presented in section 12.5.2.4.2.



SCEIRDE ROCKS WINDFARM
Feirm Ghaoithe Charraigeacha Sceirde

LEGEND

Offshore Array Area
Offshore Export Cable Corridor
Study Area (50km)
Ireland 6 NM limit
Ireland 12 NM Limit

2017 Aerial thermal survey seals sightings
1
10
50
100

2012 Aerial survey of seals sightings
1
10
50
100

0 6 12 nm
0 10 20 km

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PROJECT TITLE
Sceirde Rocks

MAP TITLE
Harbour Seal Haul Outs

VER	REMARKS	DATE	Drawn	Approved
1	DRAFT	06/12/2024	BQ	EE

DRAWING NO
Figure 12-8

SCALE	PAPER SIZE	DATUM	PROJECTION
1:950,000	A4	WGS 84	UTM 29N

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12.5.2.3.3 Eurasian otter

The majority of other mammals listed in the Annex IV of the Habitats Directive are terrestrial, and therefore will not be impacted by offshore development. However, the Eurasian otter *Lutra lutra* (also known as the European otter), although listed as a terrestrial mammal on Annex IV of the Habitats Directive, occupies marine habitat and uses the nearshore coastal waters in some parts of Ireland. There are several SACs along the coast of West Ireland designated to the Eurasian otter (see section 12.5.2.4.3).

The Eurasian otter is listed in Habitats Directive Annexes II (requiring designation of SACs) and IV (species requiring strict protection). Ireland has long been considered to hold one of the most important remaining populations of Eurasian otter in Western Europe and surveys carried out in the early 1980s and again in the early 1990s confirmed the species to be widespread throughout the country. Populations in coastal areas utilise shallow, inshore marine areas for feeding but also require fresh water for bathing and terrestrial areas for resting and breeding holts.

The most recent national otter survey was undertaken in 2010 and 2011 by the NPWS and reported by Reid *et al.* (2013). The outcomes of this national survey indicate that otters occur throughout Ireland, including in the Shannon and Western River Basin Districts (RBDs). Survey sites along the coast near to the OAA, including on Lettermullan and Errisbeg, showed otter occurrence, as well as the majority of sites along the coast of Galway Bay and towards the Shannon estuary. Otter occurrence across Ireland declined between 2004/05 and 2010/11 by a rate of 1.5 – 2.0% per year, although their range had increased. Overall, the conservation status of otters was judged to be in Favourable or 'Good' status due to available habitat and a lack of pressures at survey sites. Future prospects for the species were judged favourable considering the widespread nature of otters and no significant threats at the regional and national level. The next National Otter Survey is planned for 2023-2024 (final report expected in 2025).

The research into coastal otters diet in Ireland indicate that those individuals which inhabit the coastal marine waters feed predominantly on species such as rocklings (*Gadidae*), wrasse (*Labridae*), Crustacea, Mollusca, Atlantic eel, goby (*Gobiidae*), sea scorpions (*Cottidae*) and blennies, but they also travel inland to estuaries to feed on brackish or freshwater food resources (Reid *et al.,* 2013).

Because otters in the marine environment are restricted to a highly coastal distribution (<1 km from the shore), the intervening distance between the Offshore Site and the coast (typically >5 km) means that direct impacts to otter are very unlikely; nevertheless the species has been further considered in this chapter.

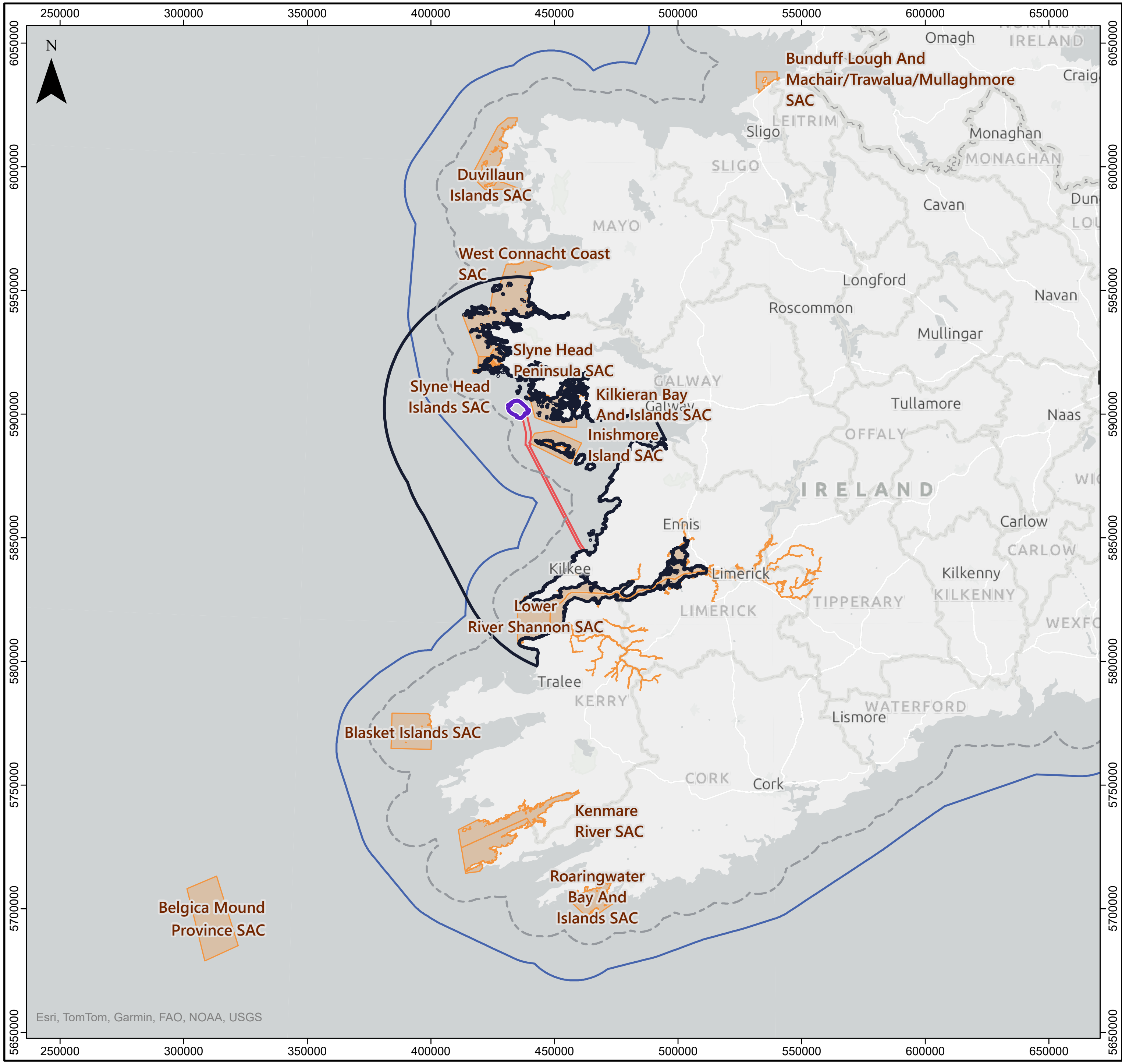
12.5.2.4 Protected Sites

12.5.2.5 Protected sites considered relevant to the impact assessment of the proposed Project activities have been identified for cetaceans, pinnipeds, and otters. Rather than straight-line distances, at-sea distances to these sites from the Project are calculated, which represent the most optimal route around land features as no meaningful travel by land is expected for the relevant receptors of this Chapter. The 'at-sea distances' have been calculated from the mean high-water springs (MHWS) limit, and will be greater than a straight-line measurement, but have more biological meaning, thus these at-sea distances will be used for the purposes of this assessment.

12.5.2.5.1 Protected sites with cetacean features

There are several protected sites with designated cetacean features that are considered relevant to the Offshore Site, due to its location and the amount of MUs that overlap (Figure 12-9). Relevant sites on the west coast of Ireland are shown on Figure 12-9 below and listed in Table 12-22. This map includes

SACs to which bottlenose dolphin, harbour porpoise or both were added as Qualifying Interests in 2024.



SCEIRDE ROCKS WINDFARM

Feirm Ghaoithe Charraigeacha Sceirde

LEGEND

- Offshore Array Area
- Offshore Export Cable Corridor
- Study Area
- Ireland 6 NM limit
- Ireland 12 NM Limit
- Cetacean SACs

0 10 20 nm

0 25 50 km

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PROJECT TITLE

Sceirde Rocks

MAP TITLE

Cetacean Special Areas of Conservation

VER	REMARKS	DATE	Drawn	Approved
1	DRAFT	06/12/2024	BQ	EE

DRAWING NO

Figure 12-9

SCALE	PAPER SIZE	DATUM	PROJECTION
1:2,250,000	A4	WGS 84	UTM 29N

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The nearest protected sites to the Offshore Site are the Kilkieran Bay and Islands SAC and Inishmore Island SAC located <5 km from the Offshore Site to which harbour porpoise were added as qualifying interests (NPWS, 2024). Population estimates within these SACs are currently not available.

The Slyne Head Islands SAC, which is located 13.4 km north. This site is in County Galway and covers the western shores and southwestern tip of the Slyne Head Peninsula. It has been designated for the protection of bottlenose dolphins and grey seals. Groups of bottlenose dolphin are present and are likely part of a larger population of around 177-337 individuals from the north and west coasts of Connacht. The SAC also supports an important breeding colony of grey seals, estimated at 238-306 no. individuals in 2005 (NPWS, 2019a). The nearby Slyne Head Peninsula SAC is also an important site for bottlenose dolphin, supporting groups that are also part of the larger population (NPWS, 2019c).

The West Connacht Coast SAC, approximately 22.7 km away from the Offshore Site, is designated to protect bottlenose dolphin which occur within the site in all seasons and is key habitat for the population within Irish waters (Table 12-22). It covers a substantial area of marine waters off the west of Ireland, off the coasts of Counties Mayo and Galway. Abundance within this site compares to the Lower River Shannon SAC (estimated 139 no. individuals; Rogan *et al.*, 2018b). Structural linkages between groups of dolphins around the coastal habitats of this site have been established with a degree of site fidelity, and genetic analyses have shown fine scale distinctions between the West Connacht Coast SAC and animals sampled elsewhere (NPWS, 2014b).

The Lower River Shannon SAC is located approximately 27.9 km south of the Project. This site covers a distance of around 120 km, stretching along the Shannon valley from Loop Head/Kerry Head to Killaloe in Country Clare, meaning it encompasses the marine area between Loop Head and Kerry Head, as well as multiple estuaries, freshwater reaches of the River Shannon, the freshwater stretches of the Feale and Mulkear catchments, and the Shannon. It is one of ten designated sites for the protection of bottlenose dolphins in Ireland and contains the only known resident population (see section 12.5.2.1.3). It is also designated for otters, which are commonly found on site (NPWS, 2013b).

The Blasket Islands SAC, located around 90.1 km from the Project, is situated at the end of the Dingle peninsula in County Kerry. It contains the six main Blasket islands, as well as some rocky islets and sea stacks. The SAC is designated for a large population of grey seals, representing one-third of the Irish population. Harbour porpoises are also protected under this SAC, with a population estimate in 2008 of 267-477 no. individuals in 2008. Other cetaceans have been observed at this site, including common dolphin, bottlenose dolphin, Risso's dolphin, killer whale and minke whale (NPWS, 2013a).

Several other SACs lie at greater distances from the Offshore Site, and well outside the Study Area (Table 12-22). Where applicable (i.e. harbour porpoise SACs that lie within the Celtic and Irish Seas MU, and bottlenose dolphin SACs that lie within the West Coast of Ireland MU) these sites are considered in detail in the Natura Impact Statement (NIS) Volume 1.

Table 12-22 SACs designated for the conservation of cetaceans of relevance to the Offshore Site

Site	Country	Qualifying feature of interest	Distance to Offshore Site boundary (km)[1]	Site detail
Inishmore Island SAC	Ireland	Harbour porpoise	<1	- Harbour porpoise were added as a qualifying interest in March 2024.[2]

				› Lies within CIS MU for harbour porpoise.
Kilkieran Bay and Islands SAC	Ireland	Harbour porpoise	1.4	› Harbour porpoise were added as a qualifying interest in March 2024.[2] › Lies within CIS MU for harbour porpoise.
Slyne Head Peninsula SAC	Ireland	Bottlenose dolphin	13.9	› Supports groups of up to 28 individuals, including juveniles; › Groups are part of the larger population of the west and north coasts of Connacht (177-237 no. individuals) (NPWS, 2019c). › Lies within WCI MU for bottlenose dolphin. › Overlaps with marine mammal Study Area.
Slyne Head Islands SAC	Ireland	Bottlenose dolphin	16.8	› Supports groups of up to 12 individuals, including juveniles; › Groups are part of the larger population of the west and north coasts of Connacht (NPWS, 2019a). › Lies within WCI MU for bottlenose dolphin. › Overlaps with marine mammal Study Area.
West Connacht Coast SAC	Ireland	Bottlenose dolphin Harbour porpoise	22.7	› Supports a minimum of 123 bottlenose dolphin individuals, and up to 150-200; › Large group sizes of bottlenose dolphins have been recorded (50-65), with frequent sightings of calves (NPWS, 2014b). › Lies within WCI MU for bottlenose dolphin. › Overlaps with marine mammal Study Area.
Lower River Shannon SAC	Ireland	Bottlenose dolphin	27.9	› Supports an estimated 140 individuals (2006) (NPWS, 2013b). › Some Project activities may take place within the Shannon estuary, so this site is considered to have ecological connectivity with the Project.

				Overlaps with marine mammal Study Area, although a different MU to the Offshore Site.
Blasket Islands SAC	Ireland	Harbour porpoise	90.1	Supports an estimated 267-477 individuals (2008) (NPWS, 2013a). Lies within CIS MU for harbour porpoise.
Duvillaun Islands SAC	Ireland	Bottlenose dolphin	91.5	Groups of 2-20 individuals observed including calves, with all observation occurring in April (NPWS, 2019e). Lies within WCI MU for bottlenose dolphin.
Kenmare River SAC	Ireland	Harbour porpoise	139.3	Harbour porpoise were added as a qualifying interest in March 2024.[2] Lies within CIS MU for harbour porpoise.
Hook Head SAC	Ireland	Harbour porpoise Bottlenose dolphin	189.1	Harbour porpoise and bottlenose dolphin were added as qualifying interests in March 2024.[2] Lies within WCI MU for bottlenose dolphin. Lies within CIS MU for harbour porpoise.
Belgica Mound Province SAC	Ireland	Harbour porpoise Bottlenose dolphin	197.9	Harbour porpoise and bottlenose dolphin were added as qualifying interests in March 2024.[2] Lies within CIS MU for harbour porpoise.
Roaringwater Bay And Islands SAC	Ireland	Harbour porpoise	198.3	Supports an estimated 117-201 individuals (2008) (NPWS, 2014c). Roaringwater Bay may be one of the most important sites in Ireland for Harbour Porpoise, as they are regularly sighted in the bay. Lies within CIS MU for harbour porpoise.
Gweedore Bay and Islands SAC	Ireland	Harbour porpoise	214.5	Harbour porpoise were added as a qualifying interest in March 2024.[2]

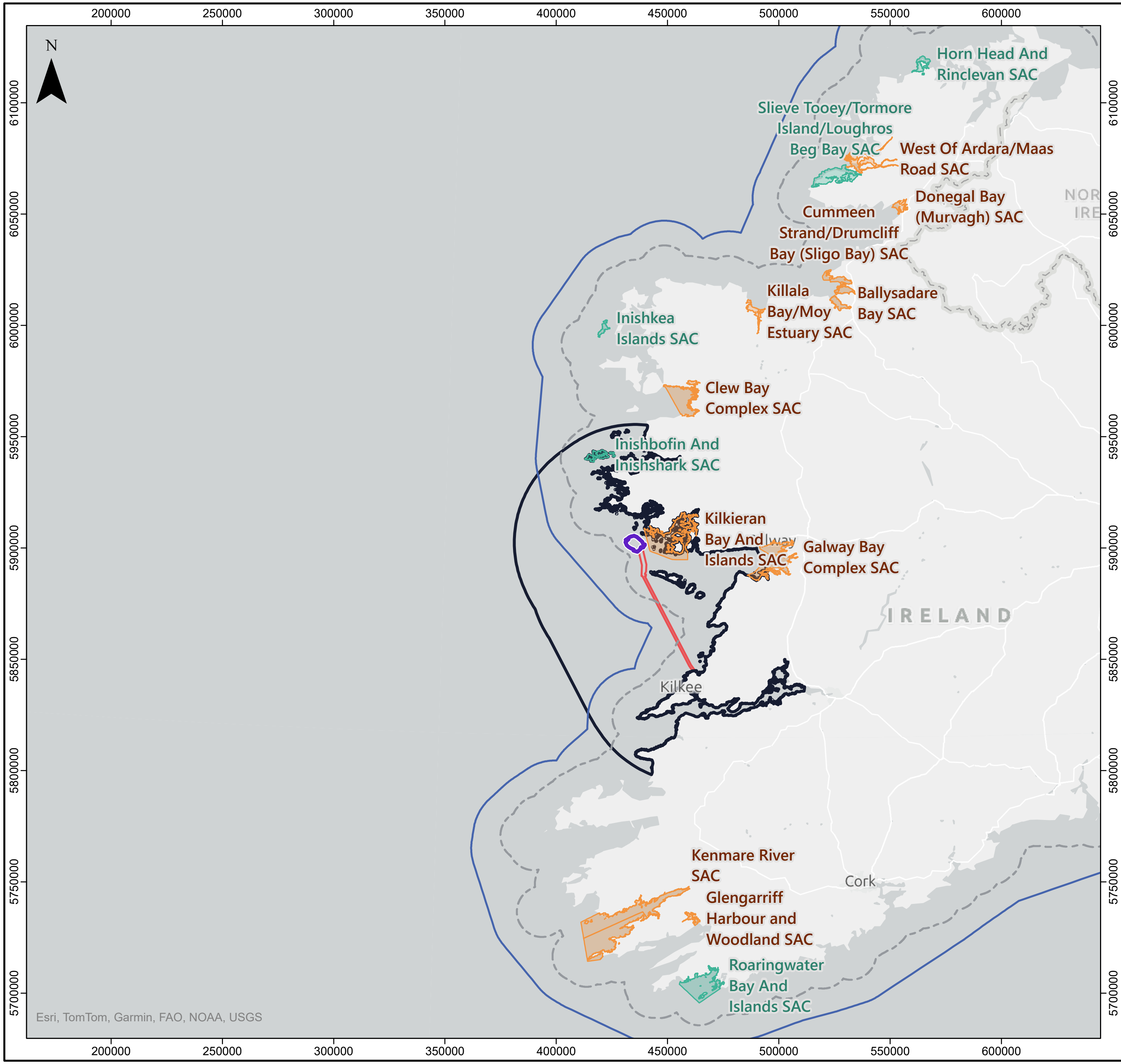
				Lies within CIS MU for harbour porpoise.
Bunduff Lough and Machair/Trawalua/Mullaghmore SAC	Ireland	Harbour porpoise	218.1	Harbour porpoise were added as aqualifying interest in March 2024.[2] Lies within CIS MU for harbour porpoise.
St. John's Point SAC	Ireland	Bottlenose dolphin	219.2	Bottlenose dolphin was added as a qualifying interest in March 2024.[2] Lies within WCI MU for bottlenose dolphin
Carnsore Point SAC	Ireland	Harbour porpoise	220.9	Harbour porpoise were added as a qualifying interest in March 2024.[2] Lies within CIS MU for harbour porpoise.
Blackwater Bank SAC	Ireland	Harbour porpoise	227.9	Harbour porpoise were added as a qualifying interest in March 2024.[2] Lies within CIS MU for harbour porpoise.
Lough Swilly SAC	Ireland	Harbour porpoise	235.7	Harbour porpoise were added as a qualifying interest in March 2024.[2] Lies within CIS MU for harbour porpoise.
Codling Fault Zone SAC	Ireland	Harbour porpoise	267.5	Harbour porpoise were added as a qualifying interest in March 2024.[2] Lies within CIS MU for harbour porpoise.
North Channel SAC	Northern Ireland	Harbour porpoise	450.8	European Site in Northern Irish waters. Lies within CIS MU for harbour porpoise.
West Wales Marine / Gorllewin Cymru Forol SAC	Wales	Harbour porpoise	472.9	European Site in Welsh waters. Lies within CIS MU for harbour porpoise.
North Anglesey Marine / Gogledd Môn Forol SAC	Wales	Harbour porpoise	569.2	European Site in Welsh waters. Lies within CIS MU for harbour porpoise.

Nord Bretagne DH	France	Harbour porpoise	618.6	European Site in French waters. Lies within CIS MU for harbour porpoise.
Ouessant-Molène	France	Harbour porpoise	638.8	European Site in French waters. Lies within CIS MU for harbour porpoise.
Abers - Côte des légendes	France	Harbour porpoise	653.8	European Site in French waters. Lies within CIS MU for harbour porpoise.
Lambay Island SAC	Ireland	Harbour porpoise	661.0	Harbour porpoise were added as a qualifying interest in March 2024.[2] Lies within CIS MU for harbour porpoise.
Chaussée de Sein	France	Harbour porpoise	664.6	European Site in French waters. Lies within CIS MU for harbour porpoise.
Côte de Granit rose-Sept-Iles	France	Harbour porpoise	676.8	European Site in French waters. Lies within CIS MU for harbour porpoise.
Baie de Morlaix	France	Harbour porpoise	679.2	European Site in French waters. Lies within CIS MU for harbour porpoise.
Côtes de Crozon	France	Harbour porpoise	683.7	European Site in French waters. Lies within CIS MU for harbour porpoise.
Récifs et landes de la Hague	France	Harbour porpoise	770.9	European Site in French waters. Lies within CIS MU for harbour porpoise.
Anse de Vauville	France	Harbour porpoise	771.6	European Site in French waters. Lies within CIS MU for harbour porpoise.
Banc et récifs de Surtainville	France	Harbour porpoise	772.9	European Site in French waters.

				Lies within CIS MU for harbour porpoise.
[1]Distance has been taken as the 'least cost path' of travel by sea for pinnipeds, which does not consider the straight-line distance to each site or the minimum distance an individual would travel between the OAA and the protected site. [2] No detail information on harbour porpoise and/or bottlenose dolphin populations has been provided by NPWS as of time of preparing assessment.				

12.5.2.5.2 Protected sites with pinniped features

There are 13 SACs with harbour seals as designated features around the coast of Ireland, and 10 SACs designated for grey seals (Figure 12-10). Relevant sites on the west coast of Ireland (i.e. between Malin Head, Co. Donegal and Cape Clear Island, Co. Cork) are listed in Table 12-23.



SCEIRDE ROCKS WINDFARM

Feirm Ghaoithe Charraigeacha Sceirde

LEGEND

- Offshore Array Area
- Offshore Export Cable Corridor
- Study Area
- Ireland 6 NM limit
- Ireland 12 NM Limit
- Harbour Seal SACs
- Grey Seal SACs

0 10 20 nm

0 30 60 km

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PROJECT TITLE

Sceirde Rocks

MAP TITLE

Pinniped Special Areas of Conservation

VER	REMARKS	DATE	Drawn	Approved
1	DRAFT	06/12/2024	BQ	EE

DRAWING NO

Figure 12-10

SCALE	PAPER SIZE	DATUM	PROJECTION
1:2,500,000	A4	WGS 84	UTM 29N

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Table 12-23 Designated sites with pinniped features relevant to the Project (NPWS)

Site	Qualifying feature of interest	Distance to Offshore Site boundary (km)[1]	Site detail
Kilkieran Bay and Islands SAC	Harbour seal	5	Maximum count of 116 in 2003; Grey Seal is a regular visitor and may breed.
Slyne Head Islands SAC	Grey seal	16.8	Supports an important breeding colony estimated at 238-306 individuals in 2005; A one-off moult count in 2007 gave a figure of 162 seals.
Kenmare River SAC	Harbour seal	188.3	Holds an important population with a maximum count of 391 in 2003.
Killala Bay/Moy Estuary SAC	Harbour seal	191.7	Maximum count of 108 in 2003.
Roaringwater Bay and Islands SAC	Grey seal	198.3	Present at the site throughout the year during breeding, moulting, non-breeding, foraging and resting phases; A minimum population was estimated at 116-149 in 2005.
Cummeen Strand/Drumcliff Bay (Sligo Bay) SAC	Harbour seal	219.7	Supports a breeding population.
Ballysadare Bay SAC	Harbour seal	227.2	Maximum count of 257 in 2003.
Slieve Tooey/Tormore Island/Loughros Beg Bay SAC	Grey seal	229.8	Supports a breeding population of 868-1116 individuals (in 2005), using sea caves to breed; A one-off moult count in 2007 gave a figure of 92 seals.
West of Ardara/Maas Road SAC	Harbour seal	250.0	Maximum count of 59 in 2003.
Glengarriff Harbour and Woodland SAC	Harbour seal	259.7	Supports the largest colony of harbour seals in the south-west of Ireland; Maximum count of 151 in 2003.
Donegal Bay (Murvagh) SAC	Harbour seal	260.0	Maximum count of 148 2003.

Rutland Island and Sound SAC	Harbour seal	260	Maximum count of 202 in 2003.
Horn Head and Rinclevan SAC	Grey seal	299.1	Supports a small breeding population of four to five individuals (estimate from 2005).
Inishbofin and Inishshark SAC	Grey seal	38.2	Supports a breeding population of 749-963 individuals (in 2005); A one-off moult count in 2007 gave a figure of 270 seals.
Galway Bay Complex SAC	Harbour seal	43.2	Provides extensive good quality habitat in the Inner Galway Bay; Maximum count of 317 in 2003; A range of haul-out sites are found throughout the bay.
Clew Bay Complex SAC	Harbour seal	78.5	95 individuals were recorded in August 2003 during a national aerial survey; Land-based monitoring within the site recorded 121 seals in August 2009 and 118 in August 2010.
Blasket Islands SAC	Grey seal	90.0	Supports one of the largest populations in Ireland, around one third of the total Irish population (648-833 breeding in 2005; one-off moult count of 989 seals in 2007); Breed on boulder beaches and caves on several of the islands.
Duvillaun Islands SAC	Grey seal	91.5	Supports an important breeding colony estimated at 648-833 individuals in 2005.
Inishkea Islands SAC	Grey seal	94.0	Supports an important breeding colony estimated at 665-855 individuals in 2005; A one-off moult count in 2007 gave a figure of 1,742 seals.

12.5.2.5.3 Protected sites with otter features

Due to their high protected status, Eurasian otters are designated features of 45 no. SACs around Ireland. An Otter Threat Response Plan was published in 2009 by the NPWS, setting a target of 88% occupancy in SACs designated for otters, and no less than 77% outside SACs (NPWS, 2009). Only SACs for otters that overlap with the Offshore Site would be considered because of the restricted range of otter in the marine environment and the distance that the Offshore Site lies from the nearest coast. The Offshore Site does not directly interact with any SAC designated for the conservation of Eurasian otter.

12.5.3 Summary

Four cetacean species identified in the Study Area are taken forward for assessment, based on their occurrence and abundance within the area. All of which are protected as EPS under Annex IV of the Habitats Directive, amongst other legislation (see Section 12.2), the following species are noted as being present in the area :

- Harbour porpoise, designated under 28 SAC as noted in Table 12-23,
- Common dolphin;
- Bottlenose dolphin, designated under eight SACs as noted in Table 12-23,
- Minke whale.

Harbour seals and grey seals are observed within and in the vicinity of the Offshore Site. Both seal species are protected under Annex II of the Habitats Directive, as well as other Irish legislation and policy. Additionally, basking sharks and leatherback turtles may be present within the Study Area and are hereafter referred to as 'other megafauna' unless otherwise specified. There are also multiple SACs designated for the protection of marine mammal and other megafauna receptors that are considered in this chapter.

12.6 Likely Significant Effects and Associated Mitigation Measures

12.6.1 Do Nothing Scenario

The 'do nothing' scenario is a consideration of the baseline if the Project was not developed. This section therefore predicts the future baseline scenario for the marine mammal and other megafauna within the Study Area in the absence of the Project.

The baseline description for marine mammals and other megafauna within the Study Area has been detailed in Section 12.5. The abundance and distribution of marine megafauna, marine turtles and smaller mammals (i.e. otters) continuously changes in response to environmental and anthropogenic pressures, which may alter their future distributions across the Study Area.

A description of the future marine climate is provided in Chapter 27: Climate. The main effects of climate change on marine mammals are expected to relate to changes in prey availability and distribution. Changes in prey species distribution because of changing sea temperature and salinity may lead to localised or broad-scale changes to marine mammal and other megafauna distributions over the Project's life cycle. Key timings in the lifecycles of prey species, such as sand eel and sprat, are becoming mismatched with phytoplankton blooms, meaning the recruitment of these prey species is declining (van Deurs *et al.*, 2009). Shifts in these proportions and in the timings of spawning will cause changes in the distribution of marine mammal species that rely on this prey, such as harbour porpoise, which were already observed in the early 2000s (Hammond *et al.*, 2008; Pinnegar & Heath, 2010; Hammond *et al.,* 2021). Changes in commercial fish species have been observed, where warm-water species are moving northwards, while cold-water species are experiencing declines (Wright *et al.*, 2020; EEA, 2022). This will affect the patterns of local fisheries and increase competition for resources between wildlife and humans and will continue to shape the marine megafauna distribution around Ireland. Interactions between seals and the fishing industry have been a continuous issue in Ireland, both due to the competition for resources and operational damage to gear (Cronin *et al.*, 2014), and with a shifting distribution and abundance of prey species, is it likely that it will continue to shift in the future. The future baseline for commercial fishing activity is described in Chapter 13: Commercial Fisheries whilst the future baseline for coastal habitats is described in Chapter 7: Marine Physical

Processes. The future baseline for prey species of marine mammals and megafauna is described in Chapter 11: Fish and Shellfish Ecology.

Climate change effects are difficult to predict, and the complex relationship between anthropogenic impacts and marine fauna make it difficult to have accurate predictions on changes to the current baseline description over the Project's life cycle (see Chapter 27: Climate for further details). It is likely that many prey species will continue to experience changes due to commercial fishing pressure and environmental changes which could impact marine mammals and megafauna species. It is anticipated that these changes are likely to occur regardless of whether the Project proceeds, although forthcoming marine protection legislation (e.g. designation and management of marine protected areas) could slow and limit some declines.

12.6.2 Construction Phase

12.6.2.1 Acoustic effects associated with construction (including pre-construction)

During pre-construction and construction, there is the potential for the generation of underwater sound which may result in injury, mortality, and/or disturbance to marine mammal and megafauna receptors. High amplitude impulsive underwater sound associated with piling activity can have a significant effect on marine mammal and megafauna activity, habitat use and distribution, with potential effects including short term or temporary displacement of marine mammals and megafauna, and even injury. Impact pile driving is considered to be one of the principal sources of underwater construction sound associated with offshore wind farm developments; however, no method of pile driving is proposed as part of the construction of this Project, and as such there is a very limited risk of physiological impacts of construction sound on marine mammal and other megafauna species. However, some construction activities do generate underwater sound, albeit at a lower amplitude ("loudness") than impact piling. These have the potential to cause injury, disturbance and/or displacement and include:

- Pre-construction geophysical and geotechnical surveys;
- Construction sound, such as cable laying, rock placement, and trenching; and
- UXO clearance.

A Foreshore Licence was granted on the 5th of September 2023 for the pre-construction surveys associated with site investigations. The associated Environmental Assessment (EA) Report considered sound sources from Ultra Low Baseline Positioning System (USBL), sub-bottom profiling (SBP), and Ultra High Resolution Seismic (UHRS) equipment. The assessment concluded that there are no likely significant residual effects from injury and disturbance resulting from sound during site investigations on any populations of marine mammals, turtles, and fish species, following mitigation. Mitigation measures for marine mammal and megafauna receptors have been incorporated into the design of site investigation surveys, including:

- Marine mammal monitoring using a qualified MMO to monitor marine mammals and log all relevant events. The MMO will carry out visual observations before the soft start commences and will recommend delays in the commencement of site investigations should any species be detected;
- A mitigation zone of 1,000 m around the UHRS sound source and a 500 m radial distance around the SBP sound source will be used. Should any marine mammal species be detected within the monitored zone, the acoustic survey will not commence until the animals have moved out of the relevant mitigation zone or the transit of the survey vessel takes it away from them;
- A soft start (i.e. a gradual ramping up of power over time) will be conducted to give any marine mammals adequate time to leave the area;

- Where the duration of a survey line or station change is greater than 40 minutes, the activity will, on completion of the line/station being surveyed, either cease or undergo a reduction in energy output to a lower state;
- If there is a break in sound output for a period of 5-10 minutes, MMO monitoring will be undertaken to check that no marine mammals are observed within the Monitoring Zone;
- Reporting by the MMO will follow standard guidance (DAHG, 2014) and will be completed within 30 days of completion of any geophysical survey activity; and
- Project vessels will be moving at a maximum speed of approximately 5 knots during surveys to allow marine mammal species to move away from vessels.

As basking sharks do not have the same hearing capacities as marine mammals and are less vulnerable to injury or behavioural effects from underwater sound (Popper *et al.,* 2014), the potential for effects has been assessed separately to marine mammals at the end of this section.

12.6.2.1.1 *Injury to marine mammals from construction sound*

Description of effect

Underwater sound is considered to affect marine mammals when the frequency of the sound is within the hearing range of the individual (defined in Southall *et al.*, 2019; Table 12-24) and exceeds a threshold for disturbance or injury.

Table 12-24 Marine mammal functional hearing groups based on their generalised hearing sensitivity (Southall et al., 2019)

Hearing group	Species	Generalised hearing range	Peak sensitivity (kHz)	Region of greatest sensitivity (kHz)
Low-frequency (LF)cetaceans	Baleen whales, including minke whale	7 Hz - 35 kHz	-	0.2 – 19
High-frequency (HF) cetaceans	Dolphins, toothed whales, beaked whales, and bottlenose whales, including common dolphin and bottlenose dolphin	150 Hz - 160 kHz	58	8.8 – 110
Very high-frequency (VHF) cetaceans	Including harbour porpoise	275 Hz - 160 kHz	105	12 – 140
Phocid carnivores in water (PCW)	Including harbour seal, grey seal	50 Hz - 86 kHz	13	1.9 – 30

Sound thresholds are the levels of sound that could result in disturbance or injury, based on the nature of the sound (impulsive vs. non-impulsive) and the type of injury, which can include Permanent Threshold Shift (PTS), where a permanent shift in hearing sensitivity occurs at certain frequencies and is assumed to be irreversible; or Temporary Threshold shift (TTS), which is a temporary reduction in hearing sensitivity at certain frequencies.

Neither PTS or TTS are analogous to complete deafness and will only likely result in significant biological effects when the shift in sensitivity occurs within the most sensitive hearing range, at a level where an animal can no longer rely on hearing for communication, orientation in its environment and navigation. More commonly, PTS/TTS manifests as a "notch" in hearing sensitivity in part of the hearing range which may fall within or outside the most biologically important frequencies.

The level of injury is calculated based on defined thresholds for each functional hearing group (Table 12-24). The PTS-onset impact ranges are calculated for unweighted peak Sound Pressure Level (SPL_{peak}, now commonly referred to as $L_{p,pk}$), which is a measure of sound intensity from a single pulse causing instantaneous PTS, and cumulative Sound Exposure Level (SEL, now commonly referred to as $L_{E,p}$), which is a metric of the combined total of sound exposure over a standard time period (defined here as 24 hours; Appendix 12-1; Subacoustech, 2024). The sound generated during construction, including cable laying, vessel sound, rock dumping, and trenching, is considered non-impulsive (of continuous nature). Therefore, the criteria for construction sound only considers cumulative SEL ($L_{E,p}$) for PTS and TTS (Table 12-25), rather the peak pressure levels more relevant to impulsive sound sources.

Table 12-25 Cumulative SEL ($L_{E,p}$) criteria for non-impulsive sound (Southall, et al., 2019)

	$L_{E,p}$ (dB re 1 µPa^{2}s)	
Hearing group	Cumulative PTS	Cumulative TTS
LF Cetaceans	199	179
HF Cetaceans	198	178
VHF Cetaceans	173	153
PCW	201	181

Characterisation of unmitigated effect

Underwater sound propagation modelling was undertaken by Subacoustech (2024; see Appendix 12-1) to determine impact ranges of construction activities that may injure marine mammals, including rock placement, trenching, and cable laying. The non-impulsive sound criteria (Southall et al., 2019) were used to account for the different hearing sensitivities of each marine mammal group due to the low source levels associated with each activity. A comparison of the estimated unweighted (i.e. without consideration of the frequency-dependent hearing sensitivity of each hearing group) source levels for the different construction sound sources is provided in Table 12-26. The modelling approach, while accurate and appropriate for the modelled sound sources, assumes that the animal remains stationary for 24 hours in relation to the sound source due to the low sound levels generated by the activities and it therefore cannot be assumed that the animal would swim away, which is considered highly precautionary and extremely unlikely.

Table 12-26 Estimated unweighted source levels for construction sound activities (Appendix 12-1; Subacoustech, 2024)

Sound source	Estimated Unweighted Source Level dB re 1 µPa @ 1 m (RMS)	Notes
Cable laying	171	Based on 11 datasets from a pipe laying vessel measuring 300 m in length; this is considered a loudest sound source for cable laying operations.

Rock placement	172	Based on four datasets from rock placement vessel '*Rollingstone*'.
Trenching	172	Based on three datasets of measurements from trenching vessels more than 100 m in length.
Vessel sound (large)	168	Based on five datasets of large vessels including container ships, FPSOs and other vessels more than 100 m in length. Vessel speed assumed as 10 knots.
Vessel sound (medium)	161	Based on three datasets of moderate sized vessels less than 100 m in length. Vessel speed assumed as 10 knots.

The greatest modelled impact range for injury to a stationary animal during rock placement occurs where an individual of the VHF cetaceans' group (i.e. harbour porpoise) must remain within 900 m of the activity for 24 hours to experience PTS. The largest impact range for TTS was 13 km, based on 24-hour exposure for VHF cetaceans during rock placement. This model assumes that the animal remains stationary for 24 hours, which is highly precautionary and extremely unlikely to occur. Overall, the effect is expected to occur over a highly localised extent, with a small part of the Study Area affected at any one time. Activities during the construction phase are considered to cause a short-term effect, that occurs intermittently, at a low frequency and intensity. It is not expected to have a significant effect on the conservation status or integrity of marine mammal receptors, causing a minor shift to baseline conditions which will cease following completion of construction activities. As such, the effect is defined as being of **low magnitude**.

The sound generated from these types of activity is unlikely to cause any damage to marine mammal auditory systems, as non-piling construction activities are generally below 1 kilohertz (kHz) (Todd *et al.,* 2015), where the hearing sensitivity for most marine mammal receptors is low. The sensitivity of harbour porpoise, dolphins and pinnipeds is relatively poor below 1 kHz (Table 12-23), meaning that they are less susceptible to auditory effects of sound exposure at frequencies below 1 kHz and a PTS at this frequency would not be likely to impact vital rates, and therefore, would have no effect at the population level. Therefore, harbour porpoise, dolphins, and pinnipeds are assessed to be of **low sensitivity.** Minke whale have a higher sensitivity to sounds at frequencies below 1 kHz (Table 12-23), so are more likely to experience PTS at low sound frequencies. Therefore, minke whale are assessed to be of **medium sensitivity.**

Assessment of significance prior to mitigation

Prior to mitigation, the risk of injury on harbour porpoise, dolphins and pinnipeds resulting from construction sound is assessed as a **not significant negative effect** which is Not Significant. Any effects on minke whales resulting from construction sound is assessed as a **slight negative effect** which is Not Significant.

Mitigation

Injury will be fully mitigated during activities generating high-amplitude sounds through the strict implementation of the NPWS guidelines. The design selection of GBS foundations at the OAA results in significantly lower emissions of underwater sound than would occur if piling was employed during the construction, because piling generates high-amplitude impulsive sound which can have a far greater potential for effects on marine mammals. The mitigation measures agreed as part of the Foreshore

Licence for site investigations also apply as measures during construction, for relevant and similar geophysical/geotechnical site investigation activities.

Residual effect following mitigation

Due to the temporary nature of the works and the use of GBS which avoids the effect of sound from piling, and considering the habitat of marine mammals is widespread within the northeast Atlantic and around the UK as a whole, significant effects due to construction sound are not anticipated at this geographical scale during the construction of the proposed Project. Additionally, the modelled impact ranges assume an individual remains stationary for 24 hours which is highly unlikely due to the transient and intermittent nature of the sound, the high mobility of marine mammals, and in most cases, the transient (mobile) nature of the source. Therefore, the residual effect is considered to be a **likely, short-term, occasional**, **not significant negative effect** and is therefore assessed to be Not Significant.

12.6.2.1.2 *Disturbance to marine mammals from construction sound*

Description of effect

Underwater sound can result in a behavioural response, which will depend on factors such as species, individual, time of year, and the type of activity being carried out. Limited data is available on the impacts of behavioural disturbance from non-piling construction activities.

Characterisation of unmitigated effect

The sound generated by cable laying, vessel sound, rock dumping and trenching are considered continuous. The estimated impact range of disturbance related to construction sound (Table 12-27) was modelled using the NOAA (2005) criteria for behavioural disturbance for a continuous sound source (Appendix 12-1; Subacoustech, 2024), defined as a threshold of 120 dB (NMFS, 2018).

Table 12-27 Impact ranges related to construction sound using the NOAA (2005) criteria for behavioural disturbance on marine mammals, using the $L_{p,\,RMS}$ metric

Activity	Estimated impact range (m)
Cable laying	8,400
Trenching	6,400
Rock placement	9,100

Rock placement was identified as producing the greatest disturbance impact range, predicting that marine mammals will experience behavioural disturbance if they are within 9.1 km of the activity. Specific information on the effects of non-piling activities is limited, as non-piling construction activities generally tend to be confounded with the presence of vessels which also cause displacement of marine mammals due to acoustic disturbance, and these effects are thus difficult to separate (Anderwald *et al.*, 2013; Todd, *et al.,* 2015). The effect of non-piling construction activities is not well studied, as most studies focus on the impacts of piling. The available literature suggests that displacement due to construction activities anticipated at the Offshore Site is likely to occur on a small spatial scale and will be of temporary nature. For example, studies on the effect of dredging sound show that harbour porpoises and harbour seals experience no risk of incurring auditory injury (e.g. PTS) and estimate that behavioural avoidance can occur between 400 m – 5 km (McQueen *et al.,* 2020). These estimates were highly conservative and concluded that behavioural avoidance by harbour porpoise was not considered significant. For harbour porpoise, monitored during the construction and installation of the Beatrice and Moray East OWFs (excluding piling), occurrence decreased by up to 17% although individuals were still regularly detected throughout the construction period (Benhemma-Le Gall *et al.*, 2021). Once animals moved away from the source of disturbance, they appeared to resume normal behavioural activities, showing an ability to compensate for disturbance. Overall, the effect is expected to occur intermittently, over a local extent, with a small part of the Study Area affected.

Studies on harbour seals have shown that no significant displacement occurs during the construction of a wind farm, apart from during piling activities, with seal distribution returning to normal after two hours from piling cessation (Russell *et al.*, 2016). Modelling carried out for Moray East, an OWF in the Moray Firth, Scotland, assessed the potential for disturbance to marine mammals due to various types of construction activities. It was predicted that for a sound threshold initiating a strong avoidance reaction, impact ranges varied from 220 m for cable laying, 550 m for rock placement, 640 m for trenching, and 200 m for vessel-related sound (Moray Offshore Renewables Ltd., 2012). Culloch *et al.* (2016) assessed the effects of construction-related activities and vessel traffic related to the construction of a pipeline in northwest Ireland and suggested that minke whale and harbour porpoise were influenced by construction-related activities, but no evidence of impacts on common dolphins were detected. Conversely, vessel presence reduced common dolphin occurrence, while that had no effect on harbour porpoise and minke whale.

The construction phase is considered to cause a short-term effect, which occurs at a low frequency and intensity. It is not expected to have a significant effect on the conservation status or integrity of marine mammal receptors, causing a minor shift to baseline conditions which will cease following completion of construction activities. As such, the effect is defined as being of **low magnitude**.

Behavioural changes are possible as a result of non-piling construction activities, particularly for species such as LF cetaceans (i.e. minke whales), where these activities may mask communication (Risch *et al.*, 2013; 2014). Considering the capacity of cetaceans to tolerate temporary disturbance or displacement given their mobility, and the results from the above studies across multiple species showing a capacity to compensate for any short-term local disturbance, all relevant species of cetaceans are assessed to be of **low sensitivity** to non-piling construction activities. Based on the monitoring of seal disturbance at OWFs (Russell *et al.*, 2016) showing no displacement effects, and the capacity of seals to return to the area following disturbance, grey and harbour seals are assessed to be of **negligible sensitivity**.

Assessment of significance prior to mitigation

Prior to mitigation, disturbance resulting from construction sound is assessed as a **not significant negative effect** for all marine mammal species which is Not Significant.

Mitigation

The risk of disturbance will be mitigated through the strict implementation of measures including visual observations described within the NPWS guidelines and implemented and adhered to through Appendix 5-6: Marine Mammal Mitigation Protocol, and through good environmental practices with respect to vessel movements which are described in detail in Appendix 5-10: Vessel Management Plan. The use of GBS at the OAA results in significantly lower emissions of underwater sound than would occur if impact pile driving was employed during the construction, which generates high-amplitude impulsive sound which can have far greater effects on marine mammals. The mitigation measures agreed as part of the Foreshore Licence for site investigations also apply as measures during construction.

Residual effect following mitigation

Due to the temporary nature of the works and the use of GBS which remove the effect of sound from piling, and considering the habitat of marine mammals is widespread within the northeast Atlantic as a whole, significant effects due to disturbance from construction sound are not anticipated at this geographical scale during the construction at the Offshore Site. Additionally, the modelled impact ranges assume an individual remains stationary for 24 hours which is highly unlikely due to the transient and intermittent nature of the sound, and the high mobility of marine mammals. Therefore, the residual effect is considered to be a **likely, short-term, occasional**, **not significant negative effect** and is therefore assessed to be Not Significant.

12.6.2.1.3 *Injury to marine mammals from UXO clearance*

Description of effect

UXO clearance may be required prior to construction of the Project, during which an underwater explosion will generate an acoustic pulse of very high peak pressure (an impulsive sound) potentially causing injury (as PTS-onset) to marine mammals. As described in Section 12.6.2.1.1, PTS-onset impact ranges are calculated for an unweighted peak SPL ($L_{p,pk}$) and a cumulative SEL ($L_{E,p}$). $L_{p,pk}$ is calculated as an unweighted sound level, meaning the sound levels have not been adjusted in any way. $L_{E,p}$ is calculated as a weighted sound level, accounting for the hearing ability of different species. The frequency-weighted LE,p takes into account the hearing sensitivity of different groups of marine mammals (i.e. LF, HF, VHF cetaceans; phocid carnivores (seals) in water) and the duration of the sound exposure. PTS-onset ranges for UXO clearance are calculated for Lp,pk, assuming that UXO detonation is defined as an impulsive and single-pulse source.

Sound levels during UXO clearance are affected by multiple factors, including the charge weight (total size of explosive material being detonated), design, age, burial depth etc. The modelling has only considered the charge weight as the variable in its assessment, and no sound mitigation has been included. Should UXO clearance be required, the scenario with the greatest risk for injury would be a high-order detonation, where all explosive materials in the UXO are completely detonated. The modelled maximum largest charge weight for potential UXO items that may be present in the Project area was 800 kg, in addition to a smaller donor charge of 0.5 kg used to initiate the detonation.

However, it must be reiterated that the risk of UXO being discovered (based on surveys undertaken to date) has been assessed as being extremely low, and even if subsequently any UXO were discovered, the primary means of mitigation will be to avoid clearance *in situ*. Based on the risk assessment presented here, it is anticipated that a Regulation 54 (European Communities (Birds and Natural Habitats) Regulations 2011) derogation licence (to injure/disturb Annex IV species) will not be required. However, if any UXO are discovered which cannot be avoided or relocated, then clearance through low-noise methods, e.g. low order deflagration, is the preferred method to minimise sound emissions, and the requirement for a derogation licence will be reconsidered.

Characterisation of unmitigated effect

This section summarises the assessment for injury and disturbance from UXO clearance to marine mammals from all hearing groups as presented in the Underwater Modelling and Assessment report (Appendix 12-1; Subacoustech, 2024). The PTS impact ranges for an impulsive source as a result of UXO clearance are presented in Table 12-28.

Table 12-28 Estimated PTS impact ranges for high order detonation (800 kg charge weight) for relevant marine mammal species using the impulsive, unweighted $L_{p,pk}$ and Weighted $L_{E,p}$ sound criteria from Southall et al. (2019)

Hearing group	Species	Range (km)	
		Unweighted $L_{p,pk}$	Weighted $L_{E,p}$
LF	Minke whale	2.6	11

HF	Common dolphin, bottlenose dolphin	0.84	0.07
VHF	Harbour porpoise	14	1.6
PCW	Harbour seal, grey seal	2.8	2

Should high-order detonation be required, the largest impulsive impact ranges calculated are for VHF cetaceans, where the animal must be within 14 km of an 800 kg charge weight UXO detonation to experience PTS (using the unweighted $L_{p,pk}$ criteria). This assumes that the sound source remains impulsive throughout the entire impact range. When accounting for marine mammal hearing sensitivities (weighted $L_{E,p}$), the highest PTS impact range are predicted for LF cetaceans (including minke whale) within 11 km of the UXO detonation. When using non-impulsive thresholds, the blast wave is assumed to become non-impulsive at a distance further than 3.5 km (Hastie *et al.,* 2019), such that the largest impact range with a potential for PTS is a maximum of 3.5 km.

Overall, the effect is expected to occur over a maximum extent of 3.5 km from the sound source, affecting a part of the Study Area. This effect is expected to be instantaneous, occurring at a low frequency and only prior to or during construction. This effect is therefore considered to be of **medium magnitude**.

Based on the estimated impact ranges for high-order UXO detonation, harbour porpoise would be the most impacted by high-order detonation. The effect is considered to be of very high intensity when considering a high-order detonation, which can lead to injury or death of marine mammals. Controlled explosions generate relatively low frequency sound (< 1kHz; von Benda-Beckmann *et al.*, 2015), with most of the energy being below the sensitivity of harbour porpoise, dolphin and pinnipeds (Table 12-23), meaning that they are less susceptible to auditory effects of sound exposure at frequencies below 1 kHz and a PTS at this frequency would not be likely to impact vital rates, and therefore, would have no effect at the population level. Therefore, all marine mammals except minke whales (LF cetaceans) are assessed to be of **medium sensitivity.** Minke whales, and other LF cetaceans, have sensitivity to lower frequencies, therefore would have a lower ability to tolerate or recover from the effect and are therefore assessed to be of **high sensitivity**.

Assessment of significance prior to mitigation

Prior to mitigation, effects on harbour porpoise, dolphin and pinnipeds are assessed as a **moderate negative effect**. Effects on minke whales are also assessed as **moderate negative**. Effects on all receptors are considered Not Significant.

Mitigation

Initial investigations during pre-construction surveys were conducted to identify potential UXO that may require investigation, in order to avoid, remove, or potentially detonate them. The surveys did not identify any UXO across the Offshore Site, therefore it is not expected that any UXO will require clearance.

In the unlikely event where UXO clearance will be required, high-order clearance is the least preferred method, and all efforts will be made to avoid it. Low order deflagration will be the preferred clearance method used, where clearance of any size of UXO is done using a special donor charge of 0.5 kg which vaporises the explosive material without explosion.

Appendix 5-6: Marine Mammal Mitigation Protocol (MMMP) will be strictly adhered to during both low-order and high-order UXO clearance. This MMMP contains mitigation measures including the use of visual observers to avoid injury and disturbance to marine mammals, and has been developed with full regard to the NPWS (2014) Guidelines and industry good practice from other jurisdictions (UK Government, 2022). The MMMP outlines the protocol for the use of acoustic deterrent devices to temporarily displace animals away from the highest risk (injury) zones, and marine mammal visual and acoustic observers to ensure that there are no marine mammals in close proximity (1,000 metres) of the UXO being cleared.

Residual effect following mitigation

The largest impact range for a low order deflagration is 1.2 km for VHF cetaceans (i.e. harbour porpoise), and <240 m for all other hearing groups. While potential injury from UXO clearance is a permanent change in the hearing threshold of animals with no recovery, a very low number of animals are predicted to be affected based on the densities of species in the area and the mitigation. Based on the high mobility of marine mammals, which will likely move away from the clearance vessels, individuals are not expected to remain in the vicinity of the area. Additionally, MMOs employed on the vessels will ensure that there are no marine mammal and megafauna receptors in the vicinity prior to the start of the operation. The effect is temporary during clearance (only expected to last a few seconds) and will be localised. Considering the habitat of marine mammals throughout the northeast Atlantic and around the UK, and the unlikely presence of UXO within the Offshore Site, significant effects due to UXO clearance are not expected when considering mitigation. Therefore, the residual effect is considered to be an **unlikely, momentary, occasional**, **not significant negative effect** which is Not Significant.

12.6.2.1.4 *Disturbance to marine mammals from UXO clearance*

Description of effect

The sound generated from UXO clearance has the potential to cause a behavioural response from marine mammals.

Characterisation of unmitigated effect

There is limited evidence on the behavioural response of marine mammals to sound generated by UXO clearance. Because an underwater explosion is a momentary effect, whereby elevated sound pressure levels only persist for one or two seconds, it is not likely that this elicits any more than an immediate startle response in marine mammals, as opposed to a disturbance effect lasting several hours. TTS ranges are used as a suitable proxy to assess behavioural disturbance from UXO sound as the sound source is a single impulsive source (Sinclair *et al.,* 2023). Behavioural disturbance was therefore calculated using unweighted $L_{p,pk}$ and weighted $L_{E,p}$ impact ranges for TTS-onset (Table 12-29).

Table 12-29 Estimated TTS impact ranges for high order detonation (800 kg charge weight) for relevant marine mammal species using the impulsive, unweighted $L_{p,pk}$ and Weighted $L_{E,p}$ sound criteria from Southall et al. (2019)

Hearing group	Species	Range (km)	
		Unweighted $L_{p,pk}$	Weighted $L_{E,p}$
LF	Minke whale	4.7	120
HF	Common dolphin, bottlenose dolphin	1.5	0.62
VHF	Harbour porpoise	26	4.2

PCW	Harbour seal, grey seal	5.3	23

Should high-order detonation be required, the largest impact ranges (based on weighted $L_{E,p}$) calculated are for LF cetaceans, where there is the potential for disturbance for up to 120 km of the UXO for a charge weight of 800 kg. This assumes that the sound source remains impulsive throughout the entire impact range, which is not the case as pulsed sounds become less impulsive with increasing distance (Hastie *et al.*, 2019). When using non-impulsive thresholds, the pressure wave is assumed to lose impulsive characteristics at a distance >3.5 km (Hastie *et al.,* 2019), such that the largest impact range with a potential for TTS is a maximum of 3.5 km. This effect is expected to be instantaneous but will not lead to injury or death of marine mammals. This effect is therefore considered to be of **low magnitude**.

JNCC guidance (JNCC, 2020) states that a one-off explosion is unlikely to cause widespread and prolonged displacement, and rather only elicit a startle response. Therefore, it is not expected that disturbance would result in any changes to the vital rates of individuals in a population. The sensitivity of all marine mammals is therefore expected to be **negligible**.

Assessment of significance prior to mitigation

Prior to mitigation, disturbance resulting from UXO clearance is assessed as a **not significant negative effect** for all marine mammal species which is Not Significant.

Mitigation

Initial investigations during pre-construction surveys were conducted to identify potential UXO that may require investigation, in order to avoid, remove, or potentially detonate them. The surveys did not identify any UXO across the Offshore Site, therefore it is not expected that any UXO will require detonation.

In the unlikely event where UXO clearance will be required, high-order clearance is the least preferred method, and all efforts will be made to avoid it. Low order deflagration will be the preferred clearance method used, where clearance of any size of UXO is done using a special donor charge of 0.5 kg which vaporises the explosive material without explosion.

Appendix 5-6: Marine Mammal Mitigation Protocol (MMMP) will be strictly adhered to during both low-order and high-order UXO clearance. This MMMP contains mitigation measures including the use of visual observers to avoid injury and disturbance to marine mammals, and has been developed with full regard to the NPWS (2014) Guidelines and industry good practice from other jurisdictions (UK Government, 2022). The MMMP also outlines the protocol for the use of acoustic deterrent devices to temporarily displace animals away from the highest risk (injury) zones, and marine mammal visual and acoustic observers to ensure that there are no marine mammals in close proximity (1,000 metres) of the UXO being cleared.

Residual effect following mitigation

Should low-order deflagration be utilised, a very low number of animals are predicted to be affected based on the densities of species in the area and the mitigation. MMOs employed on the vessels will ensure that there are no marine mammal and megafauna receptors in the vicinity prior to the start of the operation. The effect is temporary during clearance (only expected to last a few seconds) and will be localised. Considering the habitat of marine mammals throughout the northeast Atlantic and around the UK, and the unlikely presence of UXO within the Offshore Site, significant effects from disturbance due to UXO clearance are not expected when considering mitigation. Therefore, the residual effect is considered to be an **unlikely, momentary, occasional**, **imperceptible negative effect** and is therefore assessed to be **Not Significant**.

12.6.2.1.5 *Injury or disturbance to other megafauna from construction sound*

Description of effect

Underwater sound generated from construction activities has the potential to affect basking sharks and turtles, causing disturbance, injury, and displacement. Sound exposure guidelines have been developed for fishes and sea turtles (Popper *et al.*, 2014) and provide a reference for the effects of underwater sound.

Appendix 12-1 (Subacoustech, 2024) used the Popper *et al.* (2014) criteria for shipping and continuous sound as a proxy to model the effects on basking sharks and sea turtles from construction sound, and categorised the impacts into mortality, impairment (TTS, recoverable injury and masking), and behavioural (Table 12-30). Only qualitative guidelines for risk are available which are independent of source level (Popper *et al.*, 2014). Effects may have a high, moderate, or low relative risk on an individual in either near (tens of metres), intermediate (hundreds of metres), or far (thousands of metres) distances from the sound source.

Table 12-30 Recommended guidelines for shipping and continuous sounds based on Popper et al. (2014) for basking sharks and sea turtles (N = Near-field, I = Intermediate-field, F = Far-field).

	Mortality and potential mortal injury	Impairment			Behaviour
		Recoverable injury	TTS	Masking	
Basking sharks (fish with no swim bladder)	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Sea turtles	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) High (I) Moderate (F) Low

Characterisation of unmitigated effect

Subacoustech (2024) (see Appendix 12-1) determined impact ranges of construction activities that may injure basking sharks and turtles, including rock placement, trenching, dredge disposal, and cable laying (Table 12-30). The impact ranges were assessed using the Popper *et al.* (2014) qualitative risk criteria for shipping and other continuous sources as a proxy for construction sound. Based on the Popper *et al.* (2014) qualitative guidelines, the risk of mortality and potential mortal injury and recoverable injury is low for basking sharks and sea turtles within the near-field (i.e. tens of metres from the source). The risk of TTS increases to moderate within the near-field but reduces to low within the intermediate field (i.e. hundreds of metres from the source). Masking effects remain high within the near and intermediate fields. For basking sharks, the risk of behavioural effects remains moderate out to the intermediate field, whereas for sea turtles the risk is high in the near-field, reducing to moderate within the intermediate field and low within the far-field (i.e. within thousands of metres from the source).

Based on the qualitative risk criteria developed by Popper *et al.* (2014), the risk of impact is considered to be low, within hundreds of metres of the sound source, with the exception of masking effects where the risk is moderate at thousands of metres from the source. However, a degree of recovery is likely for these sub-lethal effects with no material effects on the fish and shellfish community predicted. Overall, the effect is expected to occur over a local extent, with a small part of the Study Area affected, where there is likely to be the presence of basking sharks or sea turtles based on available data of abundance and distribution. The construction phase is considered to cause a short-term effect, that occurs at a low frequency and intensity. It is not expected to have a significant effect on the conservation status or integrity of basking sharks and sea turtles, causing an imperceptible shift to baseline conditions which will cease following completion of construction activities. As such, the effect of construction is defined as being of **negligible magnitude**.

Low frequency sounds have the potential to impact basking sharks. However, limited studies have been carried out on the hearing physiology and audition of basking sharks, and conclusions are generally inferred using knowledge from other elasmobranch species or species with similar physiology (Corwin, 1981; Casper & Mann, 2010; Popper *et al.,* 2014). Sharks, as they do not have swim bladders, are likely unable to detect sound pressure, but rather may detect particle motion (i.e. the kinetic component of sound). Elasmobranchs are typically sensitive to low frequency sounds and vibrational frequencies, with studies showing that large sharks such as lemon sharks *Negaprion brevirostris* and scalloped hammerheads *Sphyrna lewini* have demonstrated increased sensitivity of up to 800 hertz (Hz) (Corwin, 1981; Casper & Mann, 2010). Sharpenosed sharks *Rhisoprionodon terranovae* has shown sensitivity to vibrational frequencies of 20 Hz (Casper & Mann, 2010). As an example, dredge disposal produces continuous low frequency below 1 kHz (Thomsen *et al.,* 2009; Todd *et al.,* 2015), which falls into the hearing range of studied shark species. Basking sharks may be able to hear and respond to construction sound, meaning there is a potential disturbance impact. Popper et al. (2014) suggests that there is minimal risk of injury from continuous sound to fish without swim bladders, meaning that physiological effects are highly unlikely. Similarly, sea turtles are considered to be sensitive to low frequency sounds (50 – 1,000 Hz) (BOEM, 2014) and so will be most sensitive to masking within that region. However, based on the low risk of injury or mortality for construction sound (Table 12-30) and high mobility, basking sharks and sea turtles are assessed to be of **negligible sensitivity**.

Assessment of significance prior to mitigation

Significant effects due to construction sound are not anticipated on basking sharks and sea turtles during the construction of the Proposed Project. Therefore, any effects are assessed as **not significant negative** which is Not Significant.

Mitigation

The design selection of GBS at Sceirde Rocks Offshore Wind Farm results in significantly lower emissions of underwater sound than would occur if piling was employed during the construction, which generates high-amplitude impulsive sound which can have far greater effects on other megafauna.

Residual effect following mitigation

Due to the temporary nature of the works and the use of GBS which remove the majority of the effect of sound from impact pile driving, and considering the widespread nature of basking shark and turtle habitat within the northeast Atlantic and around the UK as a whole and the low densities of these species in the Study Area, significant effects due to construction sound are not anticipated at this geographical scale during the construction of the proposed Project. Additionally, the risk of impact is highly localised, and therefore effects are highly unlikely due to the transient and intermittent nature of the sound, and the high mobility of basking sharks and sea turtles. Therefore, the residual effect is considered to be a **likely, short-term, occasional**, **not significant negative effect** and is therefore assessed to be Not Significant.

12.6.2.1.6 *Injury or disturbance to other megafauna from UXO clearance*

Description of effect

UXO clearance may be required prior to construction of the Project. The generation of the loud sound from the detonation of a UXO can cause disturbance and potential injury to basking sharks and sea turtles. Underwater sound generated from construction activities has the potential to affect basking sharks and turtles, causing disturbance, injury, and displacement. Sound exposure guidelines have been developed for fishes and sea turtles (Popper *et al.,* 2014) and provide a reference for the effects of underwater sound. The underwater sound modelling (Appendix 12-1; Subacoustech, 2024) used the Popper *et al.* (2014) criteria for explosions to model the effects on basking sharks and sea turtles, and categorises impacts into mortality, impairment (TTS, recoverable injury and masking), and behavioural effects (Table 12-31). Quantitative guideline values are only available for risk of mortality and potentially mortal injury (229 – 234 dB peak) for all other impacts (impairment and behavioural effects) only qualitative risk criteria are available which are independent of source level (Popper *et al.*, 2014).

Table 12-31 Recommended guidelines for explosions based on Popper et al. (2014) for basking sharks and sea turtles (N = Near-field, I = Intermediate-field, F = Far-field).

	Mortality and potential mortal injury	Impairment			Behaviour
		Recoverable injury	TTS	Masking	
Basking sharks (fish with no swim bladder)	229 – 234 dB peak	(N) High (I) Low (F) Low	(N) High (I) Moderate (F) Low	N/A	(N) High (I) Moderate (F) Low
Sea turtles	229 – 234 dB peak	(N) High (I) High (F) Low	(N) High (I) High (F) Low	N/A	(N) High (I) High (F) Low

As described in Section 12.6.2.1.2, the maximum charge weight for potential UXO items that may be present in the Offshore Site was 800 kg, in addition to a smaller donor charge of 0.5 kg used to initiate the detonation. This section summarises the assessment for injury from UXO clearance to basking sharks and sea turtles as presented in the Underwater Modelling and Assessment report (Appendix 12-1; Subacoustech, 2024).

Characterisation of unmitigated effect

For basking sharks and sea turtles, the impact range for mortality and potential mortal injury was estimated to be within 560 – 930 m for a high-order detonation of a UXO (Appendix 12-1; Subacoustech, 2024). This assumes that an animal will not flee from the site at any point, and that the sound source remains impulsive throughout the entire impact range. As described in Section 12.6.2.1.3, a blast wave is assumed to become non-impulsive at a distance further than 3.5 km (Hastie *et al.*, 2019). The Popper *et al.* (2014) qualitative guidelines (Table 12-30) suggest that the risk of impairment and behavioural effects are expected to be low for basking shark and sea turtles once in the far-field (i.e. thousands of metres from the source).

Overall, the effect is expected to occur over a local extent, affecting a part of the Study Area. This effect is expected to be instantaneous, occurring at a low frequency and only prior to or during construction. The effect is considered to be of very high intensity when considering a high-order detonation, which can lead to mortality and potential mortal injury. This effect is therefore considered to be of **medium magnitude**.

Considering the limited hearing capacities of basking sharks, combined with their mobile nature, they are considered to have a low vulnerability to underwater sound would not significantly impact vital rates or have an effect at the population level. Therefore, basking sharks are assessed to have a **low sensitivity** to UXO clearance. Based on high risk of sea turtles to impairment and behavioural impacts at intermediate distances from the source, they are considered to be of **moderate sensitivity.**

Assessment of significance prior to mitigation

Prior to mitigation, any effect on basking sharks resulting from UXO clearance is assessed as a **slight negative** effect. The effect on sea turtles is assessed as a **moderate negative effect** which is Not Significant.

Mitigation

Initial investigations during pre-construction surveys were conducted to identify potential UXO that may require investigation, in order to avoid, remove, or potentially detonate them. The surveys did not identify any UXO across the Offshore Site, therefore it is not expected that any UXO will require detonation.

In the unlikely event where UXO clearance will be required, high-order clearance is the least preferred method, and all efforts will be made to avoid it. Low order deflagration will be the preferred clearance method used, where clearance of any size of UXO is done using a special donor charge of 0.5 kg which vaporises the explosive material without explosion.

Appendix 5-6: Marine Mammal Mitigation Protocol (MMMP) will be strictly adhered to during both low-order and high-order UXO clearance. This MMMP contains mitigation measures including the use of visual observers to avoid injury and disturbance to marine mammals, and has been developed with full regard to the NPWS (2014) Guidelines and industry good practice from other jurisdictions (UK Government, 2022). Where necessary, these measures could include the use of acoustic deterrent devices to temporarily displace animals away from the highest risk (injury) zones, and visual observers to ensure that there are no basking sharks or other megafauna in close proximity (1,000 metres) of the UXO being cleared.

Residual effect following mitigation

The largest impact range for a low order deflagration is <50 – 80 m for basking sharks and sea turtles (Appendix 12-1; Subacoustech, 2024). While injury from UXO clearance is a permanent change in the hearing threshold of animals with no recovery, a very low number of animals are predicted to be affected based on the densities of species in the area and the mitigation. Based on the high mobility of both receptors, which will likely move away from the clearance vessels, individuals are not expected to remain in the vicinity of the area. UXO clearance is considered to be highly unlikely and is not anticipated, and if required, the effect will be temporary during the clearance operation only (expected to last a few seconds) and will be localised. Considering the extensive habitat of basking sharks and sea turtles throughout the northeast Atlantic there is a low likelihood of encountering these species within the Study Area, significant effects due to UXO clearance are not expected when considering mitigation. Therefore, the residual effect is considered to be an **unlikely, momentary, occasional**, **not significant negative effect** and is therefore assessed to be Not Significant.

12.6.2.2 Indirect effects of construction sound on the prey species of marine mammals and megafauna

12.6.2.2.1 *Description of effect*

Underwater sound from survey equipment, site preparation activities, and construction activities can have mortality, physical injury or behavioural effects on fish and shellfish receptors, at an individual or population level. Behavioural effects, such as disturbance or displacement, may impact acoustic communication in fish, reproductive success, foraging, predator avoidance and navigation (Hawkins & Myrberg, 1983; Radford *et al.*, 2014; de Jong *et al.*, 2020). Adverse effects on fish receptors may have indirect effects on marine mammal receptors that rely on this prey.

This assessment has been informed by the conclusions of Chapter 10: Fish and Shellfish Ecology, where the following activities were considered as having potential to generate underwater sound during the construction and pre-construction phase:

- UXO clearance;
- Vessel operations;
- Dredge and disposal activities; and
- Cable installation activities including seabed preparation, cable laying, trenching and the placement of cable protection.

The key prey species for marine mammals include a variety of species present both within the water column and on seabed sediment, including sand eels *Ammodytes marinus*, herring, cod *Gadus morhua*, whiting *Merlangius merlangus*, sprat, and flatfish (Santos & Pierce, 2003; Braulik *et al.*, 2021; Wells *et al.,* 2018; SCOS, 2020). The following fish and shellfish species that are considered prey for marine mammals have been identified within the fish and shellfish ecology Study Area (see Chapter 10: Fish and Shellfish Ecology): cod, herring, whiting, plaice *Pleuronectes platessa*, black sole *Solea solea*, mackerel *Scomber scombrus* and sandeels. Important spawning habitats for herring have been identified to the east of the Offshore Site between the Aran Islands and Galway Bay (Marine Institute, 2024) (see Chapter 10: Fish and Shellfish Ecology).

12.6.2.2.2 *Characterisation of unmitigated effect*

Marine mammals and megafauna are considered to be highly mobile and wide ranging and considering the availability of foraging habitat for these species, individuals are expected to be able to forage in alternative areas if prey species become unavailable. Marine mammal species considered in this assessment are generalist feeders, therefore can rely on other prey species rather than a single source. Given the adaptability and mobility of marine mammals and megafauna to find alternative prey or locations, they are assessed to be of **low sensitivity.**

There is potential for disturbance, injury and mortality to fish resulting from underwater sound (see Chapter 10: Fish and Shellfish Ecology). The sensitivity of all fish species ranged from low to medium, with the magnitude of the impact estimated to be low. The overall significance of effect ranged from a not significant to slight negative effect and was Not Significant. Therefore, given that the effect on prey species was determined to be Not Significant, the scale of these effects compared to the mobility and available foraging grounds for marine mammals and megafauna, this effect is considered to be of **negligible magnitude**.

12.6.2.2.3 *Assessment of significance prior to mitigation*

Prior to mitigation, any effects on marine mammals and megafauna are assessed as a **not significant negative** effect which is Not Significant.

12.6.2.2.4 Mitigation

The following measures will be adhered to:

- Use of GBS foundations which avoids the requirement for impact piling, which generates high-amplitude impulsive sound which would have far greater effects on acoustically sensitive species than those predicted for the Offshore Site;
- If UXO are not avoidable, low order deflagration will be the preferred method used for UXO clearance, reducing the effects from underwater sound; and
- Vessels engaged in construction works will typically be travelling at slow (<6 kts) speeds. This will reduce sound emissions relative to high-speed transiting and reduce the underwater sound effects associated with vessel sounds.

12.6.2.2.5 Residual effect following mitigation

Taking the mitigation into account, no long-term impacts on are anticipated. Therefore, the residual effect of underwater sound on prey species during construction is concluded to be an **imperceptible negative effect** and is therefore assessed to be Not Significant.

12.6.2.3 Disturbance due to the physical presence of vessels

12.6.2.3.1 Offshore Site

Description of effect

During the construction phase, there will be an increase in vessel traffic associated with the Project, which could result in an increased risk of disturbance from marine sound and barrier effects to marine mammals and other megafauna through avoidance and displacement, as well as potential behavioural changes. It is very difficult to separate disturbance caused by vessel presence from vessel sound as both of these impacts occur simultaneously, and many studies do not differentiate between these two effects (Erbe *et al.*, 2019). As such, vessel sound will be included in the impact assessment.

Impacts to otter from the physical presence of vessels at the Offshore Site have not been taken forward for assessment due to the offshore location of the Offshore Site and the highly coastal marine distribution of otter (rarely >1 km from the shore). Vessels in transit will be following normal shipping routes and will not constitute a major addition to shipping levels (with respect to baseline). Therefore, no additional impacts to otter as a result to vessel transits are likely, and vessels will be too far offshore for otter to experience disturbance, so there will be no effect.

Characterisation of unmitigated effect

Disturbance from the physical presence of vessels around the Offshore Site will have a likely, short-term adverse effects on marine mammals and basking sharks. There will be a maximum of 23 vessels associated with the pre-construction and construction phases of the Offshore Site, of which up to 11 will be present within the Offshore Site at any one time. The effect will be short-term (up to 4 years) and will cease following the completion of construction activities. Overall, the effect of vessel sound is expected to occur over a local extent within a small part of the Study Area, mostly around the OAA and short-term along the OECC (up to 16 months for cable installation). The magnitude of this effect is therefore **negligible**.

Cetaceans are vulnerable to shipping sound as they rely on sound for communication, navigation and foraging, and as such have evolved high auditory sensitivity. Vessel sound can mask communication between individuals and can increase stress, which can impact behaviour, including foraging, migration and reproduction. Vessel presence can alter the behaviour of marine mammals, such as interrupting feeding, resting and socialising (Christiansen & Lusseau, 2015; Meissner *et al.,* 2015; Marley *et al.,* 2017). However, studies have shown that while cetaceans will experience behavioural disruptions due to boat presence, there were no long-term impacts on foetal growth, meaning that the biological significance of vessel disturbance on populations is low (Christiansen & Lusseau, 2015; Christiansen *et al.,* 2015). Culloch *et al.* (2016) assessed the effects of vessel traffic on marine mammals during the construction of a pipeline in northwest Ireland. Evidence suggests that vessel presence reduced common dolphin occurrence, while it had no impact on harbour porpoise and minke whale. As outlined in Section 12.6.2.1, marine mammal activity generally recovers to baseline construction following turbine installations even with pile driving, which means that the disturbance effect from vessel sound is negligible. Therefore, all cetacean species apart from harbour porpoise have been assessed to be of **low sensitivity** to disturbance from vessels.

Windfarm specific studies have found that found that porpoise displacement due to construction vessel presence was observed for up to 4 km (Benhemma-Le Gall *et al.*, 2021). Presence of other types of vessels have also shown to provoke behavioural changes (Dyndo *et al.*, 2015; Oakley *et al.*, 2017; Wisniewska *et al.,* 2018), even when vessels are at 1 km away (Dyndo *et al.,* 2015). As such, harbour porpoise have been assessed to be of **medium sensitivity** to disturbance from vessels.

Vessels may disturb seals both in the water and at haul out sites. The closest SAC with pinniped designated features is the Kilkieran Bay and Islands SAC (1.4 km away from Project), which is designated for harbour seals. Vessels are unlikely to approach the SAC and as such, there are no anticipated significant effects on seals at breeding locations within this protected site (>5km from the Offshore Site). Seals may be present within the Offshore Site area to forage, and as such are at risk of being disrupted during foraging and travelling to and from haul out sites, which may lead to avoidance of foraging grounds. Biologically significant effects may occur through auditory masking, as seal vocalisations, which play a role in harbour seal reproduction, overlap in frequency with shipping sound (Hanggi & Schusterman, 1994; Van Parijs *et al.,* 2000). Seals do not show extreme displacement in response to high vessel numbers, and rather show slight avoidance behaviours based on increased vessel sound (Anderwald *et al.,* 2013). Additionally, exposure to shipping in isolation has not shown to cause declines in seal populations, where seal colonies in areas with low levels of shipping have shown declines in counts, whereas areas with high intensities of vessel traffics have increasing harbour seal populations (Duck & Morris, 2016). Therefore, seals have been assessed to be of **low sensitivity** to disturbance from vessels.

Basking sharks may experience disturbance to feeding behaviour and courtship from the presence of vessels, and have been observed to respond by diving deep and moving away from the area (Bloomfield & Solandt, 2006). However, basking sharks have limited hearing capacities (as discussed in Section 12.6.2.1.5), therefore it is likely that they will be able to tolerate the disturbance from any construction vessels and return to previous activities once the vessel has passed and are therefore assessed to be of **low sensitivity**.

Green turtles actively avoid vessels if they travel at low speeds (4 km/h or less), but avoidance rapidly decreases with increasing speeds (Hazel *et al.,* 2007). Studies during the coronavirus (COVID-19) pandemic, where a reduction in tourism led to fewer vessels present in a sea turtle rookery, showed that increased tourism pressure drove turtles offshore (Schofield *et al.,* 2021). Turtles are therefore considered to have a **medium sensitivity** to this effect.

Assessment of Significance prior to mitigation

Prior to mitigation, disturbance due to the physical presence of vessels within the Offshore Site on harbour porpoise and turtles is likely to have a **not significant negative** effect which is Not Significant. The effect of disturbance due to the physical presence on all other marine mammal and megafauna species is likely to have a **imperceptible negative** effect which is Not Significant.

Mitigation

Vessel movements will be managed in a way that will mitigate the negative effects to marine mammals and megafauna. These measures are described in detail in Appendix 5-10: Vessel Management Plan, including:

- Vessels engaged in construction works will typically be travelling at slow (<6 kts) speeds. This will reduce sound emissions relative to high-speed transiting and reduce the underwater sound effects associated with vessel sounds; and
- Vessels will follow prescribed routes (non-random movement).

Residual effect following mitigation

Given the mitigation measures, with the short-term and temporary nature of the work, the residual effect will be **likely, short-term and occasional,** and therefore is assessed as an **imperceptible negative** effect for all marine mammal and megafaunal species which is Not Significant.

12.6.2.3.2 *Shannon Estuary*

Description of effect

The GBS foundations of the WTGs will be delivered and temporarily anchored at a location likely to be in the vicinity of the Shannon Foynes port located within the Shannon Estuary prior to being transported to the OAA for installation (Chapter 5: Project Description). The temporary anchorage area is separated into two areas: the float-off location, where the GBS foundations will be removed from the semi-submersible heavy transport vessel (HTV) which transports three GBSs at a time, and the area where the GBS foundations will be temporarily stored until transported to the Site. The temporary anchorage will be subject to a separate licensing process which will consider the effects in more detail, however as it is part of the Project, a high-level assessment of the consideration of effects is presented here. These effects are principally the vessel movements associated with transport of GBS foundations to and from the temporary anchorage location.

The potential location for temporary anchorage of GBS foundations may be within the Lower River Shannon SAC, designated for the protection of bottlenose dolphin as it contains a distinct and localised population within Ireland (see section 12.5.2.1.3). This forms a precautionary basis for this assessment due to the presence of this highly protected population. The vessels used during temporary anchorage operations may cause temporary disturbance of bottlenose dolphin, as well as otters, which are also a qualifying interested of the lower River Shannon SAC as they are present along the coastline. All qualifying interests of the Lower Shannon River SAC must be maintained at favourable conservation status, including bottlenose dolphins and otters (NPWS, 2012a). The Conservation Objectives require that:

- Otters and bottlenose dolphins must not be restricted by artificial barriers to access suitable habitat;
- Critical areas for bottlenose dolphin should be maintained in natural condition;
- Human activities should occur at levels that do not adversely affect the bottlenose dolphin population at the site; and
- Marine habitat for otters must show no significant decline.

Characterisation of unmitigated effect

One semi-submersible HTV will transport the GBS foundations from the manufacturing point to the temporary anchorage area and will be moored at the designated float-off area inside the Shannon Estuary. The semi-submersible HTV can carry up to three GBS foundations per voyage, with a total of

31 GBS foundations to be stored, which equates to 11 voyages, although not all will need to be stored at the same time as they will be towed to the OAA for deployment as soon as the weather and other conditions allow.

Preparatory work is required within the temporary anchorage area. The GBS foundations will be transported to the temporary anchorage area by a HTV which will temporarily be held in position before the GBS foundations are floated off by two tug boats to be moored at a designated location. The total float-off operation for one HTV carrying three GBS foundations at a time, including all preparatory and completion works, is estimated to have a duration of approximately three working days.

Disturbance from the physical presence of vessels around the Lower River Shannon SAC will have a likely, temporary adverse effects on marine mammals and otters. Vessel traffic (passenger, cargo and other vessel activities) within the Study Area forms part of the existing baseline. The Shannon estuary is used by approximately 830 ships per year (Shannon Foynes Port Company, 2021), with 431 vessels arriving at Shannon Foynes in 2022 (Central Statistics Office, 2023), such that the additional vessels present during the temporary anchorage period would have an imperceptible effect on baseline conditions. The effect will be temporary as works will occur over a total of several days and will occur rarely, and cease following the completion of construction activities. Overall, the effect of vessel sound is expected to occur over a local extent within a small part of the Lower River Shannon SAC and is temporary and occurs rarely. Therefore, the magnitude of this effect is therefore **negligible**.

The population of bottlenose dolphin within the Lower River Shannon SAC is of regional conservation importance as a designated species. As described in section 12.5.2.1.3, the population within the SAC has also been observed up to 30 km away from the estuary, showing the high mobility of the population. Studies have shown dolphins are present in the vicinity of the Port of Shannon-Foynes for approximately 40% of days monitored (O'Brien *et al.,* 2013; Carmen *et al.*, 2021), with much higher presence (~70%) towards the mouth of the estuary. However, dolphins tend to spend more time foraging towards the mid estuary (near Shannon Foynes) than the mouth of the estuary (Carmen *et al.,* 2021), meaning that there are differences in habitat variability and use within the Shannon Estuary and the bottlenose dolphins show habitat flexibility within the estuary. Although dolphins may be foraging near to the temporary anchorage area, Carmen, *et al.* (2021) suggested that the presence of ships was not a significant deterrent to dolphin presence. As such, based on this evidence and the conservation status of this population, bottlenose dolphin are considered to be of **medium** sensitivity to the physical presence of vessels within the Shannon Estuary.

Otters utilise the coastal areas within the Lower River Shannon SAC. Due to existing vessel traffic navigating through the Shannon estuary to/from harbours, it is not likely that Project activities will have a discernible impact on otters which are already exposed to vessel movements. Therefore, they are considered to be of **negligible** sensitivity.

Assessment of Significance prior to mitigation

Prior to mitigation, the effect of disturbance due to the presence of vessels is likely to have **slight, negative** effect on bottlenose dolphin and an **imperceptible negative** effect on otters which is Not Significant.

Mitigation

Vessel movements will be managed in a way that will mitigate the negative effects to marine mammals and megafauna. These measures are described in detail in Appendix 5-10: Vessel Management Plan, including:

- Vessels engaged in construction works will typically be travelling at slow (<6 kts) speeds. This will reduce sound emissions relative to high-speed transiting and reduce the underwater sound effects associated with vessel sounds; and
- Vessels will follow prescribed routes (non-random movement).

Marine operations taking place in the vicinity of Shannon Foynes will be planned so they will not interfere with the normal operation of the estuary, and the Port of Shannon Foynes will coordinate vessel operations within the port limits.

Residual effect following mitigation

Given the mitigation measures, with the short-term and temporary nature of the work, the residual effect will be likely, short-term and occasional, and therefore is assessed as a **not significant negative** effect for all assessed receptors which is Not Significant.

12.6.2.4 Risk of injury resulting from collision of marine mammals and other megafauna with installation vessels

12.6.2.4.1 *Description of effect*

During the construction phase, there will be up to 21 vessels associated with the Project, which could result in an increased risk of injury or mortality to marine mammals and other megafauna.

12.6.2.4.2 *Characterisation of unmitigated effect*

The risk of injury resulting from collision will have an unlikely, temporary adverse effect. Increased vessel traffic will occur throughout the Offshore Site (OAA and OECC), including vessels present on site and transiting to and from the site. There are up to 21 vessels expected within the area at any time which would have an imperceptible effect on baseline conditions. The effect will be short-term (up to four years) and will cease following the completion of construction activities after which construction vessels will no longer be present.

The occurrence of vessel collisions is hard to quantify, as these events can be unnoticed or unreported, particularly for smaller marine species (Peltier *et al.,* 2019; Schoeman *et al.*, 2020). Monitoring of stranding events is one of the most effective ways to evaluate mortality from vessel collisions for marine species. The UK Cetacean Strandings Investigation Programme (CSIP) documents strandings and causes of death for marine mammals, marine turtles and basking sharks. The 2017 Report of UK marine mammal strandings shows that little mortality of marine mammals and basking sharks is caused by vessel collisions (1% of all strandings between 1991 and 2017; CSIP, 2018). Therefore, vessel collisions may not be a key cause of marine mammal and other megafauna mortality. Overall, the risk of injury from collision is expected to occur at a local extent within a small part of the Study Area, mostly around the OAA and OECC. Considering that this effect could lead to injury or mortality of marine mammals and megafauna but is unlikely to occur, the magnitude of this effect is **negligible**.

The sensitivity of marine mammals and other megafauna to vessel collisions will be species dependent. More agile species, such as harbour porpoise, common dolphin, bottlenose dolphin, Risso's dolphin, grey seal, and harbour seal, have been observed to respond to vessel sound, and so will be more likely to detect and respond to nearby vessels and avoid collision (Erbe *et al.,* 2019). Studies on seals show avoidance of vessel traffic without strong displacement effects, tending to remain beyond 20 m from vessels (Anderwald *et al.,* 2013; Onoufriou *et al.,* 2016). Therefore, harbour porpoise, dolphin species, and seal species are assessed to be of **low** sensitivity.

Less agile species, such as minke whales and basking sharks, are at higher risk of collision as they are less likely to avoid moving vessels. No sightings of minke whale were reported in the aerial surveys, and only low numbers of basking sharks were recorded. Their large size (relative to smaller dolphins, porpoise and seals) makes them more detectable to vessels, meaning avoidance action can be taken. Basking sharks are particularly at risk of collision, as they are filter feeders that spend large amounts of time at the surface of the water. As such, minke whales and basking sharks are considered to have a **high sensitivity** to this effect.

Collision reports for turtles are generally scarce, as sea turtles will initially sink after a fatal collision and are more likely to be unnoticed (Nero *et al.*, 2013). Green turtles actively avoid vessels if they travel at low speeds (4 km/h or less), but avoidance rapidly decreases with increasing speeds (Hazel *et al.*, 2007). As turtles often come up to the surface of the water, they are considered to have a **slight sensitivity** to this effect.

12.6.2.4.3 Assessment of Significance prior to mitigation

The risk of injury resulting from collision with vessels will have a **slight negative effect** on all marine mammal and megafauna species, which is Not Significant.

12.6.2.4.4 Mitigation

Vessel movements will be managed in a way that will mitigate the negative effects to marine mammals and megafauna. These measures are described in detail in Appendix 5-10: Vessel Management Plan, including:

- Vessels engaged in construction works will typically be travelling at slow (<6 kts) speeds. This will reduce sound emissions relative to high-speed transiting and reduce the underwater sound effects associated with vessel sounds; and
- Vessels will follow prescribed routes (non-random movement).

These mitigation measures mean that vessels would pose a low collision risk.

Marine mammal visual and acoustic observers can monitor, record, and protect marine mammal and megafauna receptors during activities to ensure that there are no animals in close proximity of the vessels.

12.6.2.4.5 Residual effect following mitigation

Considering the mitigation that will reduce the likelihood and severity of vessel collisions, and the fact that vessel collisions are not a dominant cause of mortality in marine mammals, the effect is highly unlikely to occur, and this is also in the context of the likelihood of occurrence of less agile species around the Offshore Site (e.g. basking shark and minke whale). Based on the temporary nature of the works and the small spatial scale around the OAA and OECC, particularly in comparison to the widespread available habitat for all marine mammals and megafauna in proximity of the Offshore Site, the residual effect is considered to be an **unlikely, temporary, rare**, **imperceptible negative** effect and is Not Significant.

12.6.2.5 Impacts associated with effects upon marine water quality, particularly due to any disturbed sediments affecting turbidity

12.6.2.5.1 *Description of effect*

This impact relates to short-term and localised increases in SSC associated with seabed disturbance during the Offshore Site construction phase. The construction activities likely to result in seabed disturbance leading to increases in SSC, include site preparation activities (namely use of the Controlled Flow Excavator (CFE)), cable installation through trenching, and OEC landfall activities.

The disturbance of sediments during these activities can increase SSC, which can result in reduced foraging success of visual predators due to decreased visibility.

12.6.2.5.2 *Characterisation of unmitigated effect*

Varying construction activities will have the potential to increase SSC based on the activity and the methods (a full assessment is described in Chapter 7: Marine Physical Processes). The relevant activities during the construction period which could result in increased SSC include:

- Pre-construction seabed levelling and clearance in the OAA only;
- Cable installation via trenching from the CFE and dredging in the OAA;
- Disposal of dredged material in the OAA; and
- HDD at landfall within the OECC.

Please note that the below assessment has been summarised from Chapter 7: Marine Physical Processes, and Chapter 8: Water and Sediment Quality.

Dredge and disposal activities

Up to 15 disposal events of the dredged material are expected in two locations within the OAA, with plumes occurring from each disposal event (with a hopper capacity of up to 10,000 m^3). No dredge material is to be released from the sea surface, instead material will be released at a maximum height of 5 m above the seabed, therefore minimising the dispersion effects of the disposal process. At 5 m above the seabed, based on the release rate, the instantaneous SSC could be very high on the order of hundreds of thousands (to millions) of mg/l at the fall pipe. However, the high SSC would quickly reduce to thousands of mg/l from the release site based on the deposition of the majority of the sediment bulk, with only a smaller proportion of the sediment fraction developing into a plume. Based on the fall pipe release height at 5 m above the seabed, as committed to by the Project (see Chapter 5: Project Description), the fine sediment could remain in suspension for up to 14 hours before resettling (i.e. just over a flood – ebb tidal cycle, reaching the maximum tidal excursion extent (estimated to be up to 15 km) on either the flood or ebb tidal cycle), depending on the time of release. However, dilution would occur with distance from the release site and sediment will continually fall out of suspension, resulting in further reduction of the SSC to baseline levels (ca. 5 mg/l). The finest sediment fraction will become readily incorporated into the surrounding seabed and consequently will become part of the sediment transport regime. This process will redistribute sediments throughout the Offshore Site and beyond, which would occur regardless of deposition induced by construction activities.

Seabed preparation and installation activities using CFE

As a result of the disturbance mechanism and the sediment release rate through using CFE for clearance within the OAA, SSC could locally increase from hundreds of thousands of mg/l in proximity to the CFE disturbance site. Nonetheless, this high instantaneous SSC would, as described above, reduce quickly with increasing distance from the disturbance to thousands and hundreds of mg/l. Based on the settling velocity for silt of 0.0001 m/s, and release height of 5 m above the seabed, silt sediment could remain in suspension for up to 14 hours before settling back to the seabed. The plume extent could be up to 15 km in relation to the flow speeds across OAA, with the potential of occurring over the tidal excursion extent for each tide, based on the sediment settling velocity. At its widest extent, the plume associated with CFE clearance would generally have concentrations of <10 mg/l, in line with background SSCs. Overall, SSC will return to background levels within two tidal cycles, with the same redistribution of fine sediment across the Offshore Site, and fish and shellfish study area.

Sediment plumes generated by CFE during cable trenching activities will fall within the stated durations and extents as described for seabed preparation using CFE i.e. a maximum of 15 km extent and 14 hours duration for resettling. Importantly, the majority of SSC will occur within the 20 m wide disturbance width corridor. Changing flow speeds and directions over the course of a tidal cycle will ultimately limit the extent of plumes to the mean annual tidal excursion extent.

Use of CFE for cable installation is a much more targeted and focussed activity occurring at the seabed. Consequently, releases will likely occur closer to the seabed, to retain the majority of the sediment within the cable trench. Based on the same silt settling velocity of 0.0001 m/s, releases at 1 m above the seabed could remain in suspension for up to 3 hours.

Landfall installation

Trenchless HDD technology will be used to install the OEC from an onshore location to the exit pit within the OECC (approximately 1 km offshore). The exit pit in the OECC has a total area of 0.001 km^3 and an associated excavated volume of 2000 m^3, with excavated material being stored alongside the pit as a sediment berm. The increases in SSC associated with the excavation is likely to be similar or less than that described for the seabed clearance activities above.

At each exit pit drilling fluid (PLONOR in nature) could be released at HDD pop out, comprising 90 % water and approximately 10 % bentonite clay, for which medium silt is applied as a proxy. Based on an assumed near-bed release height of 0.5 m, deposition thickness associated with the solids could be up to 0.05 m for the exit pit, associated with a release during the slowest neap flows. In this instance it is most likely that any sedimentation would occur directly within the exit pit and a plume would not form.

Summary

As summarised above, sediment disturbed as a result of the construction activities has the potential to form a plume that would be extremely transient within the marine mammals and megafauna study area. Due to the current flow regime within the Offshore Site, sediment would quickly settle out and SSC would return back to ambient concentrations after a short duration (less than a day). Any deposition via THSD (within the OAA only) at the deposition zones, will result in an average depth of 1.5 m.

The effect from increases in SSC from all offshore site activities is predicted to be of very local spatial extent, only of short-term in duration (less than 1 day), continuous throughout the duration of the activities but highly reversible, returning to baseline SSCs following cessation of activity, and therefore, is unlikely to materially alter water quality within the marine mammal and megafauna study area to an extent that would significantly impact marine mammal and megafauna receptors.

This effect is expected to be short-term during the period of construction of up to four years, and the increased SSC will be brief, with returns to background levels rapidly. The effect will be highly localised (within 15 km of the area), and therefore the magnitude is considered to be **negligible**.

Marine mammal and megafauna species have developed adaptations in order to tolerate turbid environments. Basking sharks have electromagnetic receptors which enable them to forage in low light, meaning they are unlikely to be susceptible to increases in turbidity (Kempster & Collin, 2011). Seals, although more likely to get affected by increased turbidity, as they often migrate through waters where conditions are turbid for extended periods without significant effects to species biology or behaviour, for example during foraging at depth and on the sea floor. Seals have adapted to reduced visibility by using their vibrissae (whiskers) as a primary sense to detect movement (Murphy *et al.*, 2015), and so are unlikely to be hindered by temporary increases in turbidity. Lastly, cetaceans, basking sharks, and leatherback turtles predominantly forage within the water column, meaning that they are unlikely to be affected by increased turbidity near the seabed and no negative effects to overall health with highly turbid waters are known (Todd *et al.*, 2015; Wallace *et al.*, 2015). Considering that marine mammals and other megafauna often reside in turbid waters, localised, temporary changes to water quality will not have a significant disturbance or displacement impact on these receptors and is not expected to have any important ecological implications. All marine mammal and megafauna receptors are thus considered to have **negligible** sensitivity to this impact pathway.

12.6.2.5.3 Assessment of Significance prior to mitigation

Significant effects from increased suspended sediments resulting from the construction of the Proposed project are not anticipated on any marine mammal and megafauna receptor. The effect is therefore considered a likely, **not significant negative effect** which is Not Significant.

12.6.2.5.4 Mitigation

Mitigation by design has been incorporated throughout the Offshore Site. The use of GBS avoids the need for drilling of foundations which can cause localised high SSC. Therefore, the highest concentrations are limited to the use of CFE for seabed preparation and the surface release by a dredger hopper, as discussed above.

A pre-construction cable route survey has been completed informing opportunities for optimisation of the Project Design and construction methodologies, to further reduce the potential for impacts. The completed survey has directly informed the potential presence of morphological features of interest in addition to requirement of seabed preparation activities, will also help reduce as far as practicable the scale of seabed clearance, thereby reducing the opportunity for elevated SSC.

Disposal of dredged material from the TSHD will use a downpipe method to deposit spoil as close to the seabed as possible, thus reducing the potential sediment plume.

The use of trenchless technologies at the Landfall such as HDD, will minimise the extent of seabed disturbance, thereby reducing elevated SSC in the water column.

12.6.2.5.5 Residual effect following mitigation

Due to the temporary nature of increased SSC and the short-term effect during the construction phase, significant effects are not anticipated at this geographical scale during the construction of the proposed Project. The effect is localised, such that cetaceans, basking sharks, and turtles are unlikely to be within the vicinity of the effect. Based on the resilience of seals to increased turbidity, effects are not anticipated on any marine mammal and megafauna receptors. Therefore, the residual effect is considered to be a likely, short-term, occasional, **imperceptible negative effect** which is Not Significant.

12.6.2.6 Impacts associated with effects upon marine water quality due to any accidental release of pollutants

12.6.2.6.1 Description of effect

Accidental releases of pollutants may occur as a result of an accidental spill (i.e. such as during a vessel collision), where spillage of fuel (i.e. diesel), chemicals or other contaminants may occur which could have a detrimental effect on marine mammals and megafauna. This includes avoidance of affected areas, and the potential for sub-lethal or lethal effects depending on the length of exposure and the concentration of the pollutants.

12.6.2.6.2 Characterisation of unmitigated effect

Accidental releases of pollutants may arise from vessel activities over the construction phase. Without the implementation of mitigation or adherence to regulation, vessels could cause pollution due to routine discharges or accidental release of pollutants within the marine environment surrounding the Offshore Site, such as from damage or loss of a vessel. During the construction phase there is likely to be up to 23 vessels required to support the delivery and installation of the Offshore Site infrastructure (with 11 within the Offshore Site at any one time). Should vessels not adhere to legal requirements, conventions and pollution management plans, there is a higher possibility of a pollution event occurring under these circumstances. The types of pollution which could be released range from oil / fuel spills to ballast waters containing a range of biological materials, including plants, animals, viruses, and bacteria.

The extent to which pollution could occur is dependent on the vessel size, materials being transported, and level of containment breach, however it is considered that should an accidental pollution event from a vessel occur that without mitigation the effect could be long lasting in the environment. Historically, five acute pollution events were reported in Irish waters between 2006 and 2011 (DHLGH, 2013). The historical frequency of pollution events is considered low in comparison to the existing vessel traffic around Ireland. The presence of vessels is expected to represent only a small, short-term and temporary shift from the existing baseline traffic of vessels in the area, and the potential impact from each vessel is not likely to have a notable effect on water quality.

The effect would be rare, intermittent, and highly unlikely over the construction phase (four years). Overall, the effect of accidental pollution from vessels is expected to occur to a local extent within a small part of the Study Area during round trips from port to the OAA and OECC. The magnitude of this effect is therefore **negligible**.

Contaminants in the water column may directly affect marine mammals and megafauna through ingestion, absorption through the skin or inhalation, as well as longer-term indirect effects through bioaccumulation of contaminants through the food chain. Contaminants can affect an individual’s immune system, reproductive system, and lipid metabolism, which can have long term consequences on populations (Bevan & Schneider, 2021). Marine mammals and megafauna are considered of **medium sensitivity** to accidental pollution.

12.6.2.6.3 Assessment of Significance prior to mitigation

Prior to mitigation, the risks associated with accidental releases of pollutants from construction vessels will have a **not significant negative effect** which is Not Significant.

12.6.2.6.4 Mitigation

Support and installation vessels operating during the construction phase will operate in accordance with best practice and maritime conventions including the MARPOL and BWM conventions. Adherence to these conventions seek to avoid, prevent and reduce the likelihood that vessel operations result in pollution events to the marine environment, including from routine discharges which are prohibited as per MARPOL IV. Additionally, control measures and SOPEPs (for oil tankers of 150 gross tonnage and above and all vessels of 400 gross tonnage and above) will be established and adhered to, if required, under MARPOL Annex I.

Mitigation by prevention will be implemented to ensure that the potential release of contaminants and pollutants is minimised, including through the implementation of an Offshore Environmental Management Plan (Appendix 5-2),comprising *inter alia* a Vessel Management Plan (Appendix 5-10) and MPCP (Appendix 5-3) (see section 12.4.3.4). These plans describe measures for compliance with international requirements of MARPOL, as well as best practice for works in the marine environment (e.g. preparation of SOPEP). In this manner, accidental release of potential contaminants from operation and maintenance vessels will be strictly controlled and procedures will be in place to minimise the effect of any accidental release if it occurs.

12.6.2.6.5 *Residual effect following mitigation*

Considering the mitigation, the residual effect will be an unlikely, temporary and rare, **imperceptible negative effect** which is Not Significant.

12.6.3 Operational and Maintenance Phase

12.6.3.1 Risk of injury resulting from collision of marine mammals or other megafauna with WTG foundations

12.6.3.1.1 *Description of effect*

During the operation and maintenance phase, there is the potential of an increased risk of injury to marine mammals and other megafauna with WTG foundations within the OAA. The presence of these novel submersed structures may elevate the risk of collision and subsequently, injury or mortality.

12.6.3.1.2 *Characterisation of unmitigated effect*

There is currently no evidence of marine mammal or basking shark collision with offshore WTG, whether as floating or fixed-bottom infrastructure. Studies characterise the risk of collision with other types of marine energy infrastructure, such as tidal turbines, which are near the seabed or in the mid water column, and which move within the water. The risk and impact magnitude of collisions with subsurface tidal energy developments is low, as demonstrated by high avoidance rates of turbine rotors by harbour porpoise (Gillespie *et al.*, 2021) and harbour seals (Onoufriou *et al.,* 2021). Additionally, the risk of severe injury from a mobile turbine is low, with the majority of predicted collisions being unlikely to cause fatal trauma to seals (Onoufriou *et al.,* 2019). Based on this, collision from a stationary foundation is highly unlikely to cause any significant or fatal injury to a marine mammal or other megafauna. As this effect is highly localised to the OAA and very unlikely to occur, with a very low risk of injury from collision, the magnitude is considered to be **negligible**.

Marine mammals and megafauna have the greatest likelihood of interacting with the substructure of the WTG, particularly during foraging activity. The presence of novel infrastructure that is unfamiliar to individuals could lead to a collision when an individual is focused on foraging and engaging in chasing behaviour. However, the 30 WTGs and the one OSS will be placed on GBS foundations with a maximum column diameter of 13 m and maximum base diameter of 55 m. There will be a minimum spacing of 1,017m between WTG's and 610 m between the OSS and the nearest WTG. In comparison to the size of marine mammals, basking shark and turtles, the scale of the WTGs and OSS would mean that they would be highly predictable, and it is very unlikely that any species would not be aware of the substructure. It is likely that the individuals would habituate to the presence of the substructures, which would further reduce the likelihood of collision. For these reasons, all marine mammal and other megafauna receptors are considered to have **negligible sensitivity** to this impact pathway.

12.6.3.1.3 *Assessment of Significance prior to mitigation*

Significant effects from the risk of injury resulting from collision with WTG foundations are not anticipated on any marine mammal and megafauna receptor during the operation and maintenance of the Project. The effect is therefore considered an unlikely, **imperceptible negative effect** which is Not Significant.

12.6.3.1.4 *Mitigation*

No mitigation measures are required for this effect.

12.6.3.1.5 *Residual effect following mitigation*

Taking the negligible magnitude of impact and the negligible sensitivity of all receptors, the overall effect of the risk of injury from collision with WTG foundations is considered an unlikely, **imperceptible negative effect** which is Not Significant.

12.6.3.2 Effects from operational sound

12.6.3.2.1 *Description of effect*

Underwater sound may be generated from the moving mechanical parts within the WTG, such as the gearbox in the nacelle (Tougaard *et al.,* 2020). As the blades rotate, vibrations are generated and travel down into the foundations, radiating out into the surrounding water and seabed, and is generally continuous and at a low frequency of less than 1 kHz (Amaral *et al.,* 2020).

12.6.3.2.2 *Characterisation of unmitigated effect*

Operational sound is expected to be almost continuous apart from occasional maintenance or shutdowns due to extreme weather. However, in shallow-water environments, the relative sound of the WTG is usually dominated by ambient sound from shipping traffic or storms. When compared to other sources, WTG sound has been found to be significantly less than passing ships (Tougaard *et al.*, 2020) and the overall relative sound from the windfarm, is unlikely to cause any significant disturbance to marine mammals and other megafauna. Nedwell *et al.* (2007) found that the sound levels within an OWF was only a few dB above the background sound outside of the OWF, showing that the variations in sound levels are well within those encountered in background sound, and is not above the sound regularly encountered by marine mammals. Studies have shown that construction sound has more severe effects on marine mammals than the operational sound, and that operational effects are negligible especially in comparison to anthropogenic or natural sound (Madsen *et al.,* 2006; Brasseur *et al.,* 2012).

Underwater sound modelling was undertaken by Subacoustech (2024; see Appendix 12-1) to estimate the sound levels generated by operational WTGs and determined the impact range that may injure marine mammals, fish, and turtles. As described in Appendix 12-1 (Subacoustech, 2024) the modelling approach assumes that the animal remains stationary for 24 hours in relation to the sound source, which is considered highly precautionary and unlikely. The greatest potential for injury is for LF cetaceans (including minke whale), where an individual must remain within 10 m of the operational WTG for 24 hours to experience injury. All other species, including fish and turtles, have an estimated impact range of < 10 m.

Overall, the operational sound will have a likely, long-term, adverse effect on marine mammals and other megafauna receptors across the entirety of the operational and maintenance phase and will cease once the operational and maintenance phase is complete. The effect is considered to occur continuously, although not all turbines may be operational at the same time, or for 24 hours per day. Based on the results of the sound modelling, it is not expected to have a significant effect on the conservation status or integrity of marine mammal and megafauna receptors, causing a minor shift to baseline conditions. The effect is considered to be highly localised to the OAA and injury is highly unlikely to occur, therefore the effect is defined as being of **low magnitude**.

As the sound generated is of low frequency, it is likely that only minke whale would be impacted by operational sound for WTGs. Other marine mammals and megafauna have been scoped out of further assessment. Minke whales may be able to detect operational WTG sound from over 18 km away (Marmo, 2013), but due to the low density of this species in the vicinity of the OAA the number of animals that would demonstrate a behavioural response is likely to be very small. As such, there is little risk of displacement for minke whales, and so they are assessed as being of **low sensitivity**.

12.6.3.2.3 *Assessment of Significance prior to mitigation*

Prior to mitigation, the effects of operational sound on minke whale are likely to have **slight, negative effect** which is Not Significant.

12.6.3.2.4 *Mitigation*

No mitigation measures are required for this effect.

12.6.3.2.5 *Residual effect following mitigation*

The residual effect of operational sound on minke whale will be likely, long-term and continuous, **slight negative effect** which is Not Significant.

12.6.3.3 Displacement or barrier effects resulting from the physical presence of devices and infrastructure

12.6.3.3.1 *Description of effect*

During the operation and maintenance phase, the physical presence of the array infrastructure, including substructures and the foundations, has the potential to cause displacement or barrier effects on marine mammals and basking sharks. The presence of these structures may restrict access to key habitats used by marine mammals and megafauna and effect movement patterns and/or behaviour of individuals or populations by compromising their access to key habitats, such as reproductive or foraging grounds, or inhibit migratory movements.

Displacement refers to the spatial displacement or loss of access to the area occupied by the Project infrastructure during its 38-year operational lifespan. Barrier effects refer to the prevention of access to areas surrounding the Project due to the presence of the array infrastructure. Migratory species, like basking sharks and minke whales, particularly rely on key pathways or seasonal habitats which could be obstructed by the infrastructure, making them vulnerable to barrier effects. Basking sharks undertake seasonal migrations along migratory pathways, which link foraging areas between the west of Scotland and the Irish and Celtic seas (Doherty *et al.,* 2017). Basking sharks have been observed in 2024 around the Aran Islands and around the coast of county Clare (IWDG, 2024), suggesting that basking sharks are likely to be present in the area. Similarly, minke whales undertake seasonal migrations to feeding hotspots in the North Sea (Risch *et al.*, 2019).

12.6.3.3.2 *Characterisation of unmitigated effect*

Submerged OWF structures can act as fish aggregate devices, increasing foraging opportunities for predators and attract new species through the creation of artificial reefs (Degraer *et al.*, 2020). Harbour porpoise and grey seals have been shown to concentrate their foraging around OWFs, repeatedly returning to the OWF and moving in between individual WTGs in a grid-like pattern (Russell *et al.,* 2014). Similarly, Fernandez-Betelu *et al.* (2022) showed that harbour porpoise are attracted to offshore structures and modify their patterns of occurrence and foraging activity around them. Studies at Dutch OWFs recorded increased harbour porpoise activity within the sites, suggesting that they may be attracted to increased food availability and the reduced vessel traffic within the OWF (Lindeboom *et al.*, 2011; Scheidat *et al.,* 2011). However, other studies have shown no effects of OWFs on harbour porpoise abundance throughout the operational and maintenance phase of an OWF in the Irish Sea (Vallejo *et al.,* 2017). Monitoring studies of OWFs using GBS foundations in the UK show no long-term effect on both white-beaked dolphins and bottlenose dolphins, and demonstrate an increase in harbour porpoise occurrence (Potlock *et al.,* 2023). Other anthropogenic sea floor structures, such as cable routes (and associated cable protection), may also act as artificial reefs and provide habitat connectivity for prey species. Seals have been observed to repetitively forage around anthropogenic structures. Additionally, no significant barrier effects were observed from anthropogenic structures as seals continued to pass by structures during foraging trips (Arnould *et al.,* 2015).

Evidence of harbour porpoise displacement due to the presence of an OWF has been shown through a long-term monitoring study on harbour porpoise in the Nysted OWF in Denmark. A decline in echolocation activity after the operation of the OWF commenced was observed, which has not recovered to baseline conditions since, albeit a gradual increase of porpoise presence was also recorded (Teilmann & Carstensen, 2012). It is possible that harbour porpoise habituated to the OWF, and potentially took advantage of reef effects.

Barrier effects from the physical presence of infrastructure around the Offshore Site will have a likely, long-term adverse effects on marine mammals and basking sharks. The Project will consist of a maximum of 30 WTGs separated by a minimum of 1,017 m, and one OSS, for an overall footprint of 117,604 m^2 in the addition to 110, 187 m^2 of stonebed material for jack-up installation vessels. The OEC will be buried or will include additional cable protection measures (165,818 m^2) where burial is not possible, for a length of 63.5 km. The IACs will also be buried where possible or will include additional cable protection measures (1,282,082 m^2) across a maximum length of 73 km. As such, the cable infrastructure is not anticipated to cause any barrier effects during the operational and maintenance phase, and therefore are not considered further for potential effects.

The effect will be long-term (up to 38 years) and will cease following decommissioning. Overall, barrier effects are expected to occur a local extent around the OAA. The spatial extent of the impact is low due to the distances between the WTGs (1,017 m), therefore it will be much smaller than that of the habitat used by marine mammals and other megafauna. The magnitude of this effect is therefore **negligible**.

The spacing between the WTGs is unlikely to prevent the functional habitat use by individuals across the OAA, and it is anticipated that individuals would swim around the substructure and within the OAA. Considering that marine mammal and megafauna receptors have high tolerance to the presence of devices and infrastructure, all receptors are assessed to be of **negligible sensitivity**.

12.6.3.3.3 Assessment of Significance prior to mitigation

Significant barrier effects are not anticipated on any marine mammal and megafauna receptor during the operation and maintenance of the Project. The effect is therefore considered an **unlikely, continuous, imperceptible negative** effect which is Not Significant.

12.6.3.3.4 Mitigation

No mitigation measures apply for this effect.

12.6.3.3.5 Residual effect following mitigation

The residual effect will be likely, long-term and continuous, **imperceptible negative** effect which is Not Significant.

12.6.3.4 Disturbance due to the physical presence of vessels

12.6.3.4.1 *Description of effect*

During the operation and maintenance phase, there will be periods of increased localised vessel traffic associated with the Project, which could result in an increased risk disturbance from marine sound and barrier effects to marine mammals and other megafauna through avoidance and displacement, as well as potential behavioural changes. As outlined in Section 12.6.2.3, vessel sound is included with physical presence as part of the assessment.

12.6.3.4.2 *Characterisation of unmitigated effect*

Disturbance from the physical presence of vessels around the Offshore Site will have a likely, long-term adverse effect on marine mammals and basking sharks. Increased vessel traffic will occur throughout the Project area (OAA and OECC), including vessels present on site and transiting to and from the site. There are up to three vessels expected within the area at any time, including up to 2 CTVs with up to four daily return vessel movements and 1 SOV, which would have an imperceptible effect on baseline conditions. There are additional campaigns expected during the lifetime of the Project, including:

- Two annual jack up intervention campaigns (may cover more than two locations);
- One repair platform per year;
- One drone campaign per year;
- Five unscheduled cable repair vessels over the lifetime;
- Cable survey vessels required annually for the first 5 years, and one every 5 years thereafter; and
- Oil exchange vessels required once every 10 years.

The effects would be rare and intermittent over the lifetime of the Project (38 years). The effect will cease following the operational and maintenance phase, after which marine mammals and basking sharks that may have been displaced would return to the area. Overall, the effect of vessel sound is expected to occur to a local extent within a small part of the Study Area, mostly around the OAA and OECC, and is expected to be reduced in comparison to the construction phase, as fewer, smaller vessels will be onsite for shorter durations. The magnitude of this effect is therefore **negligible**.

The vessel disturbance effect is expected to be the same or less than that of the construction phase. All assessed species apart from harbour porpoise and turtles have been assessed to be of **low sensitivity** to disturbance from vessels, and harbour porpoise and turtles have been assessed to be of **medium sensitivity** to disturbance from vessels.

12.6.3.4.3 *Assessment of Significance prior to mitigation*

Prior to mitigation, disturbance due to the physical presence of vessels within the Project on harbour porpoise and turtles is likely to have a **not significant negative effect** which is Not Significant. The effect of disturbance due to the physical presence of vessels on all other marine mammal and megafauna species is likely to have an **imperceptible negative effect** which is Not Significant.

12.6.3.4.4 *Mitigation*

Vessel movements will be managed in a way that will mitigate the negative effects to marine mammals and megafauna. These measures are described in detail in Appendix 5-10: Vessel Management Plan, including:

- Vessels engaged in construction works will typically be travelling at slow (<6 kts) speeds. This will reduce sound emissions relative to high-speed transiting and reduce the underwater sound effects associated with vessel sounds; and
- Vessels will follow prescribed routes (non-random movement).

12.6.3.4.5 *Residual effect following mitigation*

Given the mitigation measures, with the temporary nature of the work, the residual effect will be likely, temporary and occasional, and therefore is assessed as an **imperceptible negative effect** for all marine mammal and megafauna species which is Not Significant.

12.6.3.5 Risk of injury resulting from collision of marine mammals and megafauna with operations and maintenance vessels

12.6.3.5.1 *Description of effect*

During the operational and maintenance phase, there will be periods of increased localised vessel traffic associated with the Project, which could result in an increased risk of injury or mortality to marine mammals and other megafauna in relation to collision risk.

12.6.3.5.2 *Characterisation of unmitigated effect*

The risk of injury resulting from collision will have a likely, long-term adverse effect over the operational and maintenance phase (38 years), although the vessels would be present for only a few hours a day (temporary). A maximum of three vessels are expected to be present at the same time at the site with the addition of vessel requirements for annual jack-up intervention campaigns, repairs, surveys and oil exchange vessels. The effect will cease following the end of the operational and maintenance phase after which vessel traffic will return to background levels.

When compared to the construction phase, fewer vessels will be present during the operation and maintenance phase. Collision is highly unlikely to occur, and the magnitude is expected to be less than that of the construction phase (Section 12.6.2.4), and so this effect is therefore assessed as **negligible magnitude**.

Harbour porpoise, dolphin species, and seal species are assessed to be of **low sensitivity** to vessel collision (as outlined in Section 12.6.2.4). Minke whales and basking sharks are considered to have a **high sensitivity**, and marine turtles are considered to have a **medium sensitivity** to the effect (see Section 12.6.2.4).

12.6.3.5.3 *Assessment of Significance prior to mitigation*

The risk of injury resulting from collision with vessels on all receptors will have a **not significant negative effect** which is Not Significant.

12.6.3.5.4 *Mitigation*

Vessel movements will be managed in a way that will mitigate the negative effects to marine mammals and megafauna. These measures are described in detail in Appendix 5-10: Vessel Management Plan, including:

- Vessels engaged in construction works will typically be travelling at slow (<6 kts) speeds. This will reduce sound emissions relative to high-speed transiting and reduce the underwater sound effects associated with vessel sounds; and
- Vessels will follow prescribed routes (non-random movement).

These mitigation measures mean that vessels would pose a low collision risk.

12.6.3.5.5 *Residual effect following mitigation*

Considering the mitigation that will reduce the likelihood and severity of vessel collisions, and the fact that vessel collisions are not a dominant cause of mortality in marine mammals, the effect is highly unlikely to occur. The effect would occur over small spatial scale around the OAA and OECC, particularly in comparison to the widespread available habitat for marine mammals and megafauna in proximity of the Offshore Site. Based on the long-term (38 years) nature of this effect, the residual effect is considered to be an **unlikely, temporary, rare**, **imperceptible negative effect** which is Not Significant**.**

12.6.3.6 Risk associated with electromagnetic fields (EMFs) associated with subsea cabling

12.6.3.6.1 *Description of effect*

Electrical cables in the marine environment, such as HVAC cables, will generate EMFs, which are comprised of an electric and a magnetic component. This may alter the behaviour and distribution of marine species that can detect them, particularly ones that rely on electric and/or magnetic signals for hunting and navigation (Gill & Desender, 2020).

12.6.3.6.2 *Characterisation of unmitigated effect*

EMFs have both an electric component (E-field, measured in volts per metre (V/m)) and a magnetic component (B-fields, measured in micro Tesla (μT)). Earth has its own natural geomagnetic field (GMF) with associated B and iE-fields, which marine organisms use for orientation, navigation, and prey location (Gill & Desender, 2020). Background GMF levels in the marine environment ranges from 25 to 65 μT (Hutchison *et al.*, 2018). Direct anthropogenic E-fields are blocked by the use of conductive sheathing within the cable, and hence are not considered further in this assessment. B-fields extend beyond the cable structure and are emitted into the marine environment, which results in an induced electric (iE)-field when relative motion is present between the B-field and a conductive medium (i.e. sea water passing over the cable). B-fields decay rapidly with distance from the cable, eventually reaching background GMF levels. EMFs emitted by HVAC cables result in a dynamic, low-frequency sinusoidal B-field (Gill & Desender, 2020).

Numerical studies show that EMFs decrease with distance from the cable core (Hutchison *et al.*, 2021; Chainho *et al.*, 2021). Cable burial can increase the distance between the EMF source and the receptor, and where burial is not possible, rock placement or other protection can increase the distance. All cables will be either buried to a minimum target burial depth of 1 m or protected to a depth by a cast iron shell (CIS), therefore there will always be a degree of separation from marine mammal and megafauna receptors and the source of EMF emissions, should any receptor be present directly at the seabed. In addition, design parameters and installation methods will conform to industry standard specifications which includes shielding technology to reduce the direct emission of EMFs. The EMFs will be highly localised to the vicinity of the cables and the strengths will dissipate quickly with increased distance from the cables.

The source of EMFs from the Offshore Site will comprise of:

- A network of IAC, with a length of 73 km; and
- One OECC (220 kV) with a maximum length of 63.5 km.

The operation of these cables will result in the emission of localised EMFs around the vicinity of the cable, which may lead to localised effects on marine mammal and megafauna receptors. The modelled

B-field strengths associated with these cables based on different burial depths are presented in Table 12-32.

Table 12-32 B-fields associated with the IAC and OEC, measured at the seabed surface and the CIS surface. No cable sheath was incorporated into the modelling.

	Inter-array cables			Offshore export cable		
Measurement location	Seabed surface	Seabed surface	CIS surface	Seabed surface	Seabed surface	CIS surface
Burial depth (m)	1.0	2.0	0.0	1.0	2.0	0.0
B-field (μT)	17.7	4.6	30.3	25.3	7.0	48.3

The highest modelled B-fields are anticipated for the OEC at the CIS surface (i.e. surface laid cable), with levels up to 48.3 μT. This is lower than the background GMF levels of 50 μT, therefore will not be detectable above the baseline. The effect is expected occur fairly consistently throughout the operational and maintenance phase, although will vary depending on generated output from the WTGs. Therefore, the magnitude of impact is assessed as **negligible.**

Very few studies have assessed the effects of magnetic and induced electric fields from cables on marine mammals and megafauna. Where evidence does exist, no study has indicated that EMFs would be likely to have an important effect upon marine mammals. Harbour seals were not found to use the earth's magnetic field to orient or navigate (Renouf, 1991; Hanke & Dehnhardt, 2018), and so are unlikely to be directly impacted by EMFs, and the same is expected of grey seals given their similar physiology. The majority of studies looking at the interaction between cetaceans and EMFs have focused on dolphins. One individual in a study on Guiana dolphins *Sotalia guianensis* was able to detect electrical stimulation through their vibrissal follicles (Czech-Damal *et al.,* 2011; Mynett, 2022), although the levels of EMFs produced from subsea cables may not be high enough to trigger this detection, as Guiana dolphin electro-sensing thresholds were higher than the reported values produced from subsea cables (Czech-Damal *et al.,* 2011; Öhman *et al*., 2007; Taormina *et al.,* 2018). No other evidence of electro-sensitivity or behavioural responses have been observed in other marine mammals (Czech-Damal *et al.,* 2011; Geelhoed *et al*., 2022). There is evidence of magneto reception in some species of cetaceans (humpback whale, fin whale, bottlenose dolphin, harbour porpoise) (Bauer *et al.,* 1985; Kirschvink *et al.,* 1986), although this could only occur at very localised scales due to the rapid decay in strength of magnetic fields from cables. A modelling study found that bottlenose dolphins could potentially detect the B-field up to 50 m from a subsea cable, with the potential to alter direction of travel, although behavioural effects would only be likely if the individual were directly above the cable (Tricas & Gill, 2011). Existing evidence suggests that the levels of EMFs emitted by offshore renewable energy export cables are at a level low enough that there is no potential for significant effects on marine mammals (OES, 2020). Based on the low electro-sensitivity of marine mammals, they have been assessed to be of **negligible sensitivity.**

Elasmobranchs, such as basking sharks, are known to be electro-sensitive species as they possess specialised electro-receptors to detect changes in current flow (Copping & Hemery, 2020). They may utilise EMFs to aid in migration, orientation and hunting (Copping & Hemery, 2020). Studies have shown that elasmobranchs can detect very low electric fields (Taormina *et al.,* 2018), and thus may be sensitive to EMFs emitted from cables. Studies have found effects of EMFs on the behavioural movement of the little skate (Hutchison *et al*., 2018; 2020), small spotted sharks and captive sandbar sharks (Anderson *et al.,* 2017). Overall, basking sharks are considered to have a **low sensitivity** to EMFs as they are expected to be able to recover rapidly from any effects.

Sea turtles use the earth's magnetic fields for migration and orientation, and as such may be sensitive to EMFs emitted from subsea cables (Tricas & Gill, 2011). No data is available on the impacts of magnetic fields from subsea cables, although studies have shown that changes in field direction can cause turtles to deviate from their original direction. However, sea turtles use multiple cues during navigation and migration, such that they will be capable of adapting to the effect and recover rapidly. As such, sea turtles have been assessed to be of **low sensitivity** to EMFs.

12.6.3.6.3 *Assessment of Significance prior to mitigation*

Prior to mitigation, the risks associated with EMFs will have an **imperceptible negative effect** on marine mammals which is Not Significant; and a **not significant negative effect** on basking sharks and turtles which is Not Significant.

12.6.3.6.4 *Mitigation*

Mitigation by design has been incorporated through cable burial, where the cable will be buried to a minimum depth of 1 m, or through the use of cable protection measures (including CIS), therefore increasing the distance between the receptor and the cable and reduces the potential for exposure to high strength magnetic fields.

12.6.3.6.5 *Residual effect following mitigation*

The cable design ensures that EMF emissions are reduced to background GMF levels, where there is no evidence for biological effects from EMFs to marine mammal and megafauna receptors. Furthermore, the direct E-fields are blocked by the use of conductive sheathing within the cable, and hence are not considered within this assessment as there is no pathway for impact.

The residual effect will be constant and long-term across the operational and maintenance phase. However, the effect is highly localised (i.e. a few metres from the cable), and only directly over the cables, and the duration of the effect will only occur while the animal is directly over the cable (seconds to minutes). Cetaceans, basking sharks, and turtles are unlikely to be within the vicinity of the effect based on their high mobility and their presence throughout the water column rather than near or on the seabed. Significant effects are not anticipated on any marine mammal and megafauna receptors, and the residual effect is therefore considered to be an **unlikely, short-term, constant, imperceptible negative effect** which is Not Significant.

12.6.3.7 Impacts associated with effects upon marine water quality due to any accidental release of pollutants

12.6.3.7.1 *Vessel pollution*

Description of effect

Accidental releases of pollutants may occur as a result of an accidental spill (i.e. such as during a vessel collision), where spillage of fuel (i.e. diesel), chemicals or other contaminants may occur which could have a detrimental effect on marine mammals and megafauna. This includes avoidance of affected areas, and the potential for sub-lethal or lethal effects depending on the length of exposure and the concentration of the pollutants.

Characterisation of unmitigated effect

Accidental releases of pollutants may arise from vessel activities over the operational and maintenance phase. There are up to three vessels expected within the area at any time, including up to two CTVs with up to four daily return vessel movements and one SOV. There are additional campaigns expected during the lifetime of the Project, including:

- Two annual jack up intervention campaigns (may cover more than two locations);
- One repair platform per year;
- One drone campaign per year;
- Five unscheduled cable repair vessels over the lifetime;
- Cable survey vessels required annually for the first 5 years, and one every 5 years thereafter; and
- Oil exchange vessels required once every 10 years.

Historically, five acute pollution events were reported in Irish waters between 2006 and 2011 (DHLGH, 2013). The historical frequency of pollution events is considered low in comparison to the existing vessel traffic around Ireland. The presence of vessels is not expected to be above the existing baseline traffic of vessels in the area.

The effect would be rare, intermittent, and highly unlikely over the lifetime of the Project (38 years) and will cease following the operational and maintenance phase. Overall, the effect of accidental pollution from vessels is expected to occur to a local extent within a small part of the Study Area during round trips from port to the OAA and OECC. The magnitude of this effect is therefore **negligible**.

Marine mammals and megafauna are considered of **medium sensitivity** to accidental pollution (as outlined in Section 12.6.2.6.2).

Assessment of Significance prior to mitigation

Prior to mitigation, the risks associated with accidental releases of pollutants from maintenance vessels will have a **not significant negative** effect on marine mammals and other megafauna, which is Not Significant.

Mitigation

As detailed for the construction phase, the mitigations proposed are considered sufficient to reduce the residual effects to not significant levels (see Section 12.6.2.6.4).

Vessels operating during the operation and maintenance phase will operate in accordance with best practice and maritime conventions including the MARPOL and BWM conventions. Adherence to these conventions seek to avoid, prevent and reduce the likelihood that vessel operations result in pollution events to the marine environment, including from routine discharges which are prohibited as per MARPOL IV. Additionally, control measures and SOPEPs (for oil tankers of 150 gross tonnage and above and all vessels of 400 gross tonnage and above) will be established and adhered to, if required, under MARPOL Annex I.

Mitigation by prevention will be implemented to ensure that the potential release of contaminants and pollutants is minimised, including through the implementation of an Offshore Environmental Management Plan (Appendix 5-2), comprising *inter alia* a Vessel Management Plan (Appendix 5-10) and MPCP (Appendix 5-3) (see section 12.4.3.4). These plans describe measures for compliance with international requirements of MARPOL, as well as best practice for works in the marine environment (e.g. preparation of SOPEP). In this manner, accidental release of potential contaminants from operation and maintenance vessels will be strictly controlled and procedures will be in place to minimise the effect of any accidental release if it occurs.

Residual effect following mitigation

Considering the mitigation by prevention, the residual effect will be an unlikely, temporary and rare, **imperceptible negative effect** and is assessed to be Not Significant.

12.6.3.7.2 *Accidental release from WTGs and OSS*

Description of effect

Accidental release of pollutants can occur from pollutants contained within the WTGs and the OSS. The accidental release of pollutants is limited to oils and fluids contained within the structures. The majority of these fluids are characterised by water/glycol (21.8%) and nitrogen (65.4%), which are organic substances. These fluids have the potential to interact with marine mammals and megafauna and may have a detrimental physiological effect.

Characterisation of unmitigated effect

Offshore wind developments generally have a limited potential for accidental releases of pollutants as the WTGs generally contain small inventories of chemicals and hydrocarbons (principally hydraulic, gearbox and other lubricating oils (DECC, 2011). Accidental release of pollutants has the potential to occur from a maximum of 30 WTGs and the OSS with exceptionally low volumes of oils and fluids. The potential for full inventory release from a turbine, or multiple concurrent leaks, are considered extremely remote and, if at all, would likely occur as a slow release, which would be almost undetectable and immediately dispersed, limiting the potential interactions between pollutants and marine mammals and other megafauna. Due to the highly unlikely nature of this effect over a very localised extent and with no potential to affect the conservation status of marine mammal and other megafauna receptors, the magnitude of this effect is considered **negligible**.

As assessed in Section 12.6.3.7.1, contaminants in the water column may directly affect marine mammals and megafauna and may have a long-term consequence on populations. Based on the volume of pollutants that may accidently be released in the water column in comparison to available habitat within the Study Area, marine mammals and megafauna are considered of **low sensitivity** to accidental pollution from WTGs.

Assessment of Significance prior to mitigation

Significant effects due to accidental releases of pollutants from WTGs are not anticipated on any marine mammal and megafauna receptor during the operation and maintenance of the Project. The effect is therefore considered an unlikely, **imperceptible negative** effect which is Not Significant.

Mitigation

The WTG including the nacelle, tower, and rotor and OSS structures are designed to contain any potential leaks. The containment design of the WTG / OSS sections will therefore significantly reduce the risk of potential spills contaminating the marine environment. Additionally, for the planned oil transfers the transfer of potential pollutants to WTG's/OSS will be meticulously planned and will follow all relevant guidelines.

Residual effect following mitigation.

Considering the mitigation by prevention, the residual effect will be an unlikely, temporary and rare, **imperceptible negative effect** and is assessed to be Not Significant.

12.6.3.8 Habitat change, including the potential for change in foraging opportunities

12.6.3.8.1 *Description of effect*

The foundation structures of WTGs and the OSS, as well as scour protection and cable protection, will cause long-term habitat changes and loss for prey species of marine mammal and megafauna receptors. Long-term habitat change will cause changes in prey abundance and distribution, which can affect foraging success and losses in foraging opportunities for marine mammals and megafauna.

The presence of WTGs, the OSS, and scour protection can also generate artificial reef effects, where the presence of infrastructure can function as a fish aggregating device (as explained in Section 12.6.3.3). The infrastructure provides new habitat that can be colonized by biofouling organisms, which in turn attracts higher trophic levels (Degraer *et al.,* 2020). Marine predators, such as marine mammals and basking sharks, then target these areas for foraging and profit from the highly biodiverse community present around the array (Reubens *et al.,* 2014).

This assessment is informed by assessments presented in Chapter 9: Benthic Ecology, Chapter 10: Fish and Shellfish Ecology, and Chapter 13: Commercial Fisheries.

12.6.3.8.2 Characterisation of unmitigated effect

The WTGs and the one OSS will be placed on GBS foundations installed on stonebeds with a total footprint of 117,604 m^2. Where target burial depth cannot be achieved or in areas of cable crossings, cable protection may be required, which is expected to account for 1,282,082 m^2 of habitat loss for the IACs and 165,818 m^2 of habitat loss for the OECC. Up to 110,187 m^2 of seabed habitat loss is also assumed to occur for the establishment of stonebeds for up to 10 jack-up placements. However, placed in the context of available habitat loss for the prey species of marine mammals and megafauna, prey species sensitivity is assessed as being low to high (see Chapter 10: Fish and Shellfish Ecology). The magnitude of the impact for prey species is considered to be low, but the presence of physical infrastructure can cause displacement and slight loss of habitat. However, there is the potential for habitat creation from reef effects, which can lead to a positive effect on marine mammals and megafauna. This effect can have both a positive or adverse effect on marine mammals and megafauna, depending on whether the prey species are able to recover and aggregate around the infrastructure. Considering the small scale of this effect and the available foraging habitat, this results in an assessment of a **negligible** magnitude.

As discussed in section 12.6.3.3, pinnipeds and harbour porpoise have been shown to concentrate their foraging around OWFs. Additionally, the spatial extent of the introduced infrastructure will be much smaller than that of the habitat used by marine mammals and other megafauna. Considering that marine mammals and other megafauna are highly mobile, and their high tolerance to the presence of devices and infrastructure, all marine mammal and megafauna receptors are assessed to be of **negligible** sensitivity to the long-term habitat change from the presence of infrastructure.

12.6.3.8.3 Assessment of Significance prior to mitigation

Prior to mitigation, the effect is assessed to be an **imperceptible negative or positive effect** which is Not Significant.

12.6.3.8.4 Mitigation

Mitigation measures are in place to reduce the habitat loss or disturbance to fish and shellfish spawning or nursey habitats. This includes pre-construction benthic survey and habitat mapping that have been undertaken to inform habitat distribution and identify potential spawning or nursery habitats. This information has been taken into account during cable route refinement within the OECC, including the avoidance of sensitive habitats and the minimisation of cable installation over reef-like rocky habitat.

12.6.3.8.5 Residual effect following mitigation

Taking the mitigation measures, the residual effect of habitat change on marine mammals and megafauna is assessed to be **imperceptible positive or negative effect** which is Not Significant.

12.6.4 Decommissioning Phase

A Rehabilitation Plan (Appendix 5-18) has been prepared for the Project as well as Appendix 5-18: Rehabilitation Schedule. Further details for decommissioning will be agreed with the relevant planning authorities prior to any decommissioning works. The Decommissioning Plan will be updated prior to the end of the operational period in line with decommissioning methodologies that may exist at the time and will be agreed with the competent authority at that time. As set out in Appendix 5-18, decommissioning activity will resemble the reverse of the installation and therefore the potential impacts associated with the decommissioning phase are assessed on that basis.

The decommissioning base locations will likely be Foynes, Cork and/or Belfast. Up to three vessels will be used for WTG removal and up to four tugs for foundation removal. For infrastructure removal the installation process is reversed using vessels to remove the WTGs and then to deballast the foundations and wet tow them from the site. Rock protection used for cables and/or seabed preparation material (e.g. stonebeds) will be left *in situ*. Decommissioning of the cables will involve removal of any accessible exposed or unburied cable. All rock berms will be decommissioned *in situ* and will remain undisturbed. This method has the lowest environmental impact.

It is noted that no effect arising from the decommissioning activities will have a greater negative effect than the corresponding effect during the construction phase, and in all cases will be less.

Taking this into consideration, along with the mitigation measures presented throughout section 12.6.2, which will also be applicable to decommissioning, the effects associated with the Decommissioning Phase will be **slight negative** (or less) and will be Not Significant for all marine mammal and megafauna receptors.

12.6.5 Summary of Effects

12.6.5.1 Construction Phase

12.6.5.1.1 *Acoustic effects associated with construction (including pre-construction)*

Injury from construction sound

Table 12-33 Residual effect for injury to from construction sound

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
Harbour porpoise, dolphins, and pinnipeds	Low	Low	Not Significant, negative; Not Significant.	Mitigation by design.	Not significant, negative; Not Significant.
Minke whale	Medium	Low	Slight, negative; Not Significant.	Mitigation by design.	Not significant, negative; Not Significant.
Other megafauna	Negligible	Negligible	Not significant,	Mitigation by design.	Not significant,

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
			negative; Not Significant.		negative; Not Significant.

Disturbance from construction sound

Table 12-34 Residual effect for disturbance to from construction sound

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
Cetaceans	Low	Low	Not Significant, negative; Not Significant.	Mitigation by design.	Not significant, negative; Not Significant.
Pinnipeds	Negligible	Low	Not Significant, negative; Not Significant.	Mitigation by design.	Not significant, negative; Not Significant.
Other megafauna	Negligible	Negligible	Not significant, negative; Not Significant.	Mitigation by design.	Not significant, negative; Not Significant.

Injury from UXO clearance

Table 12-35 Residual effect for injury from UXO clearance

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
Harbour porpoise, dolphin and pinnipeds	Low	Medium	Slight, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Not significant, negative; Not Significant.
Minke whale	Medium	Medium	Moderate, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Not significant, negative; Not Significant.
Basking sharks	Low	Medium	Slight, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Not significant, negative; Not Significant.
Turtles	Medium	Medium	Moderate, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Not significant, negative; Not Significant.

Disturbance from UXO clearance

Table 12-36 Residual effect for disturbance from UXO clearance

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
All marine mammals	Low	Negligible	Not significant, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Not significant, negative; Not Significant.
Basking sharks	Low	Medium	Slight, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Not significant, negative; Not Significant.
Turtles	Medium	Medium	Moderate, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Not significant, negative; Not Significant.

12.6.5.1.2 *Indirect effects of construction sound on the prey species of marine mammals and megafauna*

Table 12-37 Residual effect of indirect effects of construction sound on the prey species of marine mammals and megafauna during construction (including pre-construction)

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
All receptors	Low	Negligible	Not significant, negative; Not Significant.	Mitigation by design.	Not significant, negative; Not significant.

12.6.5.1.3 Disturbance due to the physical presence of vessels

Offshore Site

Table 12-38 Residual effect for disturbance due to the physical presence of vessels during construction and decommissioning

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
Cetaceans (except harbour porpoise)	Low	Negligible	Imperceptible, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Not significant, negative; Not significant.
Harbour porpoise	Medium	Negligible	Not Significant, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Not significant, negative; Not significant.
Pinnipeds	Low	Negligible	Imperceptible, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Not significant, negative; Not significant.
Basking sharks	Low	Negligible	Imperceptible, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Not significant, negative; Not significant.
Turtles	Medium	Negligible	Not significant, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Not significant, negative; Not significant.

Shannon Estuary

Table 12-39 Residual effect for disturbance due to the physical presence of vessels in the Shannon Estuary during construction and decommissioning

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
Bottlenose dolphin	Medium	Negligible	Slight, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Not significant, negative; Not significant.
Otters	Negligible	Negligible	Not significant, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Not significant, negative; Not significant.

12.6.5.1.4 Risk of injury resulting from collision of marine mammals and other megafauna with installation vessels

Table 12-40 Residual effect for the risk of injury resulting from collision of marine mammals and other megafauna with installation vessels during construction and decommissioning.

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
Harbour porpoise, dolphin species, pinnipeds	Low	Low	Slight, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Imperceptible, negative; Not significant.
Minke whale, basking shark	High	Low	Moderate, negative	As per the mitigation in Section 12.4.3.4.	Imperceptible, negative; Not significant.
Turtles	Medium	Low	Slight, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Imperceptible, negative; Not significant.

12.6.5.1.5 Impacts associated with effects upon marine water quality, particularly due to any disturbed sediments affecting turbidity

Table 12-41 Residual effect for impacts t associated with effects upon marine water quality, particularly due to any disturbed sediments affecting turbidity during construction and decommissioning

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
All receptors	Negligible	Negligible	Imperceptible, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Imperceptible, negative; Not significant.

12.6.5.1.6 Impacts associated with effects upon marine water quality due to any accidental release of pollutants

Table 12-42 Residual effect for impacts t associated with effects upon marine water quality, particularly due to any disturbed sediments affecting turbidity during construction and decommissioning

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
All receptors	Medium	Negligible	Not significant, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Imperceptible, negative; Not significant.

12.6.5.2 Operational and maintenance phase

12.6.5.2.1 Risk of injury resulting from collision of marine mammals or other megafauna with WTG foundations

Table 12-43 Residual effect for risk of injury resulting from collision of marine mammals or other megafauna with WTG foundations during operation

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
All receptors	Negligible	Negligible	Imperceptible, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Imperceptible, negative; Not significant.

12.6.5.2.3 Effects from operational sound

Table 12-44 Residual effect of operational sound during operation

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
All receptors	Low	Low	Slight, negative; Not Significant.	Mitigation by design.	Slight, negative; Not significant.

12.6.5.2.4 Displacement or barrier effects resulting from the physical presence of devices and infrastructure

Table 12-45 Residual effect for displacement or barrier effects resulting from the physical presence of devices and infrastructure during operation

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
All receptors	Negligible	Negligible	Imperceptible, negative; Not Significant.	Mitigation by design.	Imperceptible, negative; Not significant.

12.6.5.2.5 Disturbance due to the physical presence of vessels

Table 12-46 Residual effect for disturbance due to the physical presence of vessels during operation

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
All marine mammals (except harbour porpoise) and megafauna (except turtles)	Low	Negligible	Not significant, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Imperceptible, negative; Not significant.
Harbour porpoise and turtles	Medium	Negligible	Imperceptible, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Imperceptible, negative; Not significant.

12.6.5.2.6 Risk of injury resulting from collision of marine mammals and megafauna with operations and maintenance vessels

Table 12-47 Residual effect of risk of injury resulting from collision of marine mammals and megafauna with operations and maintenance vessels during operation

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
Harbour porpoise, dolphin species, pinnipeds	Low	Negligible	Not significant, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Imperceptible, negative; Not significant.

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
Minke whale, basking shark	High	Negligible	Not significant, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Imperceptible, negative; Not significant.
Turtles	Medium	Negligible	Not significant, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Imperceptible, negative; Not significant.

12.6.5.2.7 *Risk associated with EMFs associated with subsea cabling*

Table 12-48 Residual effect of risk associated with EMFs associated with subsea cabling during operation

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
Marine mammals	Negligible	Negligible	Imperceptible, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Imperceptible, negative; Not significant.
Basking sharks	Low	Negligible	Not significant, negative; Not Significant.	As per the mitigation in Section 12.4.4.4.	Imperceptible, negative; Not significant.
Turtles	Low	Negligible	Not significant, negative	As per the mitigation in Section 12.4.4.4.	Imperceptible, negative; Not significant.

12.6.5.2.8 *Impacts associated with effects upon marine water quality due to any accidental release of pollutants*

Vessel pollution

Table 12-49 Residual effect of risk of injury resulting from collision of marine mammals and megafauna with operations and maintenance vessels during operation

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
All receptors	Medium	Negligible	Not Significant, negative	As per the mitigation in Section 12.4.4.4.	Imperceptible, negative; Not significant.

Accidental release from WTGs and OSS

Table 12-50 Residual effect of risk of injury resulting from collision of marine mammals and megafauna with operations and maintenance vessels during operation

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
All receptors	Low	Negligible	Imperceptible, negative; Not Significant	As per the mitigation in Section 12.4.4.4.	Imperceptible, negative; Not significant.

Habitat change, including the potential for change in foraging opportunities

Table 12-51 Residual effect of habitat change, including the potential for change in foraging opportunities during operation

Receptor	Sensitivity	Magnitude	Significance prior to Mitigation	Mitigation	Residual Effect
All receptors	Negligible	Negligible	Imperceptible, negative	As per the mitigation in Section 12.4.4.4.	Imperceptible, negative; Not significant.

12.6.6 Cumulative Effects

Potential effects from the Project may interact with those from other projects (developments), plans and activities, resulting in cumulative effects on marine mammal and megafauna receptors. The general approach to the cumulative effects assessment (CEA) is described in Chapter 4: EIA Methodology and further detail is provided below.

The list of relevant developments for consideration within the CEA is outlined in Table 12-52. This has been informed by a screening exercise, undertaken to identify relevant developments for consideration within the CEA for each EIA topic. The cumulative study area for marine mammals and megafauna is defined as the marine mammals and megafauna study area detailed in Section 12.5.1 above. It is considered that this cumulative study area provides a local (i.e. within the Offshore Site) and regional context for marine mammal and megafauna receptors. Additionally, the Shannon Estuary has been considered as part of the cumulative effects assessment in consideration of the potential temporary anchorage and associated movement of Project vessels within the estuary.

It is important to note that there are no developments of an equivalent scale or type to the Project within 30 km. To date, there have been few large-scale construction developments on the west coast of Ireland generally. Therefore, many of the relevant developments in Table 12-52 represent short-term, localised activities which are not generally associated with any long-term infrastructure presence.

A number of Foreshore Licence applications (some which have recently been withdrawn) in relation to offshore energy developments west of Ireland were initially screened in for cumulative assessment. However, as none of these projects lie within a Designated Maritime Area Plan (DMAP) area, they are not likely to proceed at the current time. Furthermore, these applications which primarily cover site investigations (e.g. geophysical and geotechnical survey) will have short duration and localised effects on marine mammals and other megafauna which are not likely to cumulate with slight negative effects associated with the Project. Consequently, all Foreshore Licences for offshore energy developments have been excluded from CEA, except for a single site investigation application for the Saoirse wave energy project which overlaps with the OECC.

There are 97 aquaculture sites within 50 km of the Offshore Site, with 74 of those licenced for shellfish production. The remaining 23 aquaculture sites are licenced for finfish production. The closest aquaculture site (the Udaras na Gaeltachta site) is located 2.64 km from the OAA. The nature of these developments is such that their associated impacts are universal between sites. These sites are considered part of the baseline environment and, though they remain present within 50 km of the Offshore Site, any discharge and deposit detritus/sediment which could result in increased SSC will be minimal allowing for rapid reincorporation of sediments into the local transport regime and is therefore unlikely to result in cumulative SSC impacts on marine mammal and megafauna receptors. Therefore, there is no opportunity for significant cumulative effects together with the impacts associated with the Project. Consequently, aquaculture sites are excluded from CEA.

A number of wave buoys, navigation buoys, and sea temperature probes are located within 50 km of the Offshore Site. These are grouped together given their similarities as small pieces of sea surface infrastructure. There are 14 navigational buoys within 50 km of the Offshore Site, the closest of which is at Killeaney. This buoy is 15.36 km from the OECC. There are 15 sea temperature probes within 50 km of the Offshore Site. These probes occur at a high density amongst the islands along the coast of the mainland, northeast of the OAA. The closest probe was installed in Kilkieran Bay in 2004 and is 7.97 km from the OAA. There is a single (Westwave) wave buoy located 7.66 km due west of the OECC Landfall. These operational buoys are considered part of the baseline environment and, though they remain present within 50 km of the Offshore Site, they have no associated continuous operational impact on the environment. Therefore, there is no opportunity for significant cumulative effects together with the impacts associated with the Project. Consequently, wave buoys, navigation buoys, and sea temperature probes are excluded from CEA.

There are a number of ferry ports located within 50 km of the Offshore Site. However, these ports are operational and have no associated licenced maintenance or dredging activities. Consequently, it is assumed that these port locations do not generate any impacts that have the potential to result in cumulative effects with the Project. Ferry ports are therefore not considered further within the CEA.

Urban wastewater treatment locations are located along the coast within 50 km of the Offshore Site, in particular close proximity to the OECC landfall. As these locations are all terrestrial and are concerned with treatment activities which occur onshore, these wastewater treatment locations are not considered further in CEA. However, some water treatments are co-located with discharge points which do discharge wastewater effluent directly from the coast or into estuaries. These discharge points, and others along the coast which output directly into coastal or estuary waters are considered further in the CEA. A total of four such discharge points are listed in Table 12-53.

Two operational wave test sites are located within 50 km of the Offshore Site. These sites are considered part of the baseline environment and, though they remain present within 50 km of the Offshore Site, they have no associated continuous operational impact on the environment. Therefore, there is no opportunity for significant cumulative effects together with the impacts associated with the Project. Consequently, operational wave test sites are excluded from CEA.

The Project is the only Relevant Project / Phase 1 offshore renewable development in the region with a Maritime Area Consent (MAC), the only offshore wind development in the region which was successful in Offshore Renewable Electricity Support Scheme (ORESS) 1 and the only offshore wind development in the region, which is permitted to make a development permission application.

A number of planned offshore renewable developments (at various levels of inception) were proposed to be developed off the western coast of Ireland before the State's policy changed to a plan-led regime. Current policy is such that none of these projects are permitted to seek a MAC or make a development permission application. However, whether any of them may progress in the future is entirely dependent on future policy decisions. In this context, there is sufficient information to consider these offshore renewables developments (including foreshore licences related to these developments) any further.

The nearest licenced dumping at sea activities occurs as part of maintenance dredging associated with the Kilrush Marina, located within the Shannon Estuary. Vessels associated with the dumping at sea activities may have a cumulative effect with the vessels associated with the Project. Therefore, licenced dumping at sea is considered within the CEA.

The list of relevant developments for inclusion within the CEA is outlined in Table 12-52.

Table 12-52 List of developments considered for the fish and shellfish cumulative effects assessment

Location	Development Type	Development Name	Distance to OAA (km)	Distance to OECC (km)	Status	Additional Information	Considered further
Foreshore Licenses							
Galway	Cable	IRIS sub-sea fibre optic cable system	0.00	71.87	Operational	License for Construction of Cable. 2022- overall duration 2-3 months	No – operational project is considered part of baseline conditions.
Galway	Scientific research	UCD Research Experiments, Inishmaan	13.12	28.21	Operational	License for Data Monitoring Equipment. 2022-2027.	No – operational project is considered part of baseline conditions.
Clare / Kerry	Cable	Eirgrid Cross Shannon Cable Project	21.54	80.04	Operational	License held for Construction of Cable. Duration of construction 12 months.	No – operational project is considered part of baseline conditions.
Dumping at Sea							
Shannon Estuary	Dredged material	Shannon Foynes Port Company	86.61	32.48	Permit valid through 31/12/2026	Permit No. S0009-03	No – Project activities will not overlap in time with this permit
Foynes Harbour	Dredged material	Shannon Foynes Port Company	88.85	34.89	Permit valid through 31/12/2026	Permit No. S0009-03	No – Project activities will not overlap in time with this permit
Discharge points							
Kilkee	Discharge Point	Kilkee	64.40	11.90	Active	Discharge in coastal water	Yes
Kilrush	Discharge Point	Kilrush	73.21	14.85	Active	Discharge in coastal water	Yes
Ennistymon	Discharge Point	Ennistymon Waste Water Treatment Plant	53.16	25.99	Active	Discharge to estuary	No – estuaries typically experience naturally elevated levels of SSC such that any additional discharge will likely be readily incorporated into the local environment.

Location	Development Type	Development Name	Distance to OAA (km)	Distance to OECC (km)	Status	Additional Information	Considered further
Clifden	Discharge Point	Clifden Waste Water Treatment Plant	21.37	26.79	Active	Discharge to estuary	No – estuaries typically experience naturally elevated levels of SSC such that any additional discharge will likely be readily incorporated into the local environment.

Bearing in mind the list of relevant developments in Table 12-52, impacts have been screened in or out of CEA. The justification for this process is provided in Table 12-53, with Section 12.6.6.1 onward assessing the construction, operational, and decommissioning phase impacts in turn.

Table 12-53 Screening of effects for CEA

Effect	Screening	Justification
Construction		
Acoustic effects associated with construction	Out	Discharge points do not generate significant levels of underwater sound, so there is no potential for a cumulative effect.
Indirect effects of construction sound effects on the prey species of marine megafauna	Out	Discharge points do not generate significant levels of underwater sound, so there is no potential for a cumulative effect.
Disturbance due to the physical presence of vessels	Out	No vessel operations are associated with discharge points, so there is no potential for a cumulative effect.
Risk of injury resulting from collision of marine mammals' megafauna with installation vessels	Out	No vessel operations are associated with discharge points, so there is no potential for a cumulative effect.
Impacts associated with effects upon marine water quality, particularly due to any disturbed sediments affecting turbidity	In	There is potential for a cumulative effect with discharge points.
Impacts associated with effects upon marine water quality due to any accidental release of pollutants	Out	There is no spatial or temporal overlap with any planned dredging activities.
Operation and maintenance		
Risk of injury due to collision of marine megafauna with WTG foundations	Out	No OWF developments within the Study Area are screened into the CEA long list.
Disturbance due to WTG operational sound	Out	No OWF developments within the Study Area are screened into the CEA long list.
Displacement or barrier effects caused by the physical presence of WTG and associated infrastructure	Out	No developments with permanent physical infrastructure are screened into the CEA long list.
Disturbance due to the physical presence of vessels	Out	No potential for overlap between operation and maintenance phase and any other project.

Effect	Screening	Justification
Risk of injury resulting from collision of marine megafauna with operation and maintenance vessels	Out	No potential for overlap between operation and maintenance phase and any other project.
Risk associated with electromagnetic fields (EMFs) emissions associated with subsea cabling	Out	No developments for future subsea cables are screened into the CEA long list.
Impacts associated with effects upon marine water quality due to any accidental release of pollutants	Out	No potential for overlap between operation and maintenance phase and any other project.
Habitat change, including the potential for change in foraging opportunities	Out	No developments with permanent physical infrastructure are screened into the CEA long list.
Decommissioning phase		
Acoustic effects associated with decommissioning	Out	The Project activities proposed during the decommissioning phase will result in residual effect levels the same as, or less than, those assessed for the construction phase of the Project. Therefore, there are no additional CEA considerations specific to the decommissioning phase. Also, there are no known plans or projects that will overlap with the decommissioning phase that have not been considered during CEA for the construction phase. Consequently, decommissioning impacts are scoped out of CEA.
Underwater decommissioning sound effects on the prey species of marine megafauna	Out	
Disturbance due to the physical presence of vessels	Out	
Risk of injury resulting from collision of marine mammals and megafauna with decommissioning vessels	Out	
Impacts associated with effects upon marine water quality, particularly due to any disturbed sediments affecting turbidity	Out	
Impacts associated with effects upon marine water quality due to any accidental release of pollutants	Out	

12.6.6.1 Cumulative construction effects

12.6.6.1.1 *Impacts associated with effects upon marine water quality, particularly due to any disturbed sediments affecting turbidity*

The presence of discharge points will result in potential increases to SSC. These discharge points are active, therefore this activity already forms part of the baseline environmental conditions. However, it is considered here in the interest of acknowledging that such discharges may change over time. The discharge points at Kilkee and Kilrush discharge directly into coastal waters within 15 km of the OECC landfall. Sediment plumes associated with construction activities (which may occur within the OECC), could extend up to several kilometres from the location of the activity causing the suspension of sediment, but the large majority of sediment will fall out of suspension quickly, and only silt and fine sand will stay in suspension for up to 14 hours. The discharge points themselves will release urban wastewater which will likely contain variable sediments/substances. When operating correctly, discharges should be in line with relevant wastewater treatment regulations which limits SSC content so should be significantly less than the sediment arising from momentary disturbance of the seabed for construction. Therefore, any sediment plumes associated with the discharge points will be less extensive than, the plumes associated with construction activities.

Consequently, there is no opportunity for these plumes to interact cumulatively. Effects to marine mammal and megafauna receptors from increased SSC as a result of the Project alone were considered to be a not significant negative effect. Based on the above justification, there is no opportunity for a cumulative impact and the impact remains a **not significant negative effect** which is Not Significant.

12.6.6.2 Cumulative operational effects

No pathways for operational effects are considered to have any cumulative effects with other projects.

12.6.6.3 Cumulative decommissioning effects

No pathways for decommissioning effects are considered to have any cumulative effects with other projects, as there are no known plans or projects that will overlap with the decommissioning phase.

12.6.7 Conclusion

In conclusion, the marine mammal and megafauna impact assessment has assessed the potential effects resulting from: underwater sound, disturbance and the risk of collision from the presence of vessels, temporary increases in SSC, accidental releases of pollutants, EMF effects, displacement and barrier effects, and habitat change during construction, operation and maintenance, and decommissioning. A number of marine mammal species, as well as megafauna including basking sharks, otters and sea turtles, have been considered within the assessment. Mitigation by design has been included during project design and additional mitigation measures are proposed and considered within the assessment including the implementation of underwater sound mitigation (as detailed in Appendix 5-6: MMMP) and pollution control and vessel speed restrictions (as detailed in Appendix 5-3: Marine Pollution Contingency Plan and Appendix 5-10: Vessel Management Plan). The assessment has concluded that the residual effect pathways will be Not Significant for all marine mammal and megafauna receptors. This includes the conclusions of the cumulative effects assessment.

Baseline and construction phase underwater sound monitoring is proposed which will be undertaken prior to the commencement of, and during construction.

Acronym	Definition
AA	Appropriate Assessment
ABP	An Bord Pleanála
AC	Alternating Current
ASCOBANS	Agreement on the Conservation of Small Cetaceans in the Baltic and North Seas
CaP	Cable Plan
CBRA	Cable Burial Risk Assessment
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CEMP	Construction Environmental Management Plan
CGNS	Celtic and Greater North Seas
CI	Confidence Interval
CIEEM	Chartered Institute of Ecology and Environmental Management
CIS	Celtic and Irish Seas
CMS	Convention on Migratory Species
CoCP	Code of Construction Practice
CODA	Cetacean Offshore Distribution and Abundance
CPA	Coast Protection Act
CSIP	Cetacean Strandings Investigation Programme
CTV	Crew Transfer Vessel
CV	Coefficient of Variation
DAHG	Department of Arts, Heritage and the Gaeltacht

DAS	Digital Aerial Survey
DNA	Deoxyribonucleic acid
EC	Export Cable
eDNA	Environmental DNA
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EIS	Environmental Impact Statement
EMF	Electromagnetic Field
EPA	Environmental Protection Agency
EPS	European Protected species
EU	European Union
FEPA	Food and Environmental Protection Act
FST	Fuinneamh Sceirde Teoranta
FV	Favourable
GBS	Gravity Base Structure
HDD	Horizontal Directional Drilling
HF	High Frequency
HTV	Heavy Transport Vessel
HVAC	High Voltage Alternating Current
Hz	Hertz
IAC	Inter-array Cable
IAMMWG	Inter-Agency Marine Mammal Working Group

IUCN	International Union for the Conservation of Nature
IWDG	Irish Whale and Dolphin Group
JNCC	Joint Nature Conservation Committee
KHz	Kilohertz
km	Kilometre
kV	Kilovolt
LF	Low Frequency
m	Metre
MARPOL	The International Convention for the Prevention of Pollution from Ships
MHWS	Mean High Water Springs
MMMP	Marine Mammal Mitigation Protocol
MPCP	Marine Pollution Contingency Plan
MU	Management Unit
NIS	Natura Impact Statement
NPWS	National Parks and Wildlife Service
NSP	Navigational Safety Plan
OAA	Offshore Array Area
OECC	Offshore Export Cable Corridor
OREDP	Offshore Renewable Energy Development Plan
OSS	Offshore 220kV Electrical Substation
OSPAR	Convention for the Protection of the Marine Environment of the Northeast Atlantic

OW	Oceanic Waters
OWF	Offshore Wind Farm
PAM	Passive Acoustic Monitoring
PCW	Phocid Carnivores in Water
PLGR	Pre-Lay Grapnel Run
PTS	Permanent Threshold Shift
RBD	River Basin District
RMS	Root Mean Square
RMU	Regional Management Unit
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
SOLAS	Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Emergency Plans
SOV	Service Operation Vessel
SPL	Sound Pressure Level
SSC	Suspended Sediment Concentration
TTS	Temporary Threshold shift
UK	United Kingdom
UXO	Unexploded Ordnance
VHF	Very High Frequency

VMP	Vessel Management Plan
WCI	West Coast of Ireland
WTG	Wind Turbine Generator