Environmental Impact Assessment Report - Volume 2B

Chapter 11:
Offshore Ornithology

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

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ORIEL WIND FARM PROJECT

Environmental Impact Assessment Report
Chapter 11: Offshore Ornithology

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11.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) provides an assessment of the potential impacts of the Oriel Wind Farm Project (hereafter referred to as "the Project") on birds in the offshore environment. Specifically, this chapter considers the potential impact of the offshore infrastructure (including the offshore wind farm and offshore cables) of the Project below the Low Water Mark (LWM) during the construction, operational and maintenance, and decommissioning phases. Potential impacts on birds in the intertidal zone between the High-Water Mark (HWM) and LWM are assessed in volume 2C, chapter 19: Onshore Biodiversity.

The assessment presented is also informed by the following technical chapters:

- Chapter 9: Fish and Shellfish Ecology.

This chapter summarises information contained within the following technical appendices:

- Appendix 11-1: Offshore Ornithology Technical Report;
- Appendix 11-2: Ornithological and Marine Megafauna Aerial Survey Results;
- Appendix 11-3: Migratory Geese Survey Report;
- Appendix 11-4: Offshore Ornithology Collision Risk Modelling;
- Appendix 11-5: Offshore Ornithology Displacement Analysis;
- Appendix 11-6: Offshore Ornithology Migratory Non-Seabirds Collision Risk Modelling; and
- Appendix 11-17: Offshore Ornithology Apportioning Impacts to Individual Colonies.

The details and competencies of the specialist who prepared this chapter can be found in volume 2A, chapter 1: Introduction.

11.2 Purpose of this chapter

The primary purpose of this EIAR chapter is to provide an assessment of the likely direct and indirect significant effects of the Project on offshore ornithology. In particular, this EIAR chapter:

- Presents the existing offshore ornithological baseline in the marine environment established from desk studies and site-specific surveys (section 11.7);
- Identifies any assumptions and limitations encountered in compiling the offshore ornithological baseline and subsequent assessments (section 11.7.5);
- Presents an assessment of the potential likely significant effects on offshore ornithology arising from the Project (section 11.10) based on the information gathered and the analysis and assessments undertaken. An assessment of potential cumulative impacts is provided in section 11.11 and an assessment of transboundary effects is outlined in section 11.12; and
- Highlights any necessary monitoring (section 11.10.6) and/or measures (see section 11.8.2 and 11.10.6) to prevent, minimise, reduce or offset the likely significant environmental effects identified in the assessment (section 11.10).

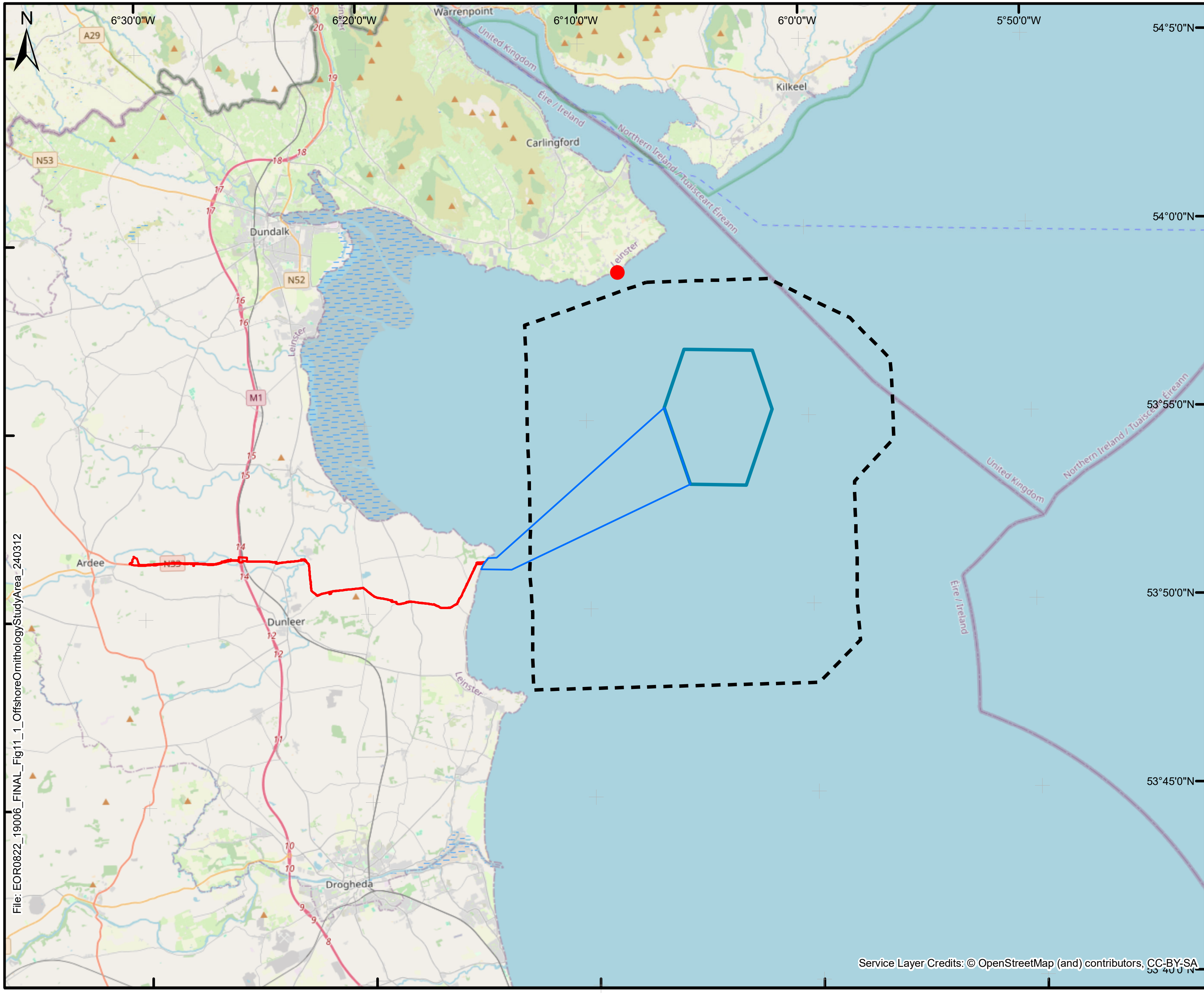
11.3 Study Area

Three appropriate Offshore Ornithology Study Areas have been defined for the purpose of this report, as illustrated within Figure 11-1 and Figure 11-2 and defined as follows:

- **The Offshore Ornithology Study Area:** defined as the extent of the area surveyed during the site-specific boat-based ornithology surveys (Aquafact, 2019) and Digital Aerial Surveys (DAS) (APEM, 2020) and the extent of the offshore cable corridor up to the LWM. The boat and aerial surveys cover a total area of 319.85 km^2 and encompasses the marine habitats within the offshore wind farm area, offshore cable corridor and an additional buffer of varying extent, as illustrated in Figure 11-1. The closest distance from the offshore wind farm area to the boundary of the Offshore Ornithology Study Area (i.e. the extent of the survey buffer around the offshore wind farm area) is 3.37 km, with the furthest distance approximately 12.74 km;

- **The Cumulative Offshore Ornithology Study Area:** where Annex I species under the Birds Directive were identified within the Offshore Ornithology Study Area, mean-maximum foraging ranges (based on those presented in Woodward et al. (2019)) of these species have been used to identify potentially connected designated sites for which they are qualifying features. The Cumulative Offshore Ornithology Study Area extends 509.4 km around the wind farm area and is based on the northern gannet *Morus bassanus* (hereafter referred to as gannet) mean-maximum plus one Standard Deviation (SD) foraging distances (Woodward *et al.*, 2019). The mean-maximum foraging range for gannet is the greatest of all the Annex I species selected for assessment as part of this assessment, therefore this extent encompasses the foraging ranges from Special Protection Areas (SPAs) of all other relevant seabird species for which the Project potentially has more than a negligible impact, as illustrated in Figure 11-2; and

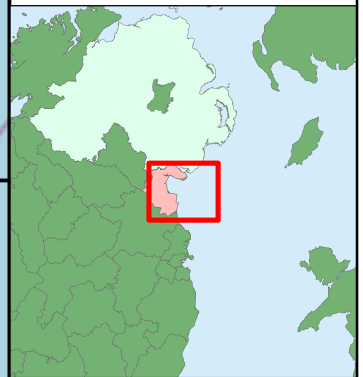
- **Brent Goose Survey Area:** The migratory geese Vantage Point (VP) surveys were undertaken from a single coastal VP at Cooley Point, County Louth (see appendix 11-3: Migratory Geese Survey Report).



Legend

- Offshore Wind Farm Area
- Offshore Cable Corridor
- Onshore Cable Route
- Offshore Ornithology Study Area / Boat-based and Aerial Survey Area
- Cooley Point vantage point survey location
- Teritorial Waters Boundary

Data Sources: Client,



Client

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project

Oriel Wind Farm Project

Title

Figure 11-1 Offshore Ornithology Study Area

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Issue Details

Drawn By: NG	**Project No.** EOR0822 (MDR1520B)
Checked By: NG	**File Ref:** EOR0822_ORN_E_19006_FINAL
Approved By: AOS	
Scale: 1:250,000 @ A4	**Projection:** ITM (IRENET95) Geographic Co-ordinates: ETRS89
Date: 12/03/24	

11.4 Policy context

Planning policy on renewable energy infrastructure is presented in volume 2A, chapter 2: Policy and Legislation. This section presents planning policy that specifically relates to offshore ornithology, which is contained in the Offshore Renewable Energy Development Plan I and II (OREDP) (DECC, 2022) and the National Marine Planning Framework (NMPF) (Department of Housing, Local Government and Heritage (DHLGH, 2021). The OREDP and NMPF include guidance on what matters are to be considered in the assessment. These are summarised in Table 11-1 and Table 11-2 below. The NMPF has also highlighted where planning policies are addressed via other activities operating alongside the NMPF.

In February 2023, the 'OREDP II - National Spatial Strategy for the transition to the Enduring Regime' was published in draft and subject to consultation. The key objectives of OREDP II are:

- *"Assess the resource potential for ORE in Ireland's maritime area;*
- *Provide an evidence base to facilitate the future identification of Broad Areas of Interest most suitable for the sustainable deployment of ORE in Ireland's maritime area; and*
- *Identify critical gaps in marine data or knowledge and recommend prioritised actions to close these gaps."*

The OREDP II will provide an evidence base to facilitate the future identification of Broad Areas of Interest most suitable for the sustainable deployment of ORE in Ireland's maritime area, to be assessed in greater detail at regional scale. This assessment will subsequently inform the identification of more refined areas as part of the designation process for Designated Maritime Area Plans (DMAP).

When published, the OREDP II will update the original OREDP published in 2014.

Table 11-1: Summary of OREDP provisions relevant to offshore ornithology.

Summary of OREDP project-level mitigation measures	How and where considered in the EIAR
Marine ornithology	
Physical disturbance and displacement: surveys to identify key breeding and foraging sites, moulting and migration. Avoid sensitive sites where possible and avoid undertaking potentially disturbing activities during sensitive seasons.	Offshore ornithological receptors have been identified through a desktop study and site-specific surveys; these are discussed in section 11.7. The potential effects of the construction, operational and maintenance and decommissioning phases of the Project have been assessed in section 11.10, including disturbance, collision risk and displacement as a result of construction, operation and maintenance and decommissioning (section 11.10.1). Measures included in the Project are outlined in section 11.8.
Collision risk: reduce risks through appropriate siting of developments and orientation of turbine rows.	
Barrier to movement: avoid large installations in migration corridors.	

Table 11-2: Summary of NMPF policy framework provisions relevant to offshore ornithology.

Summary of relevant policy framework	How and where considered in the EIAR
Biodiversity	
Biodiversity policy 1: Proposals incorporating features that enhance or facilitate species adaptation or migration, or natural native habitat connectivity will be supported, subject to the outcome of statutory environmental assessment processes and subsequent decision by the competent authority, and where they contribute to the policies and objectives of this NMPF. Proposals that may have significant adverse impacts on species adaptation or migration, or on natural native habitat connectivity must demonstrate that they	The potential effects of the construction, operational and maintenance and decommissioning phases of the Project have been assessed in section 11.10, which includes effects on offshore qualifying features of designated sites. Disturbance and displacement are assessed in sections 11.10.1 and 11.10.2. Barrier effect is assessed in section 11.10.4.

Summary of relevant policy framework	How and where considered in the EIAR
will, in order of preference and in accordance with legal requirements: a) avoid, b) minimise, or c) mitigate significant adverse impacts on species adaptation or migration, or on natural native habitat connectivity.	Measures included in the Project to avoid or minimise potential effects on birds are outlined in section 11.8, which include commitment to an Environmental Management Plan (EMP) incorporating measures to avoid pollution and minimise disturbance to birds (see volume 2A, appendix 5-2: Environmental Management Plan).
Biodiversity policy 2: Proposals that protect, maintain, restore and enhance the distribution and net extent of important habitats and distribution of important species will be supported, subject to the outcome of statutory environmental assessment processes and subsequent decision by the competent authority, and where they contribute to the policies and objectives of this NMPF. Proposals must avoid significant reduction in the distribution and net extent of important habitats and other habitats that important species depend on, including avoidance of activity that may result in disturbance or displacement of habitats.	Potential effects on the integrity of protected marine sites are considered in the Natura Impact Statement (NIS) which has been prepared for the Project and accompanies the application..
Biodiversity policy 3: Where marine or coastal natural capital assets are recognised by Government: • Proposals must seek to enhance marine or coastal natural capital assets where possible. • Proposals must demonstrate that they will in order of preference, and in accordance with legal requirements: a) avoid, b) minimise, or c) mitigate significant adverse impacts on marine or coastal natural capital assets, or d) if it is not possible to mitigate significant adverse impacts on marine or coastal natural capital assets proposals must set out the reasons for proceeding.	
Biodiversity policy 4: Proposals must demonstrate that they will, in order of preference and in accordance with legal requirements: a) avoid, b) minimise, or c) mitigate significant disturbance to, or displacement of, highly mobile species.	
Protected Marine Sites	
Protected marine sites policy 1: Proposals must demonstrate that they can be implemented without adverse effects on the integrity of Special Areas of Conservation (SACs) or SPAs. Where adverse effects from proposals remain following mitigation, in line with Habitats Directive Article 6(3), consent for the proposals cannot be granted unless the prerequisites set by Article 6(4) are met.	
Protected marine sites policy 2: Proposals supporting the objectives of protected marine sites should be supported and: • be informed by appropriate guidance • must demonstrate that they are in accordance with legal requirements, including statutory advice provided by authorities relevant to protected marine sites.	
Protected marine sites policy 4: Until the ecological coherence of the network of protected marine sites is examined and understood, proposals should identify, by review of best available evidence (including consultation with the competent authority with responsibility for designating such areas as required), the features, under consideration at the time the application is made, that may be required to develop and further establish the network. Based upon identified features that may be required to develop and further establish the network, proposals should demonstrate that	

Summary of relevant policy framework	How and where considered in the EIAR
they will, in order of preference, and in accordance with legal requirements: a) avoid, b) minimise, or c) mitigate significant impacts on features that may be required to develop and further establish the network, or d) if it is not possible to mitigate significant impacts, proposals should set out the reasons for proceeding.	

Louth County Council (LCC) adopted the local development plan in November 2021 (LCC, 2021). Relevant policies to the protection of biodiversity within Chapter 8 (Natural heritage, Biodiversity and Green Infrastructure) of the Louth County Development Plan (CDP) (2021-2027) are listed in Table 11-3.

Table 11-3: Summary of Louth CDP (2021) policies relevant to biodiversity and offshore ornithology.

Policy	Summary	How and where considered in the EIAR
International, European Union (EU) and Irish Policy on Biodiversity		
Policy NBG2	To promote and implement the objectives of the *Louth Biodiversity Action Plan 2021-2026* and any subsequent Biodiversity Action Plan adopted during the lifetime of this Plan.	The proposed policies of the Louth Biodiversity Action Plan 2021-2026 were reviewed as part of this assessment. Many refer to or replicate the policies of the Louth CDP, considered in this table (see below).
European Sites in County Louth		
Policy NBG3	To protect and conserve SACs and SPAs designated under the EU Habitats and Birds Directives.	The potential effects of the construction, operational and maintenance and decommissioning phases of the Project on offshore ornithology have been assessed in section 11.10, including potential effects on the offshore ornithology features of designated sites. Potential effects on European sites are considered in the NIS which accompanies the application.
Policy NGB4	To ensure that all proposed developments comply with the requirements set out in the DECLG “Appropriate Assessment (AA) of Plans and Projects in Ireland – Guidance for Planning Authorities 2010”	
Policy NGB5	To ensure that no plan, programme, or project giving rise to significant cumulative, direct, indirect or secondary impacts on European sites arising from their size or scale, land take, proximity, resource requirements, emissions (disposal to land, water or air), transportation requirements, duration of construction, operation, decommissioning or from any other effects shall be permitted on the basis of this Draft Plan, either individually or in combination with other plans, programmes, etc. or projects	
Policy NGB6	To ensure a screening for AA on all plans and projects and or Stage 2 AA (Natura Impact Report/ Natura Impact Assessment) where appropriate, is undertaken to make a determination. European Sites located outside of the County but within 15 km of the proposed development site shall be included in such screenings as should those to which there are pathways, for example, hydrological links for potential effects.	
Policy NGB7	To co-operate with the Regional Planning Assembly and adjoining local authorities, public agencies and community interests to protect regionally significant heritage assets, environmental quality, and to identify threats to existing environmental quality in a transboundary	

Policy	Summary	How and where considered in the EIAR
	context throughout the region including Northern Ireland.	
Protected Species		
Policy NGB8	To consult with the National Parks and Wildlife Service (NPWS), taking account of their views and any licensing requirements, when undertaking, approving or authorising development, which is likely to affect plant, bird or other animal species protected by law.	Consultees' responses with regard to offshore ornithology are summarised in section 11.5 (including the NPWS). A full list of consultation intitiatives and bodies contacted is provided in volume 2A, chapter 6: Consultation.
Protecting Biodiversity Value in Non-Designated Sites		
Policy NGB9	To ensure that proposals for development, where appropriate, protect and conserve biodiversity sites outside designated sites and require an appropriate level of ecological assessment by suitably qualified professionals to accompany development proposals likely to impact on such sites.	The potential effects of the construction, operational and maintenance and decommissioning phases of the Project on offshore ornithology have been assessed in section 11.10, including potential effects on the offshore ornithology features of designated sites. Potential effects on European sites are considered in the NIS.
Policy NGB10	To ensure that development proposals, where relevant, improve the ecological coherence of the Natura 2000 Network of European Sites and encourage the retention and management of landscape features as per Article 10 of the Habitats Directive.	
Policy NGB11	Where feasible, ensure that no ecological networks, or parts thereof, which provide significant connectivity between areas of local biodiversity, are lost without remediation as a result of implementation of this Plan.	

11.5 Consultation

Table 11-4 summarises the issues identified during consultation activities undertaken to date, which are relevant to offshore ornithology, together with how these issues have been considered in the preparation of this EIAR chapter. Volume 2A, chapter 6: Consultation provides details on the types of consultation activities undertaken for the Project between 2019 and 2024 and the consultees that were contacted, which included Birdwatch Ireland, NPWS and other key stakeholder groups.

Further detail of data provided through consultation for the desk study is presented within appendix 11-1: Offshore Ornithology Technical Report.

Table 11-4: Summary of key issues raised during consultation on offshore ornithology.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
October 2019	Department of Agriculture, Environment and Rural Affairs (DAERA): Natural Environment Division – response to scoping.	Raised that qualifying features of Northern Irelands SPAs be considered, in relation to feeding areas, in the preparation of the EIA. In particular, they highlighted potential impacts to: Shearwaters from the Copeland Islands; Terns from Carlingford Lough; and Whooper swan migration corridors.	Qualifying features of SPAs and other important ecological features (IEF), occurring in Northern Ireland, and within the Zone of Influence (ZoI) of the Project have been addressed in section 11.10 of this chapter, and within the NIS which has been prepared for the Project and accompanies the application.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
October 2019	BirdWatch Ireland – response to scoping.	Provision of Irish Wetland Bird Survey (I-WeBS) data and information on local data. Advised that there are a couple of small black guillemot colonies, one at north side of Dundalk Bay (Giles Quay) and one to the south at Clogher Head.	Detailed baseline characterisation is presented in appendix 11-1: Offshore Ornithology Technical Report.
October 2019	Irish Brent Goose Research Group – response to scoping.	Discussion of potential impacts on migratory Brent geese in late October / November and March / April in Dundalk Bay.	Migratory wildfowl VP surveys were undertaken in autumn 2019 and spring 2020. Data sources and methods for defining the baseline are presented in section 11.6 and 0 of this chapter. Potential effects are assessed in section 11.10.
October 2019	ObSERVE – response to data request.	Provision of ObSERVE project data.	Detailed baseline characterisation is presented in appendix 11-1: Offshore Ornithology Technical Report.
November 2019	Joint Nature Conservation Committee (JNCC) – response to data request.	Provision of European Seabirds at Sea (ESAS) data.	Detailed baseline characterisation is presented in appendix 11-1: Offshore Ornithology Technical Report.
November 2019	Member of the public	Discussion of migratory Brent goose across Dundalk Bay.	Migratory wildfowl VP surveys were undertaken in autumn 2019 and spring 2020. Data sources and methods for defining the baseline are presented in section 11.6 and 0 of this chapter. Potential effects are assessed in section 11.10.
June 2020	NPWS – pre-application consultation.	Discussion on project design, ornithology baseline data collection, identification of sensitive receptors, potential impacts and the proposed analytical framework for the seabird assessment.	Desk study information incorporated into baseline characterisation described in appendix 11-1: Offshore Ornithology Technical Report. Desk study and baseline survey method and results are presented in section 11.6 and 0. Potential effects are assessed in section 11.10.
January 2023	Members of the public during public consultation	Concerns regarding the Project impacting bird life.	The potential effects of the construction, operational and maintenance and decommissioning phases of the Project on offshore ornithology have been assessed in section 11.10.
August 2023	An Bord Pleanála (ABP) – pre - application consultation.	Consideration of potential issues arising from the designation of the North West Irish Sea cSPA. Examine impacts on ornithology resulting from changes to prey.	Qualifying features of the North West Irish Sea cSPA have been addressed in section 11.10 of this chapter, and within the NIS provided under separate cover. Section 11.10.2 examines the indirect displacement resulting from changes to prey.
September 2023	DAERA	Consideration should be given to Northern Irish seabird colonies and potential impacts. Specific requests that certain species are included.	Northern Ireland seabird colonies are included within the baseline and apportioning technical reports (appendix 11-1: Offshore Ornithology – Technical Report; and appendix 11-7: Offshore Ornithology Apportioning Impacts to Individual Colonies). All species present during the site-specific surveys (section 11.7) have been assessed in section 11.10.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
October 2023	Isle of Man Government – Territorial Sea Committee	Consideration should be given to Isle of Man seabird colonies and potential impacts. Consideration should be given to the Isle of Man wind farm project (Mooir Vannin).	Isle of Man seabird colonies are included within the baseline (appendix 11-1: Offshore Ornithology – Technical Report). The Mooir Vannin project has been considered as part of the Cumulative Impact Assessment (CIA) presented in section 11.11.
November 2023	ABP – pre - application consultation.	Engage with other wind farm developers to inform the cumulative impact assessment.	Other Phase 1 projects along the east coast of Ireland have been considered as part of the CIA presented in section 11.11.

11.6 Methodology to inform the baseline

The methodology to inform the baseline was discussed in consultation with key stakeholders (Table 11-4). The approach involved the use of site-specific survey data including boat-based visual surveys, aerial digital surveys and migratory VP surveys collected within the Offshore Ornithology Study Area. In addition, data were gathered through a literature review of existing data sources. These baseline data have been used to describe the occurrence, distribution and abundance / density of seabirds and migratory birds in the marine environment with reference to the Offshore Ornithology Study Areas defined above (section 11.3). Further detail on the approach is provided below.

11.6.1 Desktop study

Information on offshore ornithology within both the Offshore Ornithology Study Area and Cumulative Offshore Ornithology Study Area was collected through a detailed desktop review of existing studies and datasets relevant to the Project.

The key sources (i.e. data and reports) used to inform the baseline characterisation of the Offshore Ornithology Study Area are summarised in Table 11-5 and Table 11-6. These sources provide the most up to date data for this assessment.

Table 11-5: Summary of data sources.

Sources	Data Provision
Ireland's Marine Atlas	Ireland's Marine Atlas provides an overview of protected sites in Ireland's marine environment, as well as a resource to identify other marine developments for cumulative assessment.
NPWS	NPWS provide data on protected species, sites and conservation objectives in Ireland, including site boundaries and an overview of designated sites (SPAs) seabird feature populations and colonies.
DAERA – Northern Ireland	DAERA provides an overview of designated sites (SPAs) in Northern Ireland and details of their seabird feature populations and colonies.
Natural England	Natural England provides an overview of designated sites (SPAs) in England and details of their seabird feature populations and colonies.
Natural Resources Wales (NRW)	NRW provides an overview of designated sites (SPAs) in Wales and details of their seabird feature populations and colonies.
NatureScot (formerly Scottish Natural Heritage)	NatureScot provides an overview of designated sites (SPAs) in Scotland and details of their seabird feature populations and colonies.
European Environment Agency	The European Environment Agency provides detail of species, habitats and protected sites across Europe through the European Nature Information System (EUNIS). This system provides detailed accounts of Natura 2000 sites, including features and population demographics of seabird features.
Seabird distribution and model outputs from ObSERVE	The ObSERVE programme was established by the Department of Communications, Climate Action and Environment (DCCAE) in partnership with the Department of Culture, Heritage and the Gaeltacht (DCHG) with the aim to improve the current

Sources	Data Provision
	knowledge and understanding of protected offshore species and habitats to support sustainable management of offshore activities and the development of appropriate marine conservation strategies. In 2016, an output of the programme 'The seasonal distribution and abundance of Seabirds in the western Irish Sea, 2016' was made available.
I-WeBS	I-WeBS is a joint scheme of BirdWatch Ireland and NPWS which aims to monitor the numbers and distribution of waterbird populations wintering in Ireland to enable identification of long-term spatio-temporal trends.
ESAS	ESAS data were amalgamated from a long-running programme of survey and research work on seabirds in the marine environment in the northeast Atlantic since 1979, and in the southwest Atlantic between 1998 and 2002. This data set recorded a wide range of seabirds, divers and seaducks, presented as grid cell densities of each species.
Seabird Monitoring Programme (SMP)	An ongoing annual monitoring programme of 25 species of seabird that regularly breed in Britain and Ireland. Established in 1986, the SMP was led and co-ordinated by the JNCC in partnership with multiple organisations. As of July 2022, the annual monitoring scheme is organised by the British Trust for Ornithology (BTO) in partnership with JNCC, and the Royal Society for the Protection of Birds (RSPB) as an associate partner. It is supported by a wider advisory group which includes Natural England, NRW, NatureScot and DAERA.

The data collated from these sources provides an overview of seabird populations at both a localised Project level and a regional level. The ESAS database was reviewed for an area comprising the Offshore Ornithology Study Area plus a 5 km buffer to provide an overview of the seabird populations within the immediate vicinity of the Project. Likewise, the I-WeBS accounts provide a localised overview of the Dundalk Bay area. The ObSERVE programme provides an overview of seabird populations and densities at a regional level, spanning from Dundalk Bay in the north, to south of Wexford harbour in the south. The second phase of ObSERVE (ObSERVE II) is currently being undertaken between summer 2021 until summer 2025. The data gathered thus far is not currently available for inclusion within this EIAR.

Table 11-6: Summary of key desktop reports or databases.

Title	Source	Year	Author
ESAS Database	*www.esas.ices.dk*	2022	International Council for the Exploration of the Sea (ICES)
ObSERVE programme 'The seasonal distribution and abundance of seabirds in the western Irish Sea'	ObSERVE website	2018	DCCAE, NPWS and DCHG
Dundalk Bay (site 0Z401) I-WeBs Database	I-WeBS Website	2022	BirdWatch Ireland and NPWS
Monthly 10 km grid square species distribution models of seabird abundance	Journal of Applied Ecology	2019	Waggit *et al.* (2019) Distribution maps of cetacean and seabird populations in the northeast Atlantic

11.6.2 Site-specific surveys

In order to inform the EIAR, site-specific surveys were undertaken. An initial programme of baseline boat-based site-specific seabird surveys was carried out between 2006 and 2008 to inform a previous Environmental Impact Statement (EIS) for the Project. In order to update this data and provide suitable data to inform this EIAR, an updated programme of boat-based seabird surveys using standard ESAS methods was commissioned to take place between May 2018 and May 2020. These surveys were undertaken by Aquafact Ltd, Inis Ecology and Galway-Mayo Institute of Technology. Further detail is provided in appendix 11-1: Offshore Ornithology Technical Report.

In response to the Covid-19 pandemic and associated difficulties in continuation of the boat-based surveys in 2020, a program of six aerial digital surveys of the Offshore Ornithology Study Area were also undertaken between April and September 2020 by APEM Ltd, with the aim of complementing the boat-based surveys. Detailed information on the DAS methods and results is provided in appendix 11-2: Ornithological and Marine Megafauna Aerial Survey Results.

VP surveys targeting migratory geese and swans were undertaken in the autumn period between November and December 2019 with spring migration surveys undertaken in April 2020. The main objective of these surveys was to record movements of primary target species (brent geese and other large wildfowl) between the VP location at Cooley Point and out across Dundalk Bay to the Offshore Ornithology Study Area, between 5 to 10 km offshore. Further detail is provided in appendix 11-3: Migratory Geese Survey Report.

A summary of the surveys undertaken to inform the offshore ornithology impact assessment are outlined in Table 11-7 below.

Table 11-7: Summary of site-specific survey data.

Title	Extent of survey	Overview of survey	Survey Contractor	Date	Reference to further information
Boat-based surveys	Offshore Ornithology Study Area	Update to baseline surveys undertaken between 2006-2008. 19 surveys undertaken following ESAS survey method.	Galway Mayo Institute of Technology and IWDG on behalf of Aquafact Ltd.	May 2018 to May 2020.	Appendix 11-1: Offshore Ornithology Technical Report.
DAS	Offshore Ornithology Study Area	Aerial digital surveys to complement boat-based surveys. Six surveys following the same transects as the boat-based survey.	APEM	April 2020 to September 2020.	Appendix 11-2: Ornithological and Marine Megafauna Aerial Survey Results.
Migratory geese VP surveys	180° scan from single coastal VP location at Cooley Point, County Louth and out across Dundalk Bay to Offshore Ornithology Study Area	Targeted VP surveys to record movements of primary species (brent geese and other large waterfowl) during autumn and spring migration period.	RPS	November to December 2019, April 2020.	Appendix 11-3: Migratory Geese Survey Report.

11.6.3 Identification of designated sites

All designated sites and qualifying features within the Cumulative Offshore Ornithology Study Area that could be affected by the construction, operational and maintenance, and decommissioning of the Project were identified using the three-step process described below.

The designated sites and their qualifying seabird and migratory waterbird features with potential connectivity to the Project, as defined by potential migratory routes (appendix 11-6: Offshore Ornithology Migratory Non-Seabirds Collision Risk Modelling) or published foraging ranges (Woodward *et al.,* 2019) were identified.

- Step 1: All designated sites of international importance within the Cumulative Offshore Ornithology Study Area, and within 100km for designated sites of national importance were identified using a number of sources. These included Ireland's Marine Atlas interactive map application (http://atlas.marine.ie/), the NPWS website, and the EUNIS designated site database. For sites in Northern Ireland, the JNCC website and the Department for Environment, Food and Rural Affairs (DEFRA) Multi-Agency Geographic Information for the Countryside (MAGIC) interactive map applications (http://magic.defra.gov.uk/) were used.

- Step 2: Information was compiled on the relevant features for each of these sites, based on known species occurrences from the desktop review; and
- Step 3: Using the above information and expert judgement, sites were included for further consideration if:
  - A designated site with qualifying features directly overlaps with the offshore wind farm area or offshore cable corridor and therefore has the potential to be directly affected by the Project; or
  - The ecology of a feature of an internationally designated site (i.e. species foraging range) directly overlaps with the Project;
  - Sites and associated notified interest features are located within the potential ZoI for impacts associated with the Project.

This screening process aided in the identification of designated sites where there is the potential for species to be affected by the Project, specifically through overlap/ potential impact. The following factors were also considered:

- Foraging ranges (Woodward *et al.*, 2019) with a 5 km inland buffer to account for coastal colonies;
- Resource dependencies;
- Breeding habitat; and
- Migratory routes.

Furthermore, a review of the status of any international and national protected sites designated for waders, wildfowl and seabird qualifying features that have the potential to be affected by the Project (NPWS, 2008) was also conducted. This included a review of the Favourable Conservation Status (FCS) of the designated bird qualifying feature(s) for each site.

Where national designated sites (e.g. NHAs, pNHAs, wildfowl sanctuaries, ASSI) fall within the boundaries of an internationally designated site (e.g. a Ramsar site or SPA), only the international site has been considered, except when a national site forms a component of an international site, but the designation does not list a qualifying interest (QI) that is present as part of the international site.

11.7 Baseline environment

11.7.1 Designated sites

The review of designated sites considered nationally and internationally protected sites in the wider area. The lands in which the offshore components are located have no formal designations in relation to offshore ornithology. However, the Project does intersect one designated site, the North-west Irish Sea SPA[1] for approximately 2 km of the offshore cable corridor, and one pNHA – Dunany Point at the landfall location and for approximately 0.25 km of the offshore cable corridor.

Designated sites considered include SPAs, proposed SPAs (pSPA), candidate SPAs (cSPA)[1], Natural Heritage Areas (NHAs), proposed NHAs (pNHA), RAMSAR sites, wildfowl sanctuaries, Areas of Special Scientific Interest (ASSIs) and Marine Nature Reserves (MNR) within the Isle of Man.

Designated sites with qualifying features with potential connectivity to the Project were identified within 509.4 km (by marine pathway) of the offshore wind farm area, based on the mean-maximum foraging range plus one SD of gannet (Woodward *et al.,* 2019). This defines the Cumulative Offshore Ornithological Study Area and encompasses the foraging ranges from designated sites of all other relevant seabird species for which the Project potentially has connectivity, with the exception of Manx shearwater and fulmar. Manx shearwater and fulmar have very large published foraging ranges (mean-maximum plus one SD is 1346.8 ± 1018.7 km for Manx shearwater and 542.3 ± 657.9 km for fulmar). Whilst there may be associations with more distant SPAs, the extent and frequency of connectivity with sites beyond 509.4 km is likely to be very low, i.e. birds from further away are not expected to be present frequently at the offshore wind farm area.

Designated sites within the Cumulative Offshore Ornithological Study Area are described in Table 11-8 below, which lists the breeding seabird qualifying features for each designated site that is within foraging range (mean maximum plus one SD), or the non-breeding migratory waterbird qualifying features for each designated site where there is potential for migratory movements of birds across the offshore wind farm area.

Breeding seabird species that are qualifying features of a designated site but are beyond their defined foraging range of the offshore wind farm area are not listed in Table 11-8, but are provided in full in appendix 11-1: Offshore Ornithology Technical Report. The listed population sizes for each SPA are derived from the latest updates to the Natura 2000 Standard Data Forms.

The closest distance between the offshore wind farm area and the designated site boundary in Table 11-8 is via marine pathway. During the breeding season, seabirds are highly unlikely to commute across land and will stay in the marine environment. Therefore, to calculate the distance between the designated site and the Project, a marine pathway measurement is required and not a straight-line distance. An Appropriate Assessment (AA) Screening Report and Natura Impact Statement (NIS) have also been prepared separate to this EIAR, to assess the potential for likely significant effects and adverse effects on the integrity of any European sites. The NIS concluded that there will be no significant adverse effects on any European sites.

Table 11-8: Designated sites and relevant qualifying features for the offshore ornithology chapter.

Designated site	Closest distance to the Project (km)	Relevant qualifying feature and designated population size (for breeding colony SPAs only)
Northwest Irish Sea SPA[1]	2 km of the offshore cable corridor traverses the SPA	Classified for the following non-breeding (wintering) bird populations: • Common scoter *Melanitta nigra* • Red-throated diver *Gavia stellata* • Great northern diver *Gavia immer* • Fulmar *Fulmarus glacialis* • Little gull *Hydrocoloeus minutus* • Kittiwake *Rissa tridactyla* • Black-headed gull *Chroicocephalus ridibundus* • Common gull *Larus canus* • Lesser black-backed gull *Larus fucus* • Herring gull *Larus argentatus* • Great black-backed gull *Larus marinus* • Razorbill *Alca torda* • Guillemot *Uria aalge* Classified for the following breeding bird populations: • Fulmar • Manx shearwater *Puffinus puffinus* • Shag *Phalacrocorax aristotelis* • Cormorant *Phalacrocorax carbo* • Little tern *Sterna albifrons* • Roseate tern *Sterna dougallii* • Common tern *Sterna hirundo* • Arctic tern *Sterna paradisaea* • Puffin *Fratercula arctica* • Lesser black-backed gull

[1] Candidate and proposed sites, and European sites are collectively referred to as “SACs” and “SPAs”. There is no distinction made between candidate/proposed sites and European sites as they have the same level of protection as a matter of domestic law. For the purpose of the report, they are considered one and the same.

Designated site	Closest distance to the Project (km)	Relevant qualifying feature and designated population size (for breeding colony SPAs only)
		• Herring gull • Kittiwake • Razorbill • Guillemot
Dunany Point pNHA	Traverses the pNHA	Classified for the following non-breeding (wintering) bird population: • Cormorant • Red-breasted merganser
Carlingford Lough SPA	5.7	Classified for the following breeding bird populations: • Sandwich tern *Sterna sandvicensis* (575 pairs) • Common tern *Sterna hirundo* (339 pairs) Classified for the following non-breeding (wintering) bird population: • Light-bellied Brent goose *Branta bernicla hrota* (319 individuals)
Dundalk Bay SPA	8.0	Classified for the following non-breeding bird populations: • Great crested grebe *Podiceps cristatus* (302 individuals) • Greylag goose *Anser anser* (435 individuals) • Light-bellied brent goose (337 individuals) • Shelduck *Tadorna tadorna* (492 individuals) • Teal *Anas crecca* (488 individuals) • Mallard *Anas platyrhynchos* (763 individuals) • Pintail *Anas acuta* (117 individuals) • Common scoter *Melanitta nigra* • Red-breasted merganser *Mergus serrator* (121 individuals) • Oystercatcher *Haematopus ostralegus* (8,712 individuals) • Ringed plover *Charadrius hiaticula* (147 individuals) • Golden plover *Pluvialis apricaria* (5,967 individuals) • Grey plover *Pluvialis squatarola* (204 individuals) • Lapwing *Vanellus vanellus* (14,850 individuals) • Knot *Calidris canutus* (9,710 individuals) • Dunlin *Calidris alpina* (11,515 individuals) • Black-tailed godwit *Limosa limosa* (1,067 individuals) • Bar-tailed godwit *Limosa lapponica* (1,950 individuals) • Curlew *Numenius arquata* (1,234 individuals) • Redshank *Tringa totanus* (1,489 individuals) • Black-headed gull *Chroicocephalus ridibundus* (6,630 individuals) • Common gull *Larus canus* (555 individuals) • Herring gull *Larus argentatus* (754 individuals) • Wetland and waterbirds
River Nanny Estuary and Shore SPA	24.2	Classified for the following non-breeding (wintering) bird population: • Oystercatcher (1,014 individuals) • Ringed plover (185 individuals) • Golden plover (1,759 individuals) • Knot (1,190 individuals) • Sanderling *Calidris alba* (240 individuals) • Herring gull (609 individuals) • Wetland and waterbirds
Mourne Coast ASSI	21.2	Classified for the following breeding bird population: • Kittiwake
Rockabill SPA	28.5	Classified for the following breeding bird population: • Arctic tern *Sterna paradisaea* (89 pairs)

Designated site	Closest distance to the Project (km)	Relevant qualifying feature and designated population size (for breeding colony SPAs only)
Skerries Island SPA	33.1	Classified for the following breeding bird populations: • Herring gull (250 pairs) • Cormorant *Phalacrocorax carbo* (558 pairs)
Lambay Island SPA	42.7	Classified for the following breeding bird populations: • Fulmar *Fulmarus glacialis* (635 pairs) • Guillemot (59,824 individuals) • Herring gull (1,806 pairs) • Kittiwake *Rissa tridactyla* (4,091 pairs) • Razorbill (4,337 individuals) • Lesser black-backed gull *Larus fuscus* (309 pairs) • Puffin *Fratercula arctica* (265 individuals)
Strangford Lough SPA	49.4	Classified for the following breeding bird population: • Sandwich tern (593 pairs)
Ireland's Eye SPA	52.7	Classified for the following breeding bird populations: • Guillemot (2,191 individuals) • Herring gull (250 pairs) • Kittiwake (941 pairs) • Razorbill (522 individuals)
Howth Head Coast SPA	55.2	Classified for the following breeding bird population: • Fulmar (33 pairs) • Guillemot (995 individuals) • Kittiwake (2,329 pairs) • Razorbill (416 individuals)
Irish Sea Front SPA	56.8	Classified for the following breeding bird population: • Manx shearwater (12,039 individuals)
Dalkey Coastal Zone and Kiliney Hill pNHA	68.8	Classified for the following breeding bird population: • Herring gull • Great black-backed gull • Lesser black-backed gull • Manx shearwater
Copeland Islands SPA	86.8	Classified for the following breeding bird population: • Manx shearwater (4,800 pairs)
Baie Ny Carrickey MNR	83.7	Classified for the following breeding bird population: • Kittiwake • Guillemot • Puffin • Razorbill
Little Ness MNR	102.4	Classified for the following breeding bird population: • Fulmar
Niarbyl Bay MNR	85.4	Classified for the following breeding bird population: • Fulmar • Lesser black-backed gull
Port Erin Bay MNR	82.3	Classified for the following breeding bird population: • Fulmar • Herring gull
Calf and Wart Bank MNR	78.9	Classified for the following breeding bird population: • Manx shearwater • Puffin

Designated site	Closest distance to the Project (km)	Relevant qualifying feature and designated population size (for breeding colony SPAs only)
Wicklow Head SPA	101.2	Classified for the following breeding bird populations: • Guillemot (420 individuals) • Kittiwake (956 pairs) • Razorbill (186 individuals)
Glannau Aberdaron ac Ynys Enlli SPA	139.6	Classified for the following breeding bird populations: • Manx shearwater (6,930 pairs)
Rathlin Island SPA	145.6	Classified for the following breeding bird population: • Guillemot (41,887 individuals) • Kittiwake (6,822 pairs) • Razorbill (8,922 individuals)
Seas off Wexford SPA[2]	146	Classified for the following breeding bird populations: • Fulmar (from Saltee Islands SPA) • Gannet (from Saltee Islands SPA) • Lesser black-backed gull (from Saltee Islands SPA) • Kittiwake (from Saltee Islands SPA) • Puffin (from Saltee Islands SPA)
Ailsa Craig SPA	158.6	Classified for the following breeding bird populations: • Gannet *Morus bassanus* (23,000 pairs) • Kittiwake (3,100 pairs) • Lesser black-backed gull (1,800 pairs)
Ribble and Alt Estuaries SPA	194.5	Classified for the following breeding bird population: • Lesser black-backed gull (1,800 pairs)
Saltee Islands SPA	209.7	Classified for the following breeding bird populations: • Fulmar (525 pairs) • Gannet (2,446 pairs) • Lesser black-backed gull (175 pairs) • Kittiwake (2,125 pairs) • Puffin (1,822 individuals)
Skomer, Skokholm and the Seas off Pembrokeshire SPA	238.9	Classified for the following breeding bird populations: • Manx shearwater (150,968 pairs) • Puffin (9,500 pairs)
Grassholm SPA	240.5	Classified for the following breeding bird population: • Gannet (33,000 pairs)
North Colonsay and Western Cliffs SPA	257.1	Classified for the following breeding bird population: • Kittiwake (4,512 pairs)
Horn Head to Fanad Head SPA	269.4	Classified for the following breeding bird populations: • Fulmar (1,974 pairs) • Kittiwake (3,853 pairs)
Helvick Head to Ballyquin SPA	275.6	Classified for the following breeding bird population: • Kittiwake (1,037 pairs)
Tory Island SPA	301.8	Classified for the following breeding bird population: • Fulmar (641 pairs)

[2] Candidate and proposed sites, and European sites are collectively referred to as "SACs" and "SPAs". There is no distinction made between candidate/proposed sites and European sites as they have the same level of protection as a matter of domestic law. For the purpose of the report, they are considered one and the same.

Designated site	Closest distance to the Project (km)	Relevant qualifying feature and designated population size (for breeding colony SPAs only)
West Donegal Coast SPA	317.8	Classified for the following breeding bird population: • Fulmar (1,879 pairs)
Rum SPA	354.7	Classified for the following breeding bird population: • Manx shearwater (61,000 pairs)
Mingulay and Berneray SPA	360.9	Classified for the following breeding bird population: • Fulmar (12,500 pairs)
Beara Peninsula SPA	466.7	Classified for the following breeding bird population: • Fulmar (575 pairs)
Shiant Isles SPA	470.1	Classified for the following breeding bird population: • Fulmar (6,820 pairs)
The Bull and The Cow Rocks SPA	482.4	Classified for the following breeding bird population: • Gannet (3,694 pairs)
St Kilda SPA	483.2	Classified for the following breeding bird populations: • Fulmar (62,800 pairs) • Gannet (50,050 pairs) • Manx shearwater (1,000 pairs)
Duvillaun Islands SPA	484.8	Classified for the following breeding bird population: • Fulmar (638 pairs)
Deenish Island and Scariff Island SPA	493.2	Classified for the following breeding bird populations: • Fulmar (385 pairs) • Manx shearwater (2,311 pairs)
Iveragh Peninsula SPA	493.6	Classified for the following breeding bird populations: • Fulmar (766 pairs)
Skelligs SPA	509.0	Classified for the following breeding bird populations: • Fulmar (806 pairs) • Manx shearwater (738 pairs) • Gannet (29,683 pairs)

11.7.2 Species recorded in the Offshore Ornithology Study Area

A total of 31 bird species were recorded during the surveys undertaken between May 2018 and September 2020. The most commonly observed species recorded on transect was guillemot, comprising over half of all bird records (23,878 guillemot out of a total of 45,051 birds sighted). Manx shearwater was the second most frequently recorded species (8,043 individuals), followed by razorbill (2,955 individuals), common scoter (2,222 individuals), gannet (1,216 individuals) and black guillemot (1,135 individuals). Over 2,000 individuals were unable to be identified to species level and were therefore recorded as being either guillemot or razorbill.

Several species were observed in numbers in excess of 200 individuals (but less than 500 individuals) including great black-backed gull (414), herring gull (359) and common gull (323), and two species were observed in numbers in excess of 100 individuals (shag (183) and red-throated diver (106)). Puffin, common tern, cormorant, fulmar, roseate tern, sandwich tern and lesser black-backed gull were observed in numbers between 10 and 100 individuals, while the remaining species had less than ten individuals recorded.

A summary of the marine seabird and seaduck species recorded within the Offshore Ornithology Study Area during the site-specific surveys is presented in Table 11-9. Further details of the baseline characterisation for each species are included in appendix 11-1: Offshore Ornithology Technical Report, appendix 11-2: Ornithological and Marine Megafauna Aerial Survey Results and appendix 11-3: Migratory Geese Survey Report. The abundance presented in Table 11-9 is derived from summing all records during the site-specific surveys. The level of abundance is categorised as follows: very low < 49 individuals; low: 50 to 199; moderate: 200 to 999; high: 1,000 to 4,999 and very high: > 5,000.

Table 11-9: Summary of offshore ornithology baseline.

Species	Abundance in Offshore Ornithology Study Area during surveys	General location within the Offshore Ornithology Study Area	Seasonality
Arctic skua	7 Very low	Flying south and southeast outside of the Offshore Ornithology Study Area	August to September
Arctic tern	1 Very low	Flying throughout Offshore Ornithology Study Area	August
Black guillemot	1,115 High	Close to shore, concentrated in northwest of Offshore Ornithology Study Area.	All months; peak counts in August and September 2020
Black-headed gull	7 Very low	Low numbers recorded throughout Offshore Ornithology Study Area	October, January, March – April
Common gull	323 Moderate	Observed throughout Study Area	All months; peak count in December 2019
Common scoter	2,222 High	Records from around western and northwestern extent of Offshore Ornithology Study Area, near to the coast. Very few records of birds within offshore wind farm area.	All months; peak count in April 2020
Common tern	55 Low	All transect records were of individuals flying throughout Offshore Ornithology Study Area	May – October
Cormorant	47 Very low	Close to shore, along the coastal regions of the west and northwest of the Offshore Ornithology Study Area	All months; peak count in October 2018
Fulmar	43 Very low	Predominantly south and west of the Offshore Ornithology Study Area	April – September
Gannet	1,216 High	Observed throughout Offshore Ornithology Study Area	All months; peak counts in August and September 2018
Great black-backed gull	414 Moderate	Observed throughout Offshore Ornithology Study Area	All months; peak count in April 2019
Great northern diver	837 Moderate	The majority of observations were in the northeast of the Offshore Ornithology Study Area	All months (lower numbers during summer); peak count in April 2020
Great skua	3 Very low	Predominantly in the south and east of the Offshore Ornithology Study Area	Low numbers in April, June – October and December
Guillemot	23,878 Very high	Observed throughout Offshore Ornithology Study Area	All months; peak counts in August and September 2018
Herring gull	359 Moderate	Observed throughout Offshore Ornithology Study Area	All months; peak count in August 2019 although generally lower numbers during breeding season
Kittiwake	742 Moderate	Observed throughout Offshore Ornithology Study Area	All months; peak count in October 2018
Lesser black-backed gull	16 Very low	Observed throughout Offshore Ornithology Study Area	February, April – September and December
Manx shearwater	8,043 Very high	Widely spread throughout Offshore Ornithology Study Area with higher densities recorded offshore	March to September
Puffin	68 Low	Generally recorded in the southeast and southwest of the Offshore Ornithology Study Area	April to October

Species	Abundance in Offshore Ornithology Study Area during surveys	General location within the Offshore Ornithology Study Area	Seasonality
Razorbill	2,955 High	Observed throughout Offshore Ornithology Study Area	All months; peak count in September 2020
Red-breasted merganser	8 Very low	Northern section of Offshore Ornithology Study Area and to the west, close to the coast	January *to* February
Red-throated diver	106 Low	Generally observed in the north and west of the Offshore Ornithology Study Area	January – May, August *to* December
Roseate tern	22 Very low	Generally observed south of the Offshore Ornithology Study Area	July *to* August
Sandwich tern	19 Very low	Predominantly recorded along the western edge and northwestern corner of the Offshore Ornithology Study Area; a few observations were recorded in the east of the area between July and October 2019	May *to* September
Shag	183 Low	Predominantly observed in the north and west of the Offshore Ornithology Study Area	All months; peak count in December 2018

Non seabird assemblage summary

The non-seabird species recorded during the site-specific surveys undertaken within the Offshore Ornithology Study Area included geese, ducks, waders and a variety of passerines (see appendix 11-1: Offshore Ornithology Technical Report for further details).

Observations of waterfowl (excluding sea-duck species) and waders were sparse during the site-specific surveys; however, very low numbers of curlew, dunlin, sanderling and turnstone were recorded.

Migratory geese surveys

A total of 42 survey hours of specific observations for migratory species were conducted in November and December 2019, with 186 flights of all waterbird species recorded. In April 2020, a total of 40 survey hours were undertaken, with 15 flights of brent geese recorded (only target geese and swan species were recorded during the spring surveys).

Light-bellied brent goose was the only target species observed, with 45 individual bird flights recorded across the 17 survey dates. Flocks were also observed feeding on the shoreline and sitting on the sea surface. All records were within height-band 1 (i.e. 0 to 20 m).

Between November and December 2019, the majority of light-bellied brent geese were observed flying east to west past the VP location at Cooley Point. The majority of individual bird flights were observed between 100 m and 500 m offshore, with the exception of one flock of 22 individuals which were observed approximately 1.5 km offshore in November 2019.

In April 2020, regular commuting of light-bellied brent geese was observed with birds flying low east to west past Cooley Point. These numbers increased until 14 April, following which numbers significantly dropped off, suggesting that a significant migratory move was made in the night or morning of 14/15 April. No geese were seen flying across Dundalk Bay from Dunany Point towards the mouth of Carlingford Lough; instead individuals were observed flying close to the shore, using the traditional roosting areas at Lurgangreen, Ballymascanlon Bay and Rockmarshal as bases for migration.

11.7.3 Important Ecological Features

The IEFs included within the assessment are those species recorded during the site-specific surveys that could be potentially affected by the Project. Species that were recorded in very small numbers or very infrequently during the baseline surveys are excluded because the risk of impact to their populations is considered negligible.

The importance of the IEF is dependent upon their biodiversity, social, and economic value within a geographic framework of appropriate reference (Chartered Institute of Ecology and Environmental Management (CIEEM), 2022). IEFs have been identified based on biodiversity importance, recognised through international or national legislation or through local, regional or national conservation plans, and on assessment of value according to the functional role of the species. This includes:

- A qualifying species of a SPA within mean maximum foraging range (during the breeding season) or where non-trivial connectivity may exist (during migration or winter) with more distant SPAs;
- Species listed on Annex 1 of the Birds Directive;
- Species populations which are of international importance in Ireland;
- Species which have experienced significant declines in breeding populations and/or ranges in Ireland;
- Migratory species which are at risk of collision within turbines; and
- Populations occurring within the offshore wind farm area which are considered to be of regional, national or international importance.

Geographical thresholds within a given season were defined as follows:

- International importance: a peak population estimate within the Offshore Ornithology Study Area which exceeds 1% of the international population estimate;
- National importance: a peak population estimate within the Offshore Ornithology Study Area which exceeds 1% of the national breeding/non-breeding population estimate; and
- Regional importance: a peak population estimate within the Offshore Ornithology Study Area which exceeds 1% of the regional population estimate.

Following an initial review of species' abundances recorded during the site-specific surveys, the IEFs listed in Table 11-10 were taken forward for consideration in the impact assessment. Further screening of IEFs is detailed in section 11.10.

Seasonality

The majority of IEFs recorded within the Offshore Ornithology Study Area showed some seasonality in their distribution and abundance during the site-specific surveys, which reflected the timing of the breeding and non-breeding seasons and migratory periods (i.e. pre- and post-breeding).

Species-specific impacts have been assessed in relation to their seasonality as defined in Furness *et al.* 2015, as shown in Table 11-10 below. Where species seasonality is not included in Furness *et al.* (2015), seasons are defined with reference to Birds of the Western Palearctic (Snow *et al.,* 1998) or NatureScot guidance (NatureScot, 2014). The offshore wind farm area is located within the some of the species' foraging range from breeding colonies (Woodward *et al.,* 2019).

Table 11-10: Definition of the biological seasons for each IEF.

Species	Breeding	Autumn Migration	Winter	Spring Migration	Non-breeding
Arctic tern	May to Aug	Jul to Sep	-	Apr to May	-

Species	Breeding	Autumn Migration	Winter	Spring Migration	Non-breeding
Black-headed gull*	May to Aug	-	-	-	Sep to Mar
Black guillemot	Apr to Aug	-	Sep to Mar	-	Sep to Mar
Common gull*	May to Aug	-	-	-	Sep to Apr
Common scoter*	May to Aug	Sep to Dec	-	Feb to May	-
Common tern	May to Aug	Jul to Sep	-	Apr to May	-
Cormorant	Apr to Aug	Aug to Oct	-	Feb to Apr	Sep to Mar
Fulmar	Jan to Aug	Sep to Oct	Nov	Dec to Mar	-
Gannet	Apr to Aug	Sep to Nov	-	Dec to Mar	
Great black-backed gull	Apr to Aug	-	-	-	Sep to Mar
Great northern diver	-	Sep to Nov	Dec to Feb	Mar-May	Sep to May
Great skua	May to Aug	Aug to Oct	Nov to Feb	Mar to Apr	-
Guillemot	Mar to Jul	Jul to Oct	Nov	Dec to Feb	Aug to Feb
Herring gull	Mar to Aug	Aug to Nov	Dec	Jan to Apr	Sep to Feb
Kittiwake*	May to Jul	Aug to Dec	-	Jan to Apr	-
Lesser black-backed gull	Apr to Aug	Aug to Oct	Nov to Feb	Mar to Apr	-
Little gull*	Apr to Jul	-	-	-	Aug to Apr
Manx shearwater	Apr to Aug	Aug to Oct	Nov to Feb	Mar to May	Sep to Mar
Puffin	Apr to Aug	Jul to Aug	Sep to Feb	Mar to Apr	Aug to Mar
Razorbill	Apr to Jul	Aug to Oct	Nov to Dec	Jan to Mar	-
Red-breasted merganser	Apr to Aug	-	-	-	Sep to Mar
Red-throated diver	Mar to Aug	Sep to Nov	Dec to Jan	Feb to Apr	-
Roseate tern	May to Aug	Aug to Sep	-	Apr to May	Sep to Apr
Sandwich tern	Apr to Aug	Jul to Sep	-	Mar to May	Sep to Mar
Shag	Feb to Aug	Aug to Oct	Nov	Dec to Feb	Sep to Jan

* Seabird biological seasons taken from Snow *et al*,, 1998 or NatureScot, 2014.

Reference populations

International population estimates were taken from African-Eurasian Waterbird Agreement (AEWA) Conservation Status Report 8 (2022) or BirdLife International Datazone. The population of seabirds breeding within Ireland was derived from Cummins *et al*. (2019). Pairs are assumed to comprise of two individuals and apparently occupied sites are assumed to comprise 1.34 individuals (Walsh *et al*., 1995); thus the national breeding estimate presented in Table 11-11 has been doubled or multiplied by 1.34 from the published estimate within Cummins *et al*. (2019). The breeding population of common scoter in Ireland has recently been studied and therefore the population estimate was provided by Heffernan and Hunt (2022). The wintering population estimate for species within Ireland were taken from Burke *et al*. (2018) and Lewis *et al*. (2019) which used I-WeBS data. The winter population estimate presented Table 11-11 is a mean count over seven winter periods (2009/10 – 2015/16).

Regional population estimates for the non-breeding, wintering and autumn and spring migration periods have been defined using the Biologically Defined Minimum Population Scales (BDMPS) relevant for each species (Furness, 2015). For species which have been assessed with section 11.10 (specifically gannet, great black-backed gull, guillemot, herring gull and razorbill), the regional BDMPS has been adapted from the figure published in Furness (2015). The numbers within Furness (2015) included a low proportion of Ireland's seabirds, therefore, for some species within this assessment, Ireland's proportion has increased and some of the northern Scottish colonies have had the proportion of birds reduced. Full details of populations included within the "adapted Furness" approach presented here are provided in appendix 11-7: Offshore Ornithology Apportioning Impacts to Individual Colonies.

The conservation value included within Table 11-11, includes the status on the Birds of Conservation Concern in Ireland 4 (BoCCI) and whether the species is listed as a migratory species or on Annex 1 of the Birds Directive.

Table 11-11: International, national (Ireland) and regional estimates of species' populations (number of individual birds).

Species	Conservation value			International population	National wintering (mean)	National breeding	Regional BDMPS	
	BoCCI	Migratory Species	Annex 1 Species				Migration seasons	Non-breeding / winter season
Arctic tern	Amber	✓	✓	2,600,000 – 4,400,000	-	5,556	71,398	-
Black guillemot	Amber	✓		190,000 – 200,000	-	At least 3,917	-	-
Black-headed gull	Amber	✓		2,500,00 – 3,400,000	48,821[3]	15,620	-	-
Common gull	Amber	✓		1,400,000 – 2,000,000	21,438[3]	3,896	-	-
Common scoter	Red	✓		687,000 – 815,000	10,607	100	-	-
Common tern	Amber	✓	✓	170,000 – 220,000	-	10,116	64,659	-
Cormorant	Amber	✓		86,000 – 110,000	7,967	9,376	-	9,602
Fulmar	Amber	✓		6,760,000 – 7,000,000[1]	-	65,798	828,194	556,367
Gannet	Amber	✓		1,600,000	-	95,892	536,005[2] autumn 644,739[2] spring	-
Great black-backed gull	Green	✓		240,000 – 310,000	4,010[3]	6,162	-	53,181[2]
Great northern diver	Amber	✓	✓	8,600 – 11,000	2,128	No breeding occurs in Ireland	-	300
Great skua	Amber	✓		39,000 – 45,000	-	26 – 30	41,426	1,398
Guillemot	Amber	✓		5,100,000 – 6,200,000	-	177,388	-	1,567,398[2]
Herring gull	Amber	✓		1,600,000 – 1,780,000	11,524[3]	20,666	-	196,791[2]
Kittiwake	Red	✓		6,100,000	-	49,456	502,846[2] autumn 370,120[2] spring	-
Lesser black-backed gull	Amber	✓		1,040,000 – 1,100,000	11,842[3]	14,224	326,608	41,159

Species	Conservation value			International population	National wintering (mean)	National breeding	Regional BDMPS	
	BoCCI	Migratory Species	Annex 1 Species				Migration seasons	Non-breeding / winter season
Manx shearwater	Amber	✓		1,026,000 – 1,177,500*	-	43,610	1,580,895	-
Puffin	Red	✓		11,000,000 – 12,000,000	-	26,319	-	304,557
Razorbill	Red	✓		830,000 – 2,000,000	-	33,689	642,680[2]	377,188[2]
Red-breasted merganser	Amber	✓		100,000 – 160,000	2,430	-	-	-
Red-throated diver	Amber	✓	✓	210,000 – 340,000	657	< 10	4,373	1,657
Roseate tern	Amber	✓	✓	7,500 – 9200	-	3,640	2,100	-
Sandwich tern	Amber	✓	✓	170,000 – 200,000	-	5,038	10,761	-
Shag	Amber	✓		199,000 – 205,000	1,500	9,960	-	13,075

[1] International population estimate taken from BirdLife International Data Zone.

[2] Regional BDMPS presented has been adapted from Furness (2015) to increase representation of Irish colonies.

[3] Gull species are an optional inclusion of WeBS counting and therefore these are considered an underestimation.

Baseline mortality

Baseline mortality rates for all species (taken from Horswill *et al.,* 2015), apart from great black-backed gull which is taken from Furness (2015) including juvenile and adult survival and productivity rates are shown in Table 11-12 below. Age class was defined as a group of individuals from the same species that are of similar age (Horswill *et al.,* 2015). Only those species for which impacts have been assessed (i.e. those scoped in for specific impacts in section 11.10) have been included in Table 11-12. Table 11-12 includes an overall average mortality for each species using all age classes, as it is assumed that they are equally at risk of additional mortality from the effects of a wind farm. Age classes are shown in years, (e.g. 0-1 year old, 1-2 years old etc.).

Table 11-12: Survival and mortality estimates for selected IEFs.

Species	Survival per age class (years)					Productivity	Average mortality (all age classes)
	0-1	1-2	2-3	3-4	Adult		
Common gull	0.410	0.710	0.828	-	0.828	0.543	0.253
Gannet	0.424	0.829	0.891	0.895	0.919	0.700	0.181
Great black-backed gull	0.798	0.930	0.930	0.930	0.930	1.139	0.095
Great northern diver	0.770	0.770	0.770	-	0.870	0.543	0.161
Guillemot	0.560	0.792	0.917	-	0.939	0.672	0.136
Herring gull	0.798	0.834	0.834	-	0.834	0.920	0.172
Kittiwake	0.790	0.854	0.854	-	0.854	0.690	0.156
Razorbill	0.794	0.794	0.895	-	0.895	0.570	0.129

11.7.4 Future baseline scenario

The European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (hereafter the EIA Regulations 2018) require that "*a description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge*" is included within the EIAR.

In the event that the Project is not constructed, an assessment of the future baseline conditions has been carried out and is described within this section.

The baseline environment for Offshore Ornithology is not static and will exhibit a degree of natural change over time.

The UK and Ireland hold internationally important populations of seabirds (Mitchell *et al*., 2004; Cummins *et al*., 2019). After expanding for much of the last century, many seabird populations around Britain and Ireland have shown a marked decline over the last two decades with over a third of species experiencing declines in breeding abundance of up to 30% or more since the early 1990s (OSPAR, 2017; JNCC, 2021; Mitchell *et al.,* 2020; Booth Jones, 2021). Furthermore, the proportion of species experiencing widespread and frequent breeding failures has been increasing over the last decade. Recent analysis on 20 seabird species breeding around the coast of Ireland indicated that over the short-term (~16 years) 85% of species assessed were considered to be increasing with only two species showing stable trends and one species (kittiwake) showing a negative trend since the turn of the century. When the analysis was repeated over the long-term (~32 years) on 19 species approximately 68% were estimated to have increased, 21% decreased and 11% showing more stable trends (Cummins *et al*., 2019).

Trends in seabird numbers at breeding populations are regularly monitored at many colonies (JNCC, 2021; SMP, 2022) and include comprehensive censuses of breeding seabirds undertaken between 1969 to 1970, 1985 to 1988 and 1998 to 2002 (Mitchell *et al*., 2004). An update on the trends from the national censuses was undertaken by using data from the SMP (JNCC, 2021). The fourth UK seabird census finished in 2022, no data has been published from this to date. Additional large scale monitoring efforts include ESAS (Dunn, 2012), ObSERVE I (Jessopp *et al.*, 2018) and ObSERVE II, and the continual monitoring undertaken as part of the SMP.

A recent study suggests that, in terms of number of species affected and the average impact, the key three threats to seabird populations globally are invasive species (165 species across all the most threatened groups), bycatch in fisheries (100 species but with the greatest average impact) and climate change (96 species affected) (Dias *et al.*, 2019 and Mitchell *et al.,* 2020). Furthermore, it was estimated that more than 170 million individual birds (over 20% of all seabirds) are exposed to the combined impacts of bycatch, invasive alien species and climate change, and over 380 million (45% of all seabirds) are exposed to at least one of these three threats (Dias *et al.*, 2019). Most seabird species around Britain and Ireland are at the southern limit of their range in the northeast Atlantic and therefore an increase in global temperatures could result in a shift in species' range with the potential for overall declines in population size (Frederiksen *et al*., 2007, 2013 and Mitchell *et al*., 2020).

In the UK and Ireland, climate change is considered to be the likely primary cause of decline in seabird populations in the future, with anticipated depletion of breeding conditions for most species either indirectly, through changes in prey abundance, or directly during extreme weather events (e.g. high winds and heavy rainfall may impact on egg/chick survival or impair foraging ability at sea) (Mitchell *et al.*, 2020). Extreme weather conditions can lead to poor body condition, lower survival and cause substantial 'wrecks', partly because flying and diving are more energetically consuming at higher wind speeds.

Many studies have reported on the relationship between seabird demographic rates and indicators of climate change, such as rising Sea Surface Temperatures (SST) (Mitchell *et al.,* 2020). Particularly for species such as kittiwake, the overwintering survival of some colonies in eastern Scotland was lower following winters with a higher SST (although this varies greatly between colonies), which may be partly due to prey abundance. Other species including fulmar, puffin, Arctic tern, guillemot, razorbill and shag also appear to be vulnerable to climate change, with negative correlations between breeding success and SST. However, the effects of climate change may be less pronounced in populations around the Celtic Seas, where weaker effects of climate on seabird demography have been found (Lauria *et al.*, 2012, 2013).

Fisheries management will also likely impact on future seabird populations in the UK and Ireland. For many years, seabird species have benefitted from bycatch and fisheries discards; for scavenging species such as herring gull, kittiwake, great skua and fulmar, population levels may already be above those that naturally occurring food sources would sustain (Votier *et al.,* 2004 and Frederiksen *et al.,* 2013), however the introduction between 2015 to 2019 of the Common Fisheries Policy (CFP) Landings Obligation ('discard ban') will likely reduce the discards available and might ultimately put more pressure on scavenging species. The population impacts of the ban are not yet fully understood. Furthermore, positive management measures designed to allow commercial fish stocks to recover may have adverse impacts on some species; for example, species such as kittiwake may be outcompeted by recovering stocks of haddock and whiting in their hunt for sandeels in the North Sea (Bicknell *et al.,* 2013 and Mitchell *et al.,* 2020).

During the summer of 2022 there were large-scale outbreaks of avian flu across multiple seabird colonies within Ireland, the UK and throughout Europe. The exact number of birds that died and of which species is not known but any previous population estimates will not have taken account of this potentially reduced population. Colonies were impacted in different ways, with some reporting 100% chick mortality with fewer adult birds impacted, whereas others had large-scale adult die offs (Adlhoch *et al.,* 2022; NatureScot, 2023b; RSPB, 2024). The populations at different colonies provide an understanding of the impact, with a large variation compared to the "baseline" (RPSB, 2024). RSPB coordinated a UK wide study at important seabird colonies to understand the impact, it concluded that, on average there was a reduction in population. Great skua declined that most (-76% decrease) followed by tern species (common tern declined by -42% and sandwich tern declined by -35%) at the monitored colonies. Other species, such as guillemot (-7% decrease) did not seem as impacted).

All of the survey data and population estimates presented within this report precede the Highly Pathogenic Avian Influenza (HPAI) impacts and therefore there is no specific change to the assessment presented.

11.7.5 Data validity and limitations

The data limitations and assumptions highlighted in appendix 11-1: Offshore Ornithology Technical Report are typical of difficulties encountered with undertaking field surveys of seabirds using boat-based methods.

As with any seabird surveys, there are a number of limitations in data collection and subsequent analyses, which have been taken into account in the impact assessment below. The baseline site characterisation is based on over two years' of data collection (May 2018 to September 2020) within the Offshore Ornithology Study Area and therefore considered to be sufficiently robust to undertake an impact assessment.

During the site-specific boat-based transect surveys the November 2018, October 2019 and May 2020 surveys were only partially completed due to weather or other logistical constraints, with a single survey visit undertaken in each of those months. In November 2018, alternate transects were covered to achieve representative sampling coverage across the Offshore Ornithology Study Area. In October 2019, coverage was only achieved of transects 6 to 11 in the northern half of the Offshore Ornithology Study Area and in May 2020 transects 3 to 10 were covered. Surveys were not completed in May 2019, September 2019, November 2019, February 2020 and March 2020 due to adverse weather constraints during planned survey windows. The use of the Marine Renewables Strategic Environmental Assessment (MRSea) model to estimate spatial abundance of birds takes into account incomplete survey coverage.

ESAS data were not uniformly collected across the Offshore Ornithology Study Area and total records were sparse. The data are also undated and are therefore potentially unreliable in providing suitable baseline information. Therefore, as the dataset does not provide representative, contemporary coverage of seabirds within the Offshore Ornithology Study Area, it was not included within the development of species accounts in appendix 11-1: Offshore Ornithology Technical Report. However, it is useful in providing historical context and in identifying the species likely to be encountered and / or of importance in the Offshore Ornithology Study Area. It has been useful to compare the estimated densities of seabirds derived from the ObSERVE I project with those derived from the site-specific surveys.

As described above, the baseline site characterisation is based on over two years' of data collection and is therefore considered to be sufficiently robust to undertake an impact assessment in line with NatureScot (2023) guidance, Natural England (2022) and DCCAE (2018). Additionally, in line with NatureScot (2023) guidance (i.e. that data has been collected up to 5 years prior to the submission date) the data is therefore considered to be sufficiently robust to undertake this assessment.

11.8 Key parameters for assessment

11.8.1 Project design parameters

The project description is provided in volume 2A, chapter 5: Project Description. Table 11-13 outlines the project design parameters that have been used to inform the assessment of potential impacts of the construction, operational and maintenance and decommissioning phases of the Project on offshore ornithology.

The final height of the wind turbine will be confirmed following detailed geotechnical investigations and analysis of ground conditions (see design flexibility details in volume 2A chapter 5: Project Description). The assessment (section 11.10) considers the lowest blade tip height of 27 m above LAT (Table 11-13) as this would result in the maximum potential for impacts arising from collision risk. Should the final height of the wind turbine result in a blade tip height greater than 27 m, this would also result in a lesser impact from collision. The assessment is based on the greatest impact and therefore the most precautionary numbers are presented in section 11.10.

Additionally, due to the potential for unexpected ground conditions and obstructions, the final route and length of the offshore cable and offshore inter-array cables will be confirmed during construction (see design flexibility details in volume 2A chapter 5: Project Description). For the purposes of the assessment presented in section 11.10 the maximum length of cables has been considered (Table 11-13) to ensure the potential for maximum impact is assessed. Should the final lengths of cables be less than those specified, then the potential for effects will be the same or less than what is outlined in section 11.10. An alternative route within the offshore wind farm area of offshore cable corridor won't change the assessment presented in section 11.10.

Table 11-13: Project design parameters considered for the assessment of potential impacts on offshore ornithology.

Potential impact	Phase[1] C	O	D	Project design parameters	Justification
Disturbance and displacement	✓	✓	✓	**Construction phase:** Disturbance and displacement from construction activity including: • Installation of 25 wind turbine generators (WTGs) and one offshore substation (OSS); • 26 monopile foundations; • Maximum of 5 hours piling per pile with one pile expected to be installed within each 24-hour period; • Maximum days piling = 26 days Maximum duration of piling: 8 hours per pile; total number of days of piling: 26; • Installation of 41 km of inter-array cables and 16 km offshore cable; • 50% of inter-array cables and 50% of offshore cable may require cable protection; and • Maximum 475 vessel round trips during the construction phase (including jack-up barges, tug/anchor handlers, cable installation vessels, scour/cable protection installation vessels, guard vessels, survey vessels and crew transfer vessels (CTVs)). Offshore construction may take place over a period of 15 months. **Operational and maintenance phase**	Represents the maximum number of vessel movements that would cause greatest disturbance and displacement to birds from offshore wind farm area and offshore cable corridor. Accounts for the number of turbines and structures across the offshore wind farm area. Represents maximum extent and installation duration of cables that would cause greatest disturbance and displacement to birds.

Potential impact	Phase[1] C	O	D	Project design parameters	Justification
				• Presence and operation of 25 x WTGs and 1 x OSS; and • 352 vessel round trips per year. Operational and maintenance phase is 40 years. **Decommissioning phase** Disturbance and displacement from decommissioning activity including: • Removal of 25 x WTGs and 1 x OSS; • Maximum 475 vessel round trips during the decommissioning phase. Decommissioning duration assumed to be similar to that for construction but of a lower magnitude than construction.	
Indirect displacement resulting from changes to prey and habitats	✓	✓	✓	Project design parameters as described in chapter 9: Fish and Shellfish Ecology and chapter 8: Benthic, Subtidal and Intertidal Ecology.	Project design parameters as described in chapter 9: Fish and Shellfish Ecology for the following impacts: • Temporary subtidal habitat loss/disturbance during construction; • Long-term subtidal habitat loss during operation and maintenance phase; • Increased suspended sediment concentrations and associated sediment deposition; and • Injury and/or disturbance to fish and shellfish from underwater noise and vibration.
Collision risk	×	✓	×	**Operational and maintenance phase** Presence of 25 x WTGs within the offshore wind farm area: • Hub height 145 - 152 m above Lowest Astronomical Tide (LAT); • Lower blade tip height of 27 m above LAT; • Upper blade tip height of 270 m above LAT; and • Maximum rotor diameter of 236 m.	The wind turbine parameters assessed for collision impact risk.
Barrier effect	×	✓	×	**Operational and maintenance phase** • Presence of 25 x WTGs within wind farm array area with minimum spacing of 944 m between turbines; and • Presence of one OSS.	Maximum density of turbines and structures across the offshore wind farm area, which represents the greatest potential barrier of birds moving between colonies and foraging grounds, and those migrating through the offshore wind farm area.

1 C= Construction, O = Operation, D = Decommissioning

11.8.2 Measures included in the Project

As part of the project design process, a number of measures have been proposed to reduce the potential for impacts on offshore ornithology (see

Table 11-14). These measures include designed-in and management measures (controls). As there is a commitment to implementing these measures, they are considered inherently part of the design of the Project and have therefore been considered in the assessment presented in section 11.10 below (i.e. the determination of magnitude and therefore significance assumes implementation of these measures). These measures are considered standard industry practice for this type of development.

Table 11-14: Measures included in the Project.

Measures included in the Project	Justification
An EMP will be implemented during the construction, operational and maintenance, and decommissioning phases of the Project (see volume 2A, appendix 5-2: Environmental Management Plan). The EMP includes a plan for minimising disturbance to rafting seabirds from construction vessels. Measures include: • Use of existing navigation approaches to port; avoid over-revving engines to minimise noise; and • Avoidance of rafting seabirds and seaducks enroute between work areas and port, or within the offshore wind farm area and offshore cable corridor, achieved through briefing (e.g. toolbox talks) of vessel crew about the purpose and implications of the vessel management practices.	Rafting seabirds and seaducks may occur within the navigation routes of construction vessels. Due to the infrequency of movements of additional vessel traffic, there is low potential for significant disturbance effects; however, it is best practice to minimise disturbance to birds.
The EMP includes a Marine Pollution Contingency Plan (MPCP) which will include key emergency contact details (e.g. Environmental Protection Agency (EPA)). Measures for the MPCP include: • Designated areas for refuelling where spillages can be easily contained; • Storage of chemicals in secure designated areas in line with appropriate regulations and guidelines; and • Double skinning of pipes and tanks containing hazardous substances, and storage of these substances in impenetrable bunds.	To ensure that the potential for release of pollutants from construction, operational and maintenance, and decommissioning plant is minimised. In this manner, accidental release of contaminants from vessels will be strictly controlled, thus providing protection for marine life across all phases of the Project.

11.8.3 Impacts scoped out of the assessment

On the basis of the baseline environment and the Project description outlined in volume 2A, chapter 5: Project Description, a number of impacts are proposed to be scoped out of the assessment for offshore ornithology. These impacts are outlined, together with a justification for the scoping out decision, in Table 11-15.

Table 11-15: Impacts scoped out of the assessment for offshore ornithology.

Potential impact	Justification
Collision risk to migratory passerines during all phases of the Project.	The risks to migrating passerines are considered negligible, due to the relative size of the Project and the behaviour of the birds (e.g. passage movements restricted to twice annual events, large population sizes and flight heights typically above risk height). Migrating passerines have therefore been scoped out of the assessment.
Direct disturbance and displacement from underwater sound during operations and maintenance phases.	Underwater sound as a result of operation of the wind turbines is extremely unlikely to result in noise levels that would harm birds. In the unlikely event that such low levels of noise emission result in displacement of birds away from wind turbines, this impact would already be accounted for by the above-water operational displacement assessment.
Accidental pollution during all phases of the Project.	Pollution impacts (accidental oil/fuel spills) during all phases of the Project are scoped out on the basis that the implementation of a MPCP will avoid the risk of significant pollution events. Consequently, seabirds and shorebirds are extremely unlikely to be significantly affected by any such pollution impacts.
Indirect impact from underwater sound from wind turbine operation on prey fish species during	Noise generated by operational wind turbines is of a very low frequency and low sound pressure level (Andersson et al., 2011). Studies have found that sound levels are only high enough to possibly cause a behavioural reaction within metres from a wind turbine (Sigray and Andersson, 2011) and therefore such levels are not considered to have potentially significant effects on fish. The Marine Management Organisation (MMO, 2014)

Potential impact	Justification
operations and maintenance phase.	review of post-consent monitoring at offshore wind farms found that available data on the operational wind turbine noise, from the UK and abroad, in general showed that noise levels from operational wind turbines are low and the spatial extent of the potential impact of the operational noise is low. This is supported by project specific modelling which indicated that effects on fish (e.g. injury or behavioural effects) are unlikely to occur for the modelled operational wind turbines (see appendix 10-2: Subsea Noise Technical Report).
Disturbance to birds below the LWM from onshore construction and operational and maintenance phase activities.	Onshore disturbance as a result of noise, vibration, lighting and human presence during the construction phase of the Project will be localised and of short – term duration (i.e. installation works at the landfall including cable trenching and joint bay installation will take c. 4 months). Due to the low magnitude, reversibility and low level of disturbance of onshore installation works on birds below the LWM (i.e. within the offshore environment), this impact has been scoped out from further assessment. Similarly, during the operational and maintenance phase the level of movements (human and vessel) at the operations and maintenance facility, is highly unlikely to lead to an impact below LWM.

11.9 Impact assessment methodology

11.9.1 Overview

The assessment on offshore ornithology has followed the methodology set out in volume 2A chapter 3: Environmental Impact Assessment Methodology. Specific to the offshore ornithology impact assessment, the following guidance documents have also been considered:

- Guidance on EIS and NIS Preparation for Offshore Renewable Energy Projects (DCCAE, 2017);
- Guidance on Marine Baseline Ecological Assessments and Monitoring Activities (Part 1 and Part 2) (DCCAE, 2018);
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2022); and
- Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine published by the CIEEM (CIEEM, 2022).

Alongside the Irish guidance documents, other SNCB guidance from within the UK has been considered, including, but not limited to:

- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase I: Expectations for pre-application baseline data for designated nature conservation and landscape receptors to support offshore wind applications (Natural England, 2022a);
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase II: Expectations for pre-application engagement and best practice guidance for the evidence plan process (Natural England, 2022b);
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase III: Expectations for data analysis and presentation at examination for offshore wind applications (Natural England, 2022c);
- Joint SNCB Interim Displacement Advice Note (SNCB, 2022);
- NatureScot’s offshore wind development guidance notes (NatureScot, 2023); and
- NRW’s offshore wind developments online information (NRW, 2022).

In addition, the offshore ornithology impact assessment has considered the Irish legislative framework as defined by:

- The European Communities (Birds and Natural Habitats) Regulations 2011 to 2021; and
- The Wildlife Acts 1976 – 2022.

11.9.2 Impact assessment criteria

The criteria for determining the significance of effects is a process that involves defining the magnitude of the impacts and the sensitivity of the offshore ornithology IEFs. This section describes the criteria applied in this chapter to assign values to the magnitude of potential impacts and the sensitivity of the offshore ornithology IEFs. The terms used to define magnitude and sensitivity are based on those which are described in further detail in volume 2A chapter 3: Environmental Impact Assessment Methodology.

The criteria for defining magnitude in this chapter are outlined in Table 11-16 below.

Table 11-16: Definition of terms relating to the magnitude of an impact.

Magnitude of impact	Definition
High	The magnitude of the impact would lead to large scale effects on the behaviour and distribution of the IEF, with sufficient severity to affect the long-term viability of the population over a generational scale. Considered to be >5 % increase in baseline mortality. (Adverse)
	Long-term, large-scale increase in the population trajectory over a generational scale. (Beneficial)
Medium	The magnitude of the impact would lead to temporary changes in behaviour and/or distribution of individuals at a scale that would result in potential reductions to lifetime reproductive success to some individuals although not enough to affect the population trajectory over a generational scale and/or the impact would lead to permanent effects on individuals that may influence individual survival but not at a level that would alter population trajectory over a generational scale. Considered to be >1 % increase in baseline mortality. (Adverse)
	Benefit to the habitat influencing foraging efficiency resulting in increased reproductive potential and increased population health and size. (Beneficial)
Low	The magnitude of the impact would result in some measurable change in attributes, quality or vulnerability, or minor loss, or alteration to, one (maybe more) key characteristics, features or elements. Considered to be >0.1 % increase in baseline mortality. (Adverse)
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring. (Beneficial)
Negligible	The magnitude of the impact would result in a very minor loss or detrimental alteration to one or more characteristics, features or elements. Considered to be <0.1 % increase in baseline mortality. (Adverse)
	Very minor benefit to, or positive addition of one or more characteristics, features or elements. (Beneficial)

The magnitude of an impact can be assessed by consideration of the potential change in the level of mortality in a population. Populations are assessed at different scales, (e.g. a regional breeding population within foraging range of the Project, or the BDMPS non-breeding population. A change in the background mortality rate of less than <0.1 % can be considered to be negligible and hence not likely to cause a material effect on the population as the scale of impact is within the natural range of annual variation. An increase in mortality of between 0.1 and 1 % is considered of low significance, and unlikely to cause a material effect on the population. An increase in mortality of more than 1 % of the background rate is not necessarily significant (medium magnitude), but the likelihood of an adverse effect increases the more this threshold is exceeded. When the predicted mortality rate is above 1 %, Population Viability Analysis (PVA) might be undertaken. When small populations are concerned (e.g. a breeding colony), at least one individual (per annum or season) needs to be impacted before additional analysis (e.g. PVA) was undertaken. Cases where less than one bird is predicted to be injured/killed this would not trigger the need for additional analysis.

The criteria for defining recoverability and receptor sensitivity in this chapter are outlined in Table 11-17 and Table 11-18 below. The definition of sensitivity considers the vulnerability and recoverability of a receptor as well as taking into account the conservation value of each receptor (see Table 11-19).

It should be noted that high vulnerability and/or low recoverability are not necessarily linked with high conservation value within a particular impact. A receptor could be categorised as being of high conservation value (e.g. a qualifying feature of a SPA) but have a low or negligible physical/ecological vulnerability to an effect and vice versa. Determination of sensitivity takes these differing aspects into consideration.

Table 11-17: Definition of the recoverability of the receptor.

Recoverability	Definition
High	A species with a medium reproductive success and a stable or increasing Irish and/or UK trend in breeding abundance and productivity.
Medium	A species with a low reproductive success and a stable or increasing Irish and/or UK long-term trend in breeding abundance and productivity.
Low	A species with a low reproductive success and a declining Irish and/or UK long-term trend in breeding abundance and productivity or uncertainty regarding the long-term trend (due to data availability).

Table 11-18: Definition of terms relating to the sensitivity of the receptor.

Sensitivity	Definition
High	Species is of international conservation value, medium or high vulnerability to impact and has low or medium recoverability.
	Species is of national conservation value, high vulnerability to impact and has low recoverability.
Medium	Species is of international conservation value, low vulnerability to impact and has medium or high recoverability.
	Species is of national conservation value, medium or high vulnerability to impact and has medium recoverability.
Low	Species is of national conservation value, low vulnerability to impact and has medium recoverability.
	Species is of national conservation value, medium vulnerability to impact and high recoverability.
	Species is of regional conservation value, medium to high vulnerability to impact and medium to high recoverability.
	Species is of local conservation value, low, medium or high vulnerability to impact and low recoverability.
Negligible	Species is of local conservation value, low vulnerability to impact and medium to high recoverability.
	Species is not vulnerable to impacts.

The conservation value of offshore ornithology IEFs (Table 11-19) is based on standard guidelines by CIEEM (2022) which places the conservation value of offshore ornithology IEFs within a geographical frame of reference (e.g. International, National, Regional). This is based on standard guidance and available information, and the distribution and status of the ecological features being considered (e.g. qualifying interest of a nearby SPA).

The conservation value of ornithological receptors is based on the population from which individuals are predicted to be drawn. This reflects current understanding of the movements of species, with site-based protection (e.g. SPAs) generally limited to specific periods of the year (e.g. the breeding season). Therefore, conservation value can vary through the year depending on the relative sizes of the number of individuals predicted to be at risk of impact and the population from which they are estimated to be drawn. Conservation value therefore corresponds to the degree of connectivity which is predicted between the wind farm site and protected populations. Using this approach, the conservation importance of a species seen at different times of year may fall into any of the defined categories (Table 11-19).

Table 11-19: Criteria used to inform the conservation valuation of IEFs.

Conservation value	Justification
International (high)	Species which are a qualifying feature of an SPA or Ramsar site which are considered likely to interact with the Project (e.g. within the species mean max foraging range); Irish populations which exceed 20% of the European breeding or non-breeding population; and/or Species which are present in numbers greater than 1 % of the international biogeographical population.
National (medium)	Species listed on Annex 1 of the EU Birds Directive not already covered by international criteria; Species that form part of a Site of Special Scientific Interest (SSSI) that are considered potentially likely to interact with the Project; At least 50% of the Irish breeding or non-breeding population found in ten or fewer sites; Impacts on ecologically sensitive species (e.g. breeding populations < 300 pairs or wintering populations < 900 individuals); and/or Species which are present in numbers greater than 1% of the national population.
Regional (low)	Red-listed species listed under the BoCCI; and/or Species which are present in the Offshore Ornithology Study Area in numbers greater than 1% of the regional population.
Local (negligible)	Any other species of conservation value (e.g. Green or Amber-listed species listed under BoCCI which are not covered by the categories above.

The significance of the effect upon offshore ornithology IEFs is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The particular method employed for this assessment is presented in Table 11-20. Where a range of significance of effect is presented in Table 11-20, the final assessment for each effect is based on calculated assessment and professional judgement.

For the purposes of this assessment, any effects with a significance level of moderate or less have been concluded to be not significant in terms of the EIA Regulations (EPA, 2022).

Table 11-20: Matrix used for the assessment of the significance of the effect.

		Magnitude of impact			
		Negligible	Low	Medium	High
Sensitivity of receptor	Negligible	Imperceptible	Imperceptible or slight	Imperceptible or slight	Slight
	Low	Imperceptible or slight	Slight	Slight	Slight or moderate
	Medium	Imperceptible or slight	Slight	Moderate	Significant or very significant
	High	Slight	Slight or moderate	Significant or very significant	Very significant or profound

11.9.3 Identification of designated sites

Where Natura 2000 sites (i.e. internationally designated sites) are considered, this chapter summarises the assessments made on the qualifying features of internationally designated sites as described within section 11.7 of this chapter (with the assessment on the site itself deferred to the NIS (RPS, 2023).

With respect to nationally and locally designated sites, where these sites fall within the boundaries of an internationally designated site and where notified qualifying features of the Natura site are also qualifying features of the nationally designated sites (e.g. Natural Heritage Areas (NHAs) which underpin a Natura site), only the international site has been taken forward for assessment. This is because potential effects on the integrity and conservation status of the nationally designated site are assumed to be inherent within the assessment of the internationally designated site (i.e. a separate assessment for the national site is not undertaken).

11.10 Assessment of significance

The potential impacts arising from the construction, operational and maintenance and decommissioning phases of the Project are listed in Table 11-13, along with the project design parameters against which each impact has been assessed.

A description of the potential effects on offshore ornithology IEFs caused by each identified impact is given below.

11.10.1 Disturbance and displacement

Construction phase

Disturbance as a result of activities during the construction of a wind farm (such as installing foundations, wind turbines, inter-array cabling and associated vessel movements) and the offshore cable has the potential to displace birds from an area of sea in which the activity is occurring. This in effect represents indirect, temporary habitat loss, potentially reducing the area available for those seabirds sensitive to disturbance to forage, loaf and / or moult in the way that they are currently able to within and around the offshore wind farm area and offshore cable corridor. Such disturbance could ultimately affect the demographic fitness (i.e. survival rates and breeding productivity) of displaced birds, as well as potentially impacting on birds in areas that displaced birds move to due to increased competition for resources.

Disturbance associated with construction vessel movements will be of limited duration at any one location, because it is a transient impact as marine vessels move through an area relatively quickly. Vessel movements for the construction of the offshore infrastructure will also be infrequent, amounting to 475 round trips during a construction period of 15 months (averaging just over one round trip per day). Construction activities also result in a point source of disturbance, for example when construction vessels are at a location to undertake piling, drilling and install foundations or the wind turbines. The level of disturbance associated with each location would vary depending on the activity undertaken. As the potential impacts are spatially and temporally restricted, the potential impact is reversible in the short-term as birds are likely to return when activities have been completed at that location. However, there is potential for disturbance around each point source throughout the construction period of 15 months.

Species differ greatly in their susceptibility to disturbance (SNCB, 2022). For example, some auk species (e.g. guillemot and razorbill) have been shown to be disturbed by boats hundreds of metres away (Furness and Wade*,* 2012); amongst sea ducks, scoters are particularly vulnerable to disturbance by vessels (Kaiser *et al.,* 2006 and Furness *et al*., 2012) and divers show a higher degree of sensitivity and are especially sensitive to approaching boats at a distance of more than 1 km (Garthe and Hüppop, 1994, Schwemmer *et al*., 2011 and Furness and Wade, 2012). Gull species however are known to be attracted by human activities at sea, such as fishing vessels (Garthe and Hüppop*,* 1994 and Welcker *et al*., 2016), and are usually assumed to be insensitive to anthropogenic disturbance. Assuming there is a single point source of disturbance, potentially affecting birds within an area of 2 km (or 4 km for divers), that would result in a consistently affected area of approximately 12.56 km^2 (or 50.26 km^2 for divers) which varies in its location within the offshore wind farm area and offshore cable corridor. It is therefore possible to apply the mean-peak density of birds recorded in the Offshore Ornithology Study Area to estimate the number of birds potentially displaced temporarily by construction activities.

Species sensitivity to disturbance in response to offshore wind farms has been quantified by several means. A study undertaken by Garthe and Hüppop (2004) developed a scoring system to assess species sensitivity to disturbance by using nine factors derived from the species' attributes; each factor was scored on a five point scale from 1 (low vulnerability) to 5 (high vulnerability). Furness and Wade (2012) reviewed evidence for likely impacts on seabirds in Scottish waters, and constructed indices assessing the relative vulnerability of seabird species' populations to impacts of turbines. Bradbury *et al*. (2014) built upon Furness and Wade (2012) and produced a sensitivity score for species within English waters. The sensitivity scores presented within Bradbury *et al*. (2014) included assessment of displacement/disturbance alongside collision, therefore the sensitivities presented in Table 11-21 are taken from Bradbury *et al*. (2014), unless stated otherwise. This assessment follows the latest guidance from the joint SCNBs (SNCB, 2022) as to which species should be included within the displacement assessment. A screening assessment for construction disturbance has been carried out for each species with consideration of the species' sensitivity rating and abundance in the Offshore Ornithology Study Area (Table 11-21). Only species that were recorded in abundances within the offshore wind farm area of moderate or above **AND** with a sensitivity of moderate or above will be screened in and taken forward for assessment.

Table 11-21: Screening for assessment of disturbance and displacement during construction.

Offshore Ornithology IEF	Sensitivity to disturbance and displacement	Abundance recorded in offshore wind farm area and offshore cable corridor	Screened IN or OUT
Arctic tern	Low	Very low	Low sensitivity to disturbance and displacement; very low abundance recorded during site-specific surveys. **Screened OUT**
Black-headed gull	Low	Very low	Low sensitivity to disturbance and displacement; very low abundance recorded during site-specific surveys. **Screened OUT**
Black guillemot	Moderate	Low	Moderate sensitivity to disturbance and displacement. Recorded in high numbers within the Offshore Ornithology Study Area but low numbers and infrequently within the offshore wind farm area and offshore cable corridor where the majority of construction will occur. **Screened OUT**
Common gull	Low	Low	Low sensitivity to disturbance and displacement; low abundance recorded during site-specific surveys. **Screened OUT**
Common scoter	High	Low	High sensitivity to disturbance and displacement. Generally recorded in low numbers in inshore areas with the exception of April 2020 which recorded over 2,000 individuals, although that was not within the offshore wind farm area or offshore cable corridor. **Screened OUT**
Common tern	Low	Very low	Low sensitivity to disturbance and displacement; very low abundance recorded during site-specific surveys. **Screened OUT**
Cormorant	Moderate	Very low	Moderate sensitivity to disturbance and displacement however very low abundance recorded during site-specific surveys. **Screened OUT**
Fulmar	Very low	Low	Very low sensitivity to disturbance and displacement and low abundance

Offshore Ornithology IEF	Sensitivity to disturbance and displacement	Abundance recorded in offshore wind farm area and offshore cable corridor	Screened IN or OUT
			recorded during site-specific surveys. **Screened OUT**
Gannet	Very low	High	High abundance recorded during site-specific surveys however very low sensitivity to disturbance and displacement during construction. **Screened OUT**
Great black-backed gull	Low	Low	Low sensitivity to disturbance and displacement and low abundance recorded during site-specific surveys. **Screened OUT**
Great northern diver	High	Moderate	High sensitivity to disturbance and displacement and moderate abundance in Offshore Ornithology Study Area. **Screened IN**
Great skua	Very low	Very low	Very low sensitivity to disturbance and displacement; very low abundance recorded during site-specific surveys. **Screened OUT**
Guillemot	Moderate	Very high	Very high abundance recorded in the surveys area and moderate sensitivity to disturbance and displacement. **Screened IN**
Herring gull	Very low	Low	Very low sensitivity to disturbance and displacement and low abundance recorded during site-specific surveys. **Screened OUT**
Kittiwake	Very low	Moderate	Moderate abundance recorded during site-specific surveys however very low sensitivity to disturbance and displacement. **Screened OUT**
Lesser black-backed gull	Very low	Low	Low sensitivity to disturbance and displacement and low abundance recorded during site-specific surveys. **Screened OUT**
Manx shearwater	Very low	Very high	Very high abundance recorded in the survey area, however very low sensitivity to disturbance and displacement. **Screened OUT**
Puffin	Low	Low	Low sensitivity to disturbance and displacement and low abundance recorded during site-specific surveys. **Screened OUT**
Razorbill	Moderate	Very high	High abundance recorded in the survey area and moderate sensitivity to disturbance and displacement. **Screened IN**
Red-breasted merganser	Moderate	Very Low	Moderate sensitivity to disturbance and displacement however very low abundance recorded during site-specific surveys.

Offshore Ornithology IEF	Sensitivity to disturbance and displacement	Abundance recorded in offshore wind farm area and offshore cable corridor	Screened IN or OUT
			Screened OUT
Red-throated diver	Very high	Low	Very high sensitivity to disturbance and displacement however low abundance recorded during site-specific surveys._. **Screened OUT**
Roseate tern	Moderate	Low	Moderate sensitivity to disturbance and displacement and low abundance recorded during site-specific surveys. **Screened OUT**
Sandwich tern	Moderate	Low	Moderate sensitivity to disturbance and displacement and low abundance recorded during site-specific surveys. **Screened OUT**
Shag	Moderate	Low	Moderate sensitivity to disturbance and displacement, however low abundance recorded during site-specific surveys. **Screened OUT**

Great Northern Diver

Great northern diver was recorded in the Offshore Ornithology Study Area in low to moderate numbers across most months during the site-specific surveys. Population estimated ranged between one bird (boat-based survey in November 2018) 102 birds (DAS in April 2020) when the species was recorded. A small number of birds were recorded in the survey in June 2018, June 2019, June 2020 which is within the defined breeding season for this species (Furness, 2015), however great northern diver do not breed around Ireland and therefore it is considered that these individuals will likely comprise part of the population on migration or non-breeding birds.

The peak levels of activity were recorded during the spring migration (total records of 306 individuals during spring migration (March to May) and winter periods (181 total records), with smaller numbers recorded in the autumn migration (90 total records). Birds recorded in the autumn and spring migration seasons are likely to remain in a location for a shorter period of time as they are on the move and will be less sensitive to displacement as a result. However, the assessment takes a precautionary approach and considers displacement in the context of the peak number of birds recorded during the entire non-breeding bio-season defined as September to May, which includes the autumn and spring migration periods.

A mean-peak density of 1.59 birds/ km^2 was estimated in the offshore wind farm area during the non-breeding bio-season (September – May) during the boat-based survey (average peak of 44 birds over the offshore wind farm area). The mean-peak density of birds within the Offshore Ornithology Study Area during DAS was slightly higher with 1.78 birds/ km^2.

Magnitude of impact – non-breeding season

Based on a mean-peak density of 1.59 birds/km^2 within the offshore wind farm area and a disturbance distance of 50.27 km^2, there would be approximately 89 birds at risk of temporary displacement during one or two non-breeding seasons during which construction would occur.

Great northern divers are sensitive to disturbance and can be displaced from 4 km away from the development (Bradbury *et al*., 2014; SNCB, 2022). As such, a worst-case approach is taken to the assessment, which assumes 100 % displacement from the potential zone of influence within 4 km of the source of construction disturbance.

A value of 0.5 % mortality has been used in assessing the number of individuals that could be at risk of mortality as a result of disturbance and displacement during the construction phase, reflecting the absence of constraint to specific locations by non-breeding birds (SNCB, 2022). Topping and Petersen (2011) found no evidence for population effect in the related species, red-throated diver as a result of displacement from offshore wind farms. Furthermore, great northern diver may have a stronger tolerance to disturbance compared to other diver species (e.g. red-throated and black-throated) (Gittings *et al*., 2015), although the literature on this subject is sparse. Based on a 0.5 % mortality rate, the offshore wind farm construction would result in additional mortality of 0.45 birds annually.

The ObSERVE surveys undertaken between 2016/2017 recorded three diver species: red-throated diver, great northern diver and black-throated diver (Jessopp *et al.*, 2018). The abundance estimates for all diver species over the winter period was 2,942 individuals, with a higher estimate of 8,916 individuals in autumn and 47 individuals in summer. However, many of these are likely to be red-throated divers, so it is difficult to estimate a population of great northern divers. Burke *et al.* (2018) estimated a population of 2,128 for Ireland and given that the peak-mean population estimate for the Offshore Ornithology Study Area of the offshore wind farm area was 309 individuals, it is reasonable to assess the impact against the Irish population size of 2,128 individuals in the non-breeding season. Additional mortality of 0.45 birds would increase the baseline mortality by 0.1 % during per non-breeding season and is therefore negligible.

The impact of disturbance and displacement caused by construction activities and associated vessel movements during the non-breeding season is predicted to be of local spatial extent, short term duration, and reversible. It is predicted that the impact will affect the receptor directly, however any increases in mortality associated with construction activities are unlikely to significantly affect the population. The magnitude is therefore considered to be negligible.

Sensitivity of great northern divers

Divers are generally regarded as being highly sensitive to disturbance and displacement, showing a very high flush distance (i.e. the linear distance from an observer vessel to the birds at the moment of take-off from the water) and are likely to avoid disturbed areas (Garthe *et al.*, 1994; Furness *et al*., 2012; and Bradbury *et al.*, 2014). Furthermore, the guidance for undertaking ESAS surveys refer to the need to scan the sea area ahead of the ship "to detect the take-off of usually very wary seaduck and divers well ahead of the approaching platform" (Camphuysen *et al.*, 2004 and Gittings *et al.,* 2015).

In order to quantify the responses of great northern divers to increased marine traffic, Gittings *et al*. (2015) undertook a study on the great northern diver population in Inner Galway Bay. The study indicated that great northern divers in the area around the existing harbour did not show any significant response to normal ship and boat traffic, however they do exhibit a flush response when driven at directly in a rigid inflatable boat at speeds of 20 to 30 knots (Gittings *et al*., 2015). The study conflicted with the general perception about disturbance sensitivity in diver species and remained inconclusive.

Due to the Project's connectivity with nearby designated SPA sites, great northern diver are considered to have an international (high) conservation value as those individuals present within the offshore wind farm area are likely to form part of the wintering population of the nearby SPA populations (see Table 11-8).

Assuming an unlikely worst-case scenario of total displacement and 1% resulting mortality, great northern divers are deemed to be of high vulnerability and high conservation value. The sensitivity of the receptor is therefore, considered to be high.

Significance of the effect – non-breeding season

Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of great northern diver is considered to be high. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Guillemot

Guillemot were recorded in the Offshore Ornithology Study Area at high densities across all months during the site-specific surveys. Peak occurrences were observed during the DAS undertaken in July, August and September 2020 with peak counts of 3,235, 3,077 and 6,163 individuals on transect respectively.

A mean-peak density of 10.3 birds/ km^2 was estimated in the offshore wind farm area during the breeding bio-season from the boat-based surveys, with a peak of 21.4 birds/ km^2 from the aerial digital surveys. In the non-breeding bio-season, there was an estimated mean-peak density of 30.5 birds/ km^2 from boat-based surveys and a peak density of 61.9 birds/ km^2 from the aerial digital surveys.

Magnitude of impact – all seasons

During the breeding season, based on a mean-peak density of 10.3 to 21.4 birds/km^2 within an area of 12.56 km^2 (radial displacement around a single point of displacement). There would be approximately 129 to 269 birds at risk of temporary disturbance and displacement during one or two breeding seasons during which construction would occur.

During the non-breeding season, based on a mean-peak density of 30.5 to 61.9 birds/km^2 within an area of 12.56 km^2 (radial displacement around a single point of displacement). There would be approximately 383 to 777 birds at risk of temporary disturbance and displacement during one or two non-breeding seasons during which construction would occur.

Following the guidance presented by the SNCB (2022), the recommended displacement rate for auk species is between 30 % and 70 %, while advice provided by NatureScot recommends a displacement rate of 60 % and a mortality rate of 1 % (from Marine Scotland Scoping opinion for Seagreen development in the Firth of Forth). For the purposes of this assessment and considering the temporary and intermittent nature of the construction disturbance, the impact is assessed in the context of 50 % displacement rate and 1 % mortality rate.

Based on these rates, the construction of the offshore wind farm and offshore cable would result in additional mortality of:

- Breeding season: 6.5 to 13.4 birds; and
- Non-breeding season: 19.2 to 38.9 birds.

The non-breeding (August – February) regional BDMPS (Irish Sea) for guillemot was estimated to be 1,567,398 individuals. Using the average baseline mortality rate for guillemot (all age class mortality rate of 0.198; see Table 11-12), the baseline mortality during the non-breeding season is 310,345 birds. The additional mortality of 38.9 individuals represents a 0.02 % increase in baseline mortality and would therefore be undetectable at a population level. The impact of disturbance and displacement caused by construction activities and associated vessel movements over 15 months (including one or two breeding and non-breeding seasons) is predicted to be of local spatial extent, short term duration and reversible. It is predicted that the impact will affect the receptor directly, however any increases in mortality associated with construction activities are negligible.

Sensitivity of guillemot

Garthe *et al.* (2004), Furness *et al*. (2012 and 2013) and Wade *et al*. (2016) reported that guillemot are highly vulnerable and may be disturbed by vessels several hundred metres away, however the effects of construction activity on auk species remain unclear. For example, Leopold *et al.* (2010) found indications of disturbance to auks during surveys at Egmond aan Zee, but numbers were too low to reach statistical significance and Wade *et al*. (2016) reported that auks may be disturbed by boats at several hundreds of metres although this varied considerably. Whereas during construction surveys at Lynn and Inner Dowsing there appeared to be no significant patterns of change in guillemot abundance between the wind farm and control sites. Although guillemot are likely to respond to visual stimuli during the construction phase, the impacts of disturbance/displacement are short-term and guillemot have the ability to return to the baseline abundance and distribution after construction.

Although the species has a low reproductive success (Robinson, 2005), guillemot have a medium recoverability given their increasing trend in abundance and productivity in Ireland and the UK (Cummins *et al*., 2019 and JNCC, 2021).

Guillemot are considered to have an international (high) conservation value, as those individuals present within the offshore wind farm area are likely to form part of the breeding colonies of nearby SPA populations (see Table 11-8). These SPAs are designated for their guillemot breeding populations and fall within the mean maximum foraging range plus one SD from the offshore wind farm area.

Guillemot are deemed to be of high vulnerability, medium recoverability and high conservation value. The sensitivity of the receptor is therefore, considered to be high.

Significance of the effect – all seasons

Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of guillemot are considered to be high. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Razorbill

During the site-specific surveys, razorbill was recorded on transect throughout the survey period with a peak count observed in September 2020 (1,064 individuals). The peak in September 2020 is likely related to post-breeding dispersal of adults and juveniles from breeding sites. However, as there are no large razorbill breeding colonies within close proximity to the Project, numbers during the breeding season (April to July) were relatively low.

A mean-peak density of 0.25 birds/ km^2 was estimated in the offshore wind farm area during the breeding bio-season from the boat-based surveys, with a peak of 5.6 birds/ km^2 from the aerial digital surveys. In the non-breeding bio-season, there was an estimated mean-peak density of 10.5 birds/km^2 from boat-based surveys and a peak density of 9.6 birds/km^2 from the aerial digital surveys.

Magnitude of impact – all seasons

During the breeding period, based on a mean-peak density of 0.25 to 5.6 birds/km^2 within an area of 12.56 km^2. There would be approximately 3 to 70 birds at risk of temporary disturbance and displacement during one or two breeding seasons during which construction would occur.

During the non-breeding period, based on a mean-peak density of 9.6 to 10.5 birds/km^2 within an area of 12.56 km^2. There would be approximately 121 to 132 birds at risk of temporary disturbance and displacement during one or two non-breeding seasons during which construction would occur.

Following the guidance presented by the SNCB (2022), the recommended displacement rate for auk species is between 30% and 70% and mortality between 1 and 10%, while advice provided by NatureScot recommends a displacement rate of 60% and a mortality rate of 1% (from Marine Scotland Scoping opinion for Seagreen development in the Firth of Forth). For the purposes of this assessment and considering the temporary and intermittent nature of the construction disturbance, the impact is assessed in the context of 50% displacement rate and 1% mortality rate.

Based on these rates, the construction of the offshore wind farm and offshore cable would result in additional mortality of:

- Breeding season: 0.2 to 3.5 birds ; and
- Non-breeding season: 6.0 to 6.6 birds.

The winter season regional BDMPS (Irish Sea) for razorbill was estimated to be 341,422 individuals. Using the average baseline mortality rate for razorbill (all age class mortality rate of 0.129; see Table 11-12), the baseline mortality during the winter period is 44,043 birds. The addition of between 7.9 individuals per season represents 0.01 % increase in baseline mortality and would therefore be undetectable at a population level.

The impact of disturbance and displacement caused by construction activities and associated vessel movements over 15 months (including one or two breeding and non-breeding seasons) is predicted to be of local spatial extent, short term duration, and reversible. It is predicted that the impact will affect the receptor directly however any increases in mortality associated with construction activities are negligible.

Sensitivity of razorbill

Similar to guillemot, razorbill are considered to have a medium vulnerability to disturbance and displacement, in response to construction activities and vessel movements (Garthe *et al.,* 2004, Furness *et al.,* 2012 and 2013 and Bradbury *et al*., 2014), however the effects of construction activity and vessel movements on auk species remain unclear.

Due to the Project's connectivity with nearby designated SPA sites, razorbill are considered to have an international (high) conservation value as those individuals present within the offshore wind farm area are likely to form part of the breeding colonies of nearby SPA populations (see Table 11-8).These SPAs are designated for their razorbill breeding populations and fall within the mean maximum foraging range plus one SD from the offshore wind farm area.

Although the species has a low reproductive success (i.e. laying one egg and not breeding until five years old) (Robinson, 2005), razorbill have a medium recoverability given their increasing trend in abundance and productivity in Ireland and the UK (Cummins *et al*., 2019 and JNCC, 2021).

Razorbill are deemed to be of medium vulnerability, medium recoverability and high conservation value. The sensitivity of the receptor is therefore, considered to be high.

Significance of the effect – all seasons

Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of razorbill are considered to be high. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Operational and maintenance phase

During the operational and maintenance phase, the presence of operational turbines has the potential to directly disturb seabirds leading to displacement from the offshore wind farm area including an area of variable size or buffer (depending on sensitivity) around it (Furness *et al*., 2013 and Bradbury *et al.*, 2014). This would most affect those seabird species that are more sensitive to disturbance, although their sensitivity can vary by season and location. For example, the greatest impact is likely to be on breeding seabirds from nearby colonies that have highly specialised (and limited) habitat requirements and limited foraging ranges; it is unlikely that passage birds would be significantly affected by operational and maintenance activities as they are only present in the wind farm area for short periods during migration periods.

The period of time and constancy that individuals within a population may be subject to displacement impacts is uncertain, however it is likely that the impacts will be of higher intensity during the first years of operation, such that additional mortality in the population might be at its greatest in these early years, while in subsequent years it is possible that birds may become habituated to a certain extent, thereby reducing mortality rates.

Similar to the construction phase, seabird species differ in their reactions to offshore operational infrastructure and maintenance activities that accompany them, however the extent to which is still uncertain and subject to ongoing research. Although some species may show little avoidance, others such as divers, auks and pelagic seabirds may not forage or fly within hundreds of metres, or even several kilometres, of turbines. Comparatively, some gull species, cormorant and terns have generally shown little avoidance to wind farms and for instance were seen regularly foraging within the Egmond aan Zee offshore wind farm (Krijgsveld *et al*., 2009 and 2011).

Dierschke *et al.* (2016) reviewed studies from 20 operational wind farms in Europe, assessing the extent of displacement or attraction of 33 seabird species. They found that diver species and gannets showed consistent and strong avoidance behaviour of operational wind farms, whereas northern fulmar, common scoter, Manx shearwater, razorbill, common guillemot, little gull and sandwich tern showed less consistent displacement. Dierschke *et al.* (2016) suggested that displacement seemed more likely to be a response to the structures themselves, which appeared stronger when the turbines were rotating. However, for some species such as cormorant and shag, the attraction to offshore wind farms is beneficial for providing roosting and basking opportunities and increases in food availability are also apparent for some species.

Studies have shown that generally, migrants appear to be more obviously displaced than resident birds, perhaps due to a lack of habituation (Peterson *et al.,* 2005) and habituation is likely to occur for some species once turbines are operational and human activity is reduced.

As described in the sections above relating to the construction phase, species' sensitivity to disturbance in response to offshore wind farms has been quantified by several means, including studies by Garthe and Hüppop (2004) whereby species sensitivity to disturbance was assessed using nine factors derived from the species' attributes and used a five point scale from 1 (low vulnerability) to 5 (high vulnerability), and Furness *et al.* (2013) which reviewed evidence for likely impacts on seabirds, and constructed indices assessing the relative vulnerability of seabird species' populations to impacts of turbines. Similarly, Bradbury *et al.* (2014) expanded on Furness *et al.* (2013) to incorporate more species and also include an assessment of disturbance and displacement.

There is currently no detailed Irish guidance regarding the method of assessment of displacement of seabirds as a result of offshore wind farms. Guidance for offshore renewable energy projects published by the DCCAE includes reference to emerging methods for displacement assessment at the time of its publication, namely JNCC report 551 (Busch *et al.*, 2015). However, such proposed approaches have largely been superseded. This analysis therefore draws on the most recent recommendations of the joint SNCB guidance (SNCB, 2022), which promotes a displacement matrix approach.

The methodology presented in SNCB (2022) recommends that a matrix is compiled for each key species for a range of displacement levels (at 10% increments) across a range of likely adult mortality levels (at 0, 1%, 2%, 3%, 4%, 5%, 10% and then 10% increments) in each relevant biological season for that species.

Using available evidence on seabird sensitivity and habitat flexibility, a value, or small range of values of displacement rate and associated mortality levels are selected to provide an estimate of the potential losses. The consequent potential losses to the population as a result of displacement is then assessed for each season against an appropriate population scale. For the breeding season, the appropriate regional population covers the total colony counts within mean-maximum foraging range; for the non-breeding season assessment is done against the BDMPS (Furness, 2015).

In order to focus the assessment of operational and maintenance activities on species' disturbance and displacement within the offshore wind farm area, a screening exercise was undertaken as detailed within Table 11-22 below. Species with a low sensitivity to disturbance and displacement or recorded in low abundances within the offshore wind farm area during the breeding and non-breeding seasons, were screened out of further assessment as significant effects are highly unlikely for those species. Therefore, only species that were recorded in abundances within the offshore wind farm area of moderate or above **AND** with a sensitivity of moderate or above will be screened in and taken forward for assessment. These criteria do not apply to gannet, as the SNCB guidance (2022) states that gannet should always be taken through to matrix stage.

Table 11-22: Screening for assessment of disturbance and displacement during operation and maintenance.

Offshore Ornithological IEF	Sensitivity to disturbance and displacement	Abundance recorded in offshore wind farm area and offshore cable corridor	Screened IN or OUT
Arctic tern	Low	Very low	Low sensitivity to disturbance and displacement; very low abundance recorded during site-specific surveys. **Screened OUT**
Black-headed gull	Low	Very low	Low sensitivity to disturbance and displacement; very low abundance recorded during site-specific surveys. **Screened OUT**
Black guillemot	Moderate	Low	Moderate sensitivity to disturbance and displacement. Recorded in high numbers within the

Offshore Ornithological IEF	Sensitivity to disturbance and displacement	Abundance recorded in offshore wind farm area and offshore cable corridor	Screened IN or OUT
			Offshore Ornithology Study Area but low numbers and infrequently within the offshore wind farm area and offshore cable corridor where the majority of construction will occur. **Screened OUT**
Common gull	Low	Low	Low sensitivity to disturbance and displacement; low abundance recorded during site-specific surveys. **Screened OUT**
Common scoter	High	Low	High sensitivity to disturbance and displacement. Generally recorded in low numbers in inshore areas with the exception of April 2020 which recorded over 2,000 individuals, although that was not within the offshore wind farm area or offshore cable corridor. **Screened OUT**
Common tern	Low	Very low	Low sensitivity to disturbance and displacement; very low abundance recorded during site-specific surveys. **Screened OUT**
Cormorant	Moderate	Very low	Moderate sensitivity to disturbance and displacement however very low abundance recorded during site-specific surveys. **Screened OUT**
Fulmar	Very low	Low	Very low sensitivity to disturbance and displacement and low abundance recorded during site-specific surveys. **Screened OUT**
Gannet	Very low	High	High abundance recorded during site-specific surveys however very low sensitivity to disturbance and displacement. Following SNCB guidance (2022), this species is screened in due to the empirical studies demonstrating they are sensitive to disturbance and displacement post construction (Krijgsveld *et al.*, 2011 and Vanermen *et al.*, 2013) **Screened IN**
Great black-backed gull	Low	Low	Low sensitivity to disturbance and displacement and low abundance recorded during site-specific surveys. **Screened OUT**
Great northern diver	High	Moderate	High sensitivity to disturbance and displacement and moderate abundance in Offshore Ornithology Study Area. **Screened IN**
Great skua	Very low	Very low	Very low sensitivity to disturbance and displacement; very low abundance recorded during site-specific surveys. **Screened OUT**
Guillemot	Moderate	Very high	Very high abundance recorded in the surveys area and moderate sensitivity to disturbance and displacement. **Screened IN**
Herring gull	Very low	Low	Very low sensitivity to disturbance and displacement and low abundance recorded during site-specific surveys. **Screened OUT**

Offshore Ornithological IEF	Sensitivity to disturbance and displacement	Abundance recorded in offshore wind farm area and offshore cable corridor	Screened IN or OUT
Kittiwake	Very low	Moderate	Moderate abundance recorded during site-specific surveys however very low sensitivity to disturbance and displacement. **Screened OUT**
Lesser black-backed gull	Very low	Low	Low sensitivity to disturbance and displacement and low abundance recorded during site-specific surveys. **Screened OUT**
Manx shearwater	Very low	Very high	Very high abundance recorded in the survey area, however very low sensitivity to disturbance and displacement. **Screened OUT**
Puffin	Low	Low	Low sensitivity to disturbance and displacement and low abundance recorded during site-specific surveys. **Screened OUT**
Razorbill	Moderate	Very high	High abundance recorded in the survey area and moderate sensitivity to disturbance and displacement. **Screened IN**
Red-breasted merganser	Moderate	Very Low	Moderate sensitivity to disturbance and displacement however very low abundance recorded during site-specific surveys. **Screened OUT**
Red-throated diver	Very high	Low	Very high sensitivity to disturbance and displacement however low abundance recorded in Offshore Ornithology Study Area. **Screened OUT**
Roseate tern	Moderate	Low	Moderate sensitivity to disturbance and displacement and low abundance recorded during site-specific surveys. **Screened OUT**
Sandwich tern	Moderate	Low	Moderate sensitivity to disturbance and displacement and low abundance recorded during site-specific surveys. **Screened OUT**
Shag	Moderate	Low	Moderate sensitivity to disturbance and displacement, however low abundance recorded during site-specific surveys. **Screened OUT**

Displacement matrices are presented for each of the four species screened into the assessment (gannet, great northern diver, guillemot, and razorbill) including data on different species' behaviours. For great northern diver, Manx shearwater, guillemot and razorbill, only "sitting" birds (which includes birds observed diving, landing and taking off) were included from the site-specific survey data in the displacement analysis as it is representative of their foraging use of the site, with the behaviour of these species being predominately from the water's surface. For gannet all behaviours (flying and sitting) were included for displacement assessment as both sitting and flying birds may be actively foraging in the area.

Following the SNCB (2022) guidance, displacement assessment is based on bio-season mean peak abundances. The peak abundance within a bio-season is the highest recorded abundance from surveys within a single bio-season. Mean peak abundance is the mean of peak abundances for each bio-season across a number of years.

Gannet

The worst-case scenario for gannet is that displacement will occur at a constant level 2 km from the offshore wind farm area. Following recommended guidance, a displacement rate of 60 – 80 % and a mortality rate of 1 % are applicable (SNCB, 2022).

Gannet scores low for vulnerability to displacement, however literature suggests that they may exhibit strong macro avoidance (Cook *et al.,* 2014, Rehfisch *et al*., 2014 Humphreys *et al.,* 2015, Dierschke *et al*., 2016 and Weckler *et al.,* 2016), with studies demonstrating between 60 % and 80 % avoidance rates of offshore wind farms. A mortality rate of 1 % has been used for the assessment as gannet are able to utilise a wide range of habitat types and food sources and can range over a large area away from breeding colonies and during migration periods.

The displacement matrices in Table 11-23 to Table 11-26 have been populated with data for gannet during the breeding season (April – August), return migration (December – March) and autumn migration (September – November) bio-seasons based on surveys undertaken between May 2018 and September 2020. The tables present displacement from 0 to 100% at 10% increments and mortality from 0 to 100% at 1% increments 10% and 10% thereafter. Shading has been used to highlight the displacement and mortality ranges described in this section.

Magnitude of impact – breeding season

For the estimate derived from boat-based surveys, using the breeding seasonal mean peak in the offshore wind farm area plus 2 km buffer of 246 individuals, the estimated number of gannet which could be at risk of mortality from displacement is one to two birds (60 – 80 % displacement, 1% mortality) (Table 11-23).

For the estimate derived from aerial digital surveys, using the breeding seasonal peak in the offshore wind farm area plus 2 km buffer of 149 individuals, the estimated number of gannet which could be at risk of mortality from displacement is one bird (60 – 80 % displacement, 1% mortality) (Table 11-24).

Table 11-23: Boat-based displacement matrix presenting the mean peak number of gannet in the offshore wind farm area plus 2 km buffer, during the breeding season.

Displacement (%)	Mortality rates (%)															
	0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	1	1	1	1	2	2	2	2
10	0	0	0	1	1	1	2	5	7	10	12	15	17	20	22	25
20	0	0	1	1	2	2	5	10	15	20	25	29	34	39	44	49
30	0	1	1	2	3	4	7	15	22	29	37	44	52	59	66	74
40	0	1	2	3	4	5	10	20	29	39	49	59	69	79	88	98
50	0	1	2	4	5	6	12	25	37	49	61	74	86	98	110	123
60	0	1	3	4	6	7	15	29	44	59	74	88	103	118	133	147
70	0	2	3	5	7	9	17	34	52	69	86	103	120	137	155	172
80	0	2	4	6	8	10	20	39	59	79	98	118	137	157	177	196
90	0	2	4	7	9	11	22	44	66	88	110	133	155	177	199	221
100	0	2	5	7	10	12	25	49	74	98	123	147	172	196	221	246

Table 11-24: Aerial digital displacement matrix presenting the peak number of gannet in the offshore wind farm area plus 2 km buffer, during the breeding season.

Displacement (%)	Mortality rates (%)															
	0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
10	0	0	0	0	1	1	1	3	4	6	7	9	10	12	13	15
20	0	0	1	1	1	1	3	6	9	12	15	18	21	24	27	30
30	0	0	1	1	2	2	4	9	13	18	22	27	31	36	40	45
40	0	1	1	2	2	3	6	12	18	24	30	36	42	48	54	60
50	0	1	1	2	3	4	7	15	22	30	37	45	52	60	67	75
60	0	1	2	3	4	4	9	18	27	36	45	54	63	72	80	89
70	0	1	2	3	4	5	10	21	31	42	52	63	73	83	94	104
80	0	1	2	4	5	6	12	24	36	48	60	72	83	95	107	119
90	0	1	3	4	5	7	13	27	40	54	67	80	94	107	121	134
100	0	1	3	4	6	7	15	30	45	60	75	89	104	119	134	149

The breeding population of gannet within mean maximum foraging range plus one SD (509.4 km) of the offshore wind farm area was estimated to be 153,897 breeding adults (SMP, 2022 and Burnell *et al.*, 2023). There are both SPA and non-SPA breeding colonies within the mean max foraging range. Within the population present within the impacted area during the breeding season there are immatures in addition to the adults. Horswill and Robinson (2015) estimated that for every adult there is 0.761 juveniles in the breeding season population, therefore the breeding season population within the mean maximum foraging range of the Project is 265,730 birds.

Using the published figures provided above and the baseline mortality rate (all age class mortality rate of 0.181; see Table 11-12) during the breeding season an estimated 48,097 gannet would die naturally. The additional mortality of one or two birds during the breeding season as a result of disturbance and displacement is of negligible magnitude (<0.1 % increase in mortality), which would be undetectable in the populations.

The impact of disturbance and displacement caused by operational and maintenance activities during the breeding season is predicted to be of local spatial extent, long term duration, continuous and reversible. It is predicted that the impact will affect the receptor both directly and indirectly, however with between one and two individuals estimated to be at risk of mortality during the breeding season, this impact will be undetectable at a population level. The magnitude is therefore considered to be negligible.

Sensitivity of gannets

Gannet demonstrate strong avoidance of wind farms (Rehfisch *et al*., 2014 and Dierschke *et al*., 2016). In terms of behavioural response to wind farm structures, gannet are considered to be of high vulnerability, with a score of four out of five assigned by Wade *et al*. (2016). During the breeding season, northern gannet showed a strong avoidance of offshore wind farms (Peschko *et al*., 2021).

Gannet are considered to have an international (high) conservation value as those individuals present within the wind farm array area are likely to form part of the breeding colonies of SPA populations (see Table 11-18). These SPAs are designated for their breeding populations of gannet and fall within the mean maximum foraging range plus one SD from the offshore wind farm area.

Although northern gannet has a low reproductive success (only laying one egg) and does not breed until five years old (Robinson, 2005), the species is deemed to have a medium recoverability given the consistent increasing trend in abundance in Ireland and the UK (Cummins *et al*., 2019 and JNCC, 2021). However, the species has suffered from the outbreak of avian flu during the 2022 breeding season. The consequences of this will not be known for several seasons, when breeding birds return to colonies.

Gannet are deemed to be of high vulnerability, medium recoverability and high conservation value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect – breeding season

Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of gannets is considered to be high. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Magnitude of impact – spring migration

For the boat-based estimate, using the spring migration seasonal mean peak in the offshore wind farm area plus 2 km buffer of 43 individuals, the estimated number of gannet which could be at risk of mortality from displacement is zero birds (60 – 80 % displacement, 1 % mortality) (Table 11-25).

Table 11-25: Boat-based displacement matrix presenting the mean peak number of gannet in the offshore wind farm area plus 2 km buffer, during the spring migration season.

Displacement (%)	Mortality rates (%)															
	0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	1	1	2	2	3	3	3	4	4
20	0	0	0	0	0	0	1	2	3	3	4	5	6	7	8	9
30	0	0	0	0	1	1	1	3	4	5	6	8	9	10	11	13
40	0	0	0	1	1	1	2	3	5	7	9	10	12	14	15	17
50	0	0	0	1	1	1	2	4	6	9	11	13	15	17	19	21
60	0	0	1	1	1	1	3	5	8	10	13	15	18	20	23	26
70	0	0	1	1	1	1	3	6	9	12	15	18	21	24	27	30
80	0	0	1	1	1	2	3	7	10	14	17	20	24	27	31	34
90	0	0	1	1	2	2	4	8	11	15	19	23	27	31	34	38
100	0	0	1	1	2	2	4	9	13	17	21	26	30	34	38	43

The impact of disturbance and displacement caused by operational and maintenance activities during the spring migration period is predicted to be of local spatial extent, long term duration, intermittent and medium reversibility. It is therefore predicted that the impact will affect the receptor both directly and indirectly. However, there is not predicted to be any additional mortality in the population during the spring migration period. The magnitude is therefore considered to be negligible.

Sensitivity of gannets

As detailed above as part of the breeding season assessment gannet are deemed to be of high vulnerability, medium recoverability and high conservation value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect – spring migration

Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of gannets is considered to be high. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Magnitude of impact – autumn migration

For the boat-based estimate, using the autumn migration seasonal peak in the offshore wind farm area plus 2 km buffer of 336 individuals, the estimated number of gannet which could be at risk of mortality from displacement is two to three birds (60 – 80 % displacement, 1 % mortality) (Table 11-26).

Table 11-26: Boat-based displacement matrix presenting the peak number of gannet in the offshore wind farm area plus 2 km buffer, during the autumn migration season.

Displacement (%)	Mortality rates (%)															
	0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1	1	1	2	2	2	3	3	3
10	0	0	1	1	1	2	3	7	10	13	17	20	24	27	30	34
20	0	1	1	2	3	3	7	13	20	27	34	40	47	54	60	67
30	0	1	2	3	4	5	10	20	30	40	50	60	71	81	91	101
40	0	1	3	4	5	7	13	27	40	54	67	81	94	108	121	134
50	0	2	3	5	7	8	17	34	50	67	84	101	118	134	151	168
60	0	2	4	6	8	10	20	40	60	81	101	121	141	161	181	202
70	0	2	5	7	9	12	24	47	71	94	118	141	165	188	212	235
80	0	3	5	8	11	13	27	54	81	108	134	161	188	215	242	269
90	0	3	6	9	12	15	30	60	91	121	151	181	212	242	272	302
100	0	3	7	10	13	17	34	67	101	134	168	202	235	269	302	336

The autumn migration population of gannet was estimated to be 536,005 individuals (adapted from Furness, 2015). Using the published figures provided above and the baseline mortality rate (all age class mortality rate of 0.181; see Table 11-12) an estimated 97,017 birds would die naturally. The additional mortality of up three birds as a result of disturbance and displacement is of negligible magnitude (<0.1 % increase in mortality), which would be undetectable in the populations.

The impact of disturbance and displacement caused by operational and maintenance activities during the autumn migration period is predicted to be of local spatial extent, long term duration, intermittent and medium reversibility. It is therefore predicted that the impact will affect the receptor both directly and indirectly, however the two or three individuals estimated to be at risk of mortality during the autumn migration period would be undetectable at a population level. The magnitude is therefore considered to be negligible.

Sensitivity of gannets

As detailed above as part of the breeding season assessment gannet are deemed to be of high vulnerability, medium recoverability and high conservation value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect – autumn migration

Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of gannets is considered to be high. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Great northern diver

Following the guidance presented by the SNCB (2022), this assessment presents displacement matrices for great northern diver within the offshore wind farm area and a 4 km buffer, with a displacement rate of 90-100%. A value of 1 % mortality has been used in assessing the number of individuals that could be at risk of mortality as a result of disturbance and displacement during the operational phase, reflecting the absence of constraint to specific locations by non-breeding birds and that Topping and Petersen (2011) found no evidence for population effect in the related species, red-throated diver. Furthermore, great northern diver may have a stronger tolerance to disturbance compared to other diver species (e.g. red-throated and black-throated) (Gittings *et al*., 2015), although the literature on this subject is sparse.

The displacement matrices in Tables Table 11-27 and Table 11-28 have been populated with data for great northern diver during the non-breeding season (September – May) for the boat-based and DAS. The tables present displacement from 0 to 100 % at 10 % increments and mortality from 0 to 100 % at 1 % increments

10 % and 10 % thereafter. Shading has been used to highlight the displacement and mortality ranges described in this section.

Magnitude of impact – non-breeding season

During the non-breeding season (September – May) a high mean peak abundance of 281 (boat-based survey estimate) and 412 individuals (DAS estimate) were estimated within the Offshore Ornithology Study Area and offshore wind farm area plus a 4 km buffer, respectively, during the site-specific surveys. This results in estimated additional mortality in the non-breeding population of between two and four birds (Table 11-27 and Table 11-28).

Table 11-27: Boat-based displacement matrix presenting the mean peak number of great northern divers in the offshore ornithology Study Area, during the non-breeding season.

	Mortality rates (%)															
Displacement (%)	0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0.0	0.1	0.1	0.1	0.1	0.3	0.6	0.8	1.1	1.4	1.7	2.0	2.2	2.5	2.8
10	0	0.3	0.6	0.8	1.1	1.4	2.8	5.6	8.4	11.2	14.1	16.9	19.7	22.5	25.3	28.1
20	0	0.6	1.1	1.7	2.2	2.8	5.6	11.2	16.9	22.5	28.1	33.7	39.3	45.0	50.6	56.2
30	0	0.8	1.7	2.5	3.4	4.2	8.4	16.9	25.3	33.7	42.2	50.6	59.0	67.4	75.9	84.3
40	0	1.1	2.2	3.4	4.5	5.6	11.2	22.5	33.7	45.0	56.2	67.4	78.7	89.9	101.2	112.4
50	0	1.4	2.8	4.2	5.6	7.0	14.1	28.1	42.2	56.2	70.3	84.3	98.4	112.4	126.5	140.5
60	0	1.7	3.4	5.1	6.7	8.4	16.9	33.7	50.6	67.4	84.3	101.2	118.0	134.9	151.7	168.6
70	0	2.0	3.9	5.9	7.9	9.8	19.7	39.3	59.0	78.7	98.4	118.0	137.7	157.4	177.0	196.7
80	0	2.2	4.5	6.7	9.0	11.2	22.5	45.0	67.4	89.9	112.4	134.9	157.4	179.8	202.3	224.8
90	0	2.5	5.1	7.6	10.1	12.6	25.3	50.6	75.9	101.2	126.5	151.7	177.0	202.3	227.6	252.9
100	0	2.8	5.6	8.4	11.2	14.1	28.1	56.2	84.3	112.4	140.5	168.6	196.7	224.8	252.9	281.0

Table 11-28: Digital aerial displacement matrix presenting the peak number of great northern divers in the offshore wind farm area plus 4 km buffer, during the non-breeding season.

	Mortality rates (%)															
Displacement (%)	0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0.0	0.1	0.1	0.2	0.2	0.4	0.8	1.2	1.6	2.1	2.5	2.9	3.3	3.7	4.1
10	0	0.4	0.8	1.2	1.6	2.1	4.1	8.2	12.4	16.5	20.6	24.7	28.8	33.0	37.1	41.2
20	0	0.8	1.6	2.5	3.3	4.1	8.2	16.5	24.7	33.0	41.2	49.4	57.7	65.9	74.2	82.4
30	0	1.2	2.5	3.7	4.9	6.2	12.4	24.7	37.1	49.4	61.8	74.2	86.5	98.9	111.2	123.6
40	0	1.6	3.3	4.9	6.6	8.2	16.5	33.0	49.4	65.9	82.4	98.9	115.4	131.8	148.3	164.8
50	0	2.1	4.1	6.2	8.2	10.3	20.6	41.2	61.8	82.4	103.0	123.6	144.2	164.8	185.4	206.0
60	0	2.5	4.9	7.4	9.9	12.4	24.7	49.4	74.2	98.9	123.6	148.3	173.0	197.8	222.5	247.2
70	0	2.9	5.8	8.7	11.5	14.4	28.8	57.7	86.5	115.4	144.2	173.0	201.9	230.7	259.6	288.4
80	0	3.3	6.6	9.9	13.2	16.5	33.0	65.9	98.9	131.8	164.8	197.8	230.7	263.7	296.6	329.6
90	0	3.7	7.4	11.1	14.8	18.5	37.1	74.2	111.2	148.3	185.4	222.5	259.6	296.6	333.7	370.8
100	0	4.1	8.2	12.4	16.5	20.6	41.2	82.4	123.6	164.8	206.0	247.2	288.4	329.6	370.8	412.0

Burke *et al.* (2018) estimated a non-breeding population of 2,128 for Ireland and given that the peak-mean population estimate for the area within 4 km of the offshore wind farm area was 309 to 412 individuals, it is reasonable to assess the impact against the Irish population estimate of 2,128 individuals in the non-breeding season. Approximate background mortality at a rate of 0.161 gives a background annual mortality of 343 birds (see Table 11-12). Additional mortality of between 2.5 and 4.1 birds during the non-breeding season would increase annual mortality by 0.72 to 1.20 % when considering the boat-based density or DAS density estimate. However, this approach is very highly precautionary, considering that all birds within the area 4 km from the offshore wind farm area are displaced. It is more realistic to consider that there may be high displacement rate in areas closer to the offshore wind farm area with less displacement as distance increases. For example, if there was 100 % displacement within the area 2 km from the offshore wind farm area and 50 % displacement between 2 – 4 km from the offshore wind farm area the overall impact would be less. When considering this, the impact would be reduced to 2.0 birds is using the boat-based density estimate and 3.2 for the DAS density estimate. Which would represent a 0.93% increase in baseline mortality.

The impact of disturbance and displacement caused by operational and maintenance activities during the non-breeding season is predicted to be of local spatial extent, long term duration, continuous and medium reversibility and any increases in mortality associated with operational and maintenance activities are unlikely to significantly affect the population. It is predicted that the impact will affect the receptor both directly and indirectly. The magnitude is considered to be low.

Sensitivity of great northern divers

Divers are generally regarded as being highly sensitive to disturbance and displacement, showing a very high flush distance (i.e. the linear distance from an observer vessel to the birds at the moment of take-off from the water) and are likely to avoid disturbed areas (Garthe *et al*., 1994; Furness *et al*., 2012; and Bradbury *et al.*, 2014). Furthermore, the guidance for undertaking ESAS surveys refer to the need to scan the sea area ahead of the ship “to detect the take-off of usually very wary seaduck and divers well ahead of the approaching platform” (Camphuysen *et al.*, 2004 and Gittings *et al.,* 2015).

In order to quantify the responses of great northern divers to increased marine traffic, Gittings *et al*. (2015) undertook a study on the great northern diver population in Inner Galway Bay. The study indicated that great northern divers in the area around the existing harbour did not show any significant response to normal ship and boat traffic, however they do exhibit a flush response when driven at directly in a rigid inflatable boat at speeds of 20 to 30 knots (Gittings *et al*., 2015). The study conflicted with the general perception about disturbance sensitivity in diver species and remained inconclusive.

Due to the Project’s connectivity with nearby designated SPA sites, great northern diver are considered to have an international (high) conservation value as those individuals present within the offshore wind farm area are likely to form part of the wintering population of the nearby SPA populations (see Table 11-18).

Assuming an unlikely worst-case scenario of total displacement and 1% resulting mortality, great northern divers are deemed to be of high vulnerability and high conservation value. The sensitivity of the receptor is therefore, considered to be high.

Significance of the effect – non-breeding season

Overall, the magnitude of the impact is deemed to be low and the sensitivity of great northern diver are considered to be high. The effect will therefore be of **slight adverse significance.**

Guillemot

The worst-case scenario for guillemot are that displacement will occur at a constant level within 2 km of the offshore wind farm area, of which between 30 and 70 % of birds will be displaced, leading to a mortality rate of between 1 and 5 % (JNCC, 2022).

Several studies, such as those by Peterson *et al*. (2006) and Dierschke *et al*. (2006) indicated a level of displacement on guillemot in offshore wind farms that would suggest high sensitivity to disturbance during the operational and maintenance phase of the Project. However, more recent studies undertaken at other offshore wind farm sites have not shown the same level of effect. For example, Dierschke *et al.* (2016) suggested that auk displacement is only partial and negligible at some sites, and studies undertaken at Dutch wind farms have reported displacement effects of less than 50 % (Leopold *et al.*, 2011). At the Robin Rigg offshore wind farm, located in the Irish Sea, the number of guillemot observed during all three phases of development remained comparable, providing no evidence of guillemot displacement (Vallejo *et al.*, 2017).

The displacement matrices in Table 11-29 to Table 11-32 have been populated with data for guillemot during the breeding (March – July) and non-breeding seasons (August – February) for the boat-based and aerial digital surveys. The tables present displacement from 0 to 100% at 10% increments and mortality from 0 to 100% at 1% increments 10% and 10% thereafter. Shading has been used to highlight the displacement and mortality ranges described in this section.

Magnitude of impact – breeding season

For the boat-based estimate, using the breeding seasonal mean peak in the offshore wind farm area and a 2 km buffer of 820 individuals, the estimated number of guillemot which could be at risk of mortality from displacement is between 2 and 29 birds (Table 11-29).

For the aerial digital survey estimate, using the breeding seasonal peak in the offshore wind farm area and a 2 km buffer of 1,594 individuals, the estimated number of guillemot which could be at risk of mortality from displacement is between 5 and 56 birds (Table 11-30).

Table 11-29: Boat-based displacement matrix presenting the mean peak number of guillemot in the offshore wind farm area plus 2 km buffer, during the breeding season.

Displacement (%)	Mortality rates (%)															
	0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	1	2	2	3	4	5	6	7	7	8
10	0	1	2	2	3	4	8	16	25	33	41	49	57	66	74	82
20	0	2	3	5	7	8	16	33	49	66	82	98	115	131	148	164
30	0	2	5	7	10	12	25	49	74	98	123	148	172	197	221	246
40	0	3	7	10	13	16	33	66	98	131	164	197	230	262	295	328
50	0	4	8	12	16	21	41	82	123	164	205	246	287	328	369	410
60	0	5	10	15	20	25	49	98	148	197	246	295	344	394	443	492
70	0	6	11	17	23	29	57	115	172	230	287	344	402	459	517	574
80	0	7	13	20	26	33	66	131	197	262	328	394	459	525	590	656
90	0	7	15	22	30	37	74	148	221	295	369	443	517	590	664	738
100	0	8	16	25	33	41	82	164	246	328	410	492	574	656	738	820

Table 11-30: Aerial digital displacement matrix presenting the peak number of guillemot in the offshore wind farm area plus 2 km buffer, during the breeding season.

Displacement (%)	Mortality rates (%)															
	0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	1	1	2	3	5	6	8	10	11	13	14	16
10	0	2	3	5	6	8	16	32	48	64	80	96	112	128	143	159
20	0	3	6	10	13	16	32	64	96	128	159	191	223	255	287	319
30	0	5	10	14	19	24	48	96	143	191	239	287	335	383	430	478
40	0	6	13	19	26	32	64	128	191	255	319	383	446	510	574	638
50	0	8	16	24	32	40	80	159	239	319	398	478	558	638	717	797
60	0	10	19	29	38	48	96	191	287	383	478	574	669	765	861	956
70	0	11	22	33	45	56	112	223	335	446	558	669	781	893	1,004	1,116
80	0	13	26	38	51	64	128	255	383	510	638	765	893	1,020	1,148	1,275
90	0	14	29	43	57	72	143	287	430	574	717	861	1,004	1,148	1,291	1,434
100	0	16	32	48	64	80	159	319	478	638	797	956	1,116	1,275	1,434	1,594

The breeding population of guillemot within mean maximum foraging range plus one SD (153.7 km) of the offshore wind farm area was estimated to be 351,632 breeding adults (Cummins *et al.*, 2019, SMP, 2022 and Burnell *et al.*, 2023). There are both SPA and non-SPA breeding colonies within the mean max foraging range. Within the population present within the impacted area during the breeding season there are immatures in addition to the adults. Horswill and Robinson (2015) estimated that for every adult there is 0.916 juveniles in the breeding season population, therefore the breeding season population within the mean maximum foraging range of the Project is 673,727 birds.

Using the published figures provided above and the baseline mortality rate (average mortality rate of 0.198; see Table 11-12) an estimated 133,398 birds die naturally each year. The additional mortality of 56 birds during the breeding season as a result of disturbance and displacement is of negligible magnitude (0.04 % increase in mortality), which would be undetectable in the populations.

The impact of disturbance and displacement caused by operational and maintenance activities during the breeding season is predicted to be of local spatial extent, long term duration, continuous and medium reversibility. It is predicted that the impact will affect the receptor both directly and indirectly. The magnitude is therefore considered to be negligible.

Sensitivity of guillemot

Guillemot are considered to have high vulnerability to disturbance and displacement effects in relation to operational offshore wind farms (Garthe *et al.,* 2004, Furness *et al*., 2012 and 2013, Dierschke *et al*., 2016 and Wade *et al*., 2016).

Although the species has a low reproductive success (Robinson, 2005), guillemot have a medium recoverability given their increasing trend in abundance and productivity in Ireland and the UK (Cummins *et al*., 2019 and JNCC, 2021).

Guillemot are considered to have an international (high) conservation value, as those individuals present within the offshore wind farm area are likely to form part of the breeding colonies of nearby SPA populations (see Table 11-18). These SPAs are designated for their guillemot breeding populations and fall within the mean maximum foraging range plus one SD from the offshore wind farm area.

Guillemot are deemed to be of high vulnerability, medium recoverability and high conservation value. The sensitivity of the receptor is therefore, considered to be high.

Significance of the effect – breeding season

Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of guillemot are considered to be high. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Magnitude of impact – non-breeding season

For the boat-based estimate, using the non-breeding seasonal mean peak in the offshore wind farm area plus 2 km buffer of 2,670 individuals, the estimated number of guillemot which could be at risk of mortality from displacement is between 8 and 93 birds (Table 11-31).

For the aerial digital survey estimate, using the breeding seasonal peak in the offshore wind farm area plus 2 km buffer of 4,938 individuals, the estimated number of guillemot which could be at risk of mortality from displacement is between 15 and 173 birds (Table 11-32).

Table 11-31: Boat-based displacement matrix presenting the mean peak number of guillemot in the offshore wind farm area plus 2 km buffer, during the non-breeding season.

Displacement (%)	Mortality rates (%)															
	0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	1	1	1	1	3	5	8	11	13	16	19	21	24	27
10	0	3	5	8	11	13	27	53	80	107	133	160	187	214	240	267
20	0	5	11	16	21	27	53	107	160	214	267	320	374	427	481	534
30	0	8	16	24	32	40	80	160	240	320	400	481	561	641	721	801
40	0	11	21	32	43	53	107	214	320	427	534	641	747	854	961	1,068
50	0	13	27	40	53	67	133	267	400	534	667	801	934	1,068	1,201	1,335
60	0	16	32	48	64	80	160	320	481	641	801	961	1,121	1,281	1,442	1,602
70	0	19	37	56	75	93	187	374	561	747	934	1,121	1,308	1,495	1,682	1,869
80	0	21	43	64	85	107	214	427	641	854	1,068	1,281	1,495	1,708	1,922	2,136
90	0	24	48	72	96	120	240	481	721	961	1,201	1,442	1,682	1,922	2,162	2,403
100	0	27	53	80	107	133	267	534	801	1,068	1,335	1,602	1,869	2,136	2,403	2,670

Table 11-32: Aerial digital displacement matrix presenting the peak number of guillemot in the offshore wind farm area plus 2 km buffer, during the non-breeding season.

Displacement (%)	Mortality rates (%)															
		0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	0	0	1	1	2	2	5	10	15	20	25	30	35	40	44	49
	10	0	5	10	15	20	25	49	99	148	198	247	296	346	395	444	494
	20	0	10	20	30	40	49	99	198	296	395	494	593	691	790	889	988
	30	0	15	30	44	59	74	148	296	444	593	741	889	1,037	1,185	1,333	1,482
	40	0	20	40	59	79	99	198	395	593	790	988	1,185	1,383	1,580	1,778	1,975
	50	0	25	49	74	99	123	247	494	741	988	1,235	1,482	1,728	1,975	2,222	2,469
	60	0	30	59	89	119	148	296	593	889	1,185	1,482	1,778	2,074	2,370	2,667	2,963
	70	0	35	69	104	138	173	346	691	1,037	1,383	1,728	2,074	2,420	2,766	3,111	3,457
	80	0	40	79	119	158	198	395	790	1,185	1,580	1,975	2,370	2,766	3,161	3,556	3,951
	90	0	44	89	133	178	222	444	889	1,333	1,778	2,222	2,667	3,111	3,556	4,000	4,445
	100	0	49	99	148	198	247	494	988	1,482	1,975	2,469	2,963	3,457	3,951	4,445	4,938

The non-breeding (August – February) regional BDMPS (Irish Sea) for guillemot was estimated to be 1,567,398 individuals. Using the average baseline mortality rate for guillemot (all age class mortality rate of 0.198; see Table 11-12), the baseline mortality during the non-breeding season is 310,345 birds. The additional mortality of between eight and 173 individuals represents a 0.06 % increase in baseline mortality and would therefore be undetectable at a population level.

The impact of disturbance and displacement caused by operational and maintenance activities during the non-breeding season is predicted to be of local spatial extent, long term duration, continuous and medium reversibility. It is predicted that the impact will affect the receptor both directly and indirectly. The magnitude is therefore considered to be negligible.

Sensitivity of guillemot

As detailed above as part of the breeding season assessment guillemot are deemed to be of high vulnerability, medium recoverability and high conservation value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect – non-breeding season

Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of guillemot are considered to be high. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Razorbill

The worst-case scenario for razorbill are that displacement will occur at a constant level within 2 km of the offshore wind farm area, of which between 30 and 70 % of birds will be displaced, with a mortality rate of between 1% and 5 % (JNCC, 2012).

As with guillemot, the literature has documented various responses of razorbill to operational offshore wind farms, with some studies showing complete displacement from within the offshore wind farm area (Peterson *et al*., 2016 and Dierschke *et al*., 2016), whereas others have shown no evidence of displacement (Vallejo *et al*., 2017).

The displacement matrices in Table 11-33 to Table 11-38 have been populated with data for razorbill during the breeding season (April – July), spring and autumn migration (January – March and August – October) and winter (November – December) periods. The tables present displacement from 0 to 100% at 10%

increments and mortality from 0 to 100% at 1% increments 10% and 10% thereafter. Shading has been used to highlight the displacement and mortality ranges described in this section.

Magnitude of impact – breeding season

For the boat-based estimate, using the breeding seasonal mean peak in the offshore wind farm area and a 2 km buffer of 12 individuals, the estimated number of razorbill which could be at risk of mortality from displacement is between zero birds (Table 11-33).

For the aerial digital survey estimate, using the breeding seasonal peak in the offshore wind farm area and a 2 km buffer of 353 individuals, the estimated number of razorbill which could be at risk of mortality from displacement is between 1 and 12 birds (Table 11-34).

Table 11-33: Boat-based displacement matrix presenting the mean peak number of razorbill in the offshore wind farm area plus 2 km buffer, during the breeding season.

	Mortality rates (%)															
Displacement (%)	0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
20	0	0	0	0	0	0	0	0	1	1	1	1	2	2	2	2
30	0	0	0	0	0	0	0	1	1	1	2	2	3	3	3	4
40	0	0	0	0	0	0	0	1	1	2	2	3	3	4	4	5
50	0	0	0	0	0	0	1	1	2	2	3	4	4	5	5	6
60	0	0	0	0	0	0	1	1	2	3	4	4	5	6	6	7
70	0	0	0	0	0	0	1	2	3	3	4	5	6	7	8	8
80	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10
90	0	0	0	0	0	1	1	2	3	4	5	6	8	9	10	11
100	0	0	0	0	0	1	1	2	4	5	6	7	8	10	11	12

Table 11-34: Aerial digital displacement matrix presenting the peak number of razorbill in the offshore wind farm area plus 2 km buffer, during the breeding season

	Mortality rates (%)															
Displacement (%)	0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1	1	1	2	2	2	3	3	4
10	0	0	1	1	1	2	4	7	11	14	18	21	25	28	32	35
20	0	1	1	2	3	4	7	14	21	28	35	42	49	56	63	71
30	0	1	2	3	4	5	11	21	32	42	53	63	74	85	95	106
40	0	1	3	4	6	7	14	28	42	56	71	85	99	113	127	141
50	0	2	4	5	7	9	18	35	53	71	88	106	123	141	159	176
60	0	2	4	6	8	11	21	42	63	85	106	127	148	169	190	212
70	0	2	5	7	10	12	25	49	74	99	123	148	173	198	222	247
80	0	3	6	8	11	14	28	56	85	113	141	169	198	226	254	282
90	0	3	6	10	13	16	32	63	95	127	159	190	222	254	286	317
100	0	4	7	11	14	18	35	71	106	141	176	212	247	282	317	353

The breeding population of razorbill at breeding colonies within mean maximum foraging range plus one SD (164.6 km) of the offshore wind farm area was estimated to be 55,886 breeding adults (Cummins *et al.*, 2019, SMP, 2022 and Burnell *et al.*, 2023). There are both SPA and non-SPA breeding colonies within the mean max foraging range. Within the population present within the impacted area during the breeding season there are immatures in addition to the adults. Horswill and Robinson (2015) estimated that for every adult there is 0.876 juveniles in the breeding season population, therefore the breeding season population within the mean maximum foraging range of the Project is 104,842 birds.

Using the published figures provided above and the baseline mortality rate (average mortality rate of 0.129; see Table 11-12), the mortality during the breeding season is estimated to be 13,525 birds. The additional mortality of 12 birds during the breeding season as a result of disturbance and displacement is a 0.09% increase in baseline mortality, which is considered of negligible magnitude. The impact of disturbance and displacement caused by operational and maintenance activities during the breeding season is predicted to be of local spatial extent, long term duration, continuous and medium reversibility. It is predicted that the impact will affect the receptor both directly and indirectly. The magnitude is therefore considered to be low.

Sensitivity of razorbill

Similar to guillemot, razorbill are considered to have a high vulnerability to disturbance and displacement, in response to operation and maintenance activities and vessel movements (Garthe *et al.,* 2004, Furness *et al.,* 2012 and 2013 and Bradbury *et al*., 2014), however the effects of construction activity and vessel movements on auk species remain unclear.

Due to the Project's connectivity with nearby designated SPA sites, razorbill are considered to have an international (high) conservation value as those individuals present within the offshore wind farm area are likely to form part of the breeding colonies of nearby SPA populations (see Table 11-18). These SPAs are designated for their razorbill breeding populations and fall within the mean maximum foraging range plus one SD from the offshore wind farm area.

Although the species has a low reproductive success (i.e. laying one egg and not breeding until five years old) (Robinson, 2005), razorbill have a medium recoverability given their increasing trend in abundance and productivity in Ireland and the UK (Cummins *et al*., 2019 and JNCC, 2021).

Razorbill are deemed to be of high vulnerability, medium recoverability and high conservation value. The sensitivity of the receptor is therefore, considered to be high.

Significance of the effect – breeding season

Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of razorbill are considered to be high. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Magnitude of impact – migration seasons

For the boat-based estimate, using the spring migration seasonal peak in the offshore wind farm area and a 2 km buffer of 859 individuals, the estimated number of razorbill which could be at risk of mortality from displacement is between three and 30 birds (Table 11-35).

Table 11-35: Boat-based displacement matrix presenting the peak number of razorbill in the offshore wind farm area plus 2 km buffer, during the spring migration period.

Displacement (%)	Mortality rates (%)															
	0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	1	2	3	3	4	5	6	7	8	9
10	0	1	2	3	3	4	9	17	26	34	43	52	60	69	77	86
20	0	2	3	5	7	9	17	34	52	69	86	103	120	137	155	172
30	0	3	5	8	10	13	26	52	77	103	129	155	180	206	232	258
40	0	3	7	10	14	17	34	69	103	137	172	206	241	275	309	344
50	0	4	9	13	17	21	43	86	129	172	215	258	301	344	387	430
60	0	5	10	15	21	26	52	103	155	206	258	309	361	412	464	515
70	0	6	12	18	24	30	60	120	180	241	301	361	421	481	541	601
80	0	7	14	21	27	34	69	137	206	275	344	412	481	550	618	687
90	0	8	15	23	31	39	77	155	232	309	387	464	541	618	696	773
100	0	9	17	26	34	43	86	172	258	344	430	515	601	687	773	859

For the boat-based estimate, using the autumn migration seasonal mean peak in the offshore wind farm area and a 2 km buffer of 962 individuals, the estimated number of razorbill which could be at risk of mortality from displacement is between three and 34 birds (Table 11-36).

Table 11-36: Boat-based displacement matrix presenting the mean peak number of razorbill in the offshore wind farm area plus 2 km buffer, during the autumn migration period.

Displacement (%)	Mortality rates (%)															
	0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10
10	0	1	2	3	4	5	10	19	29	38	48	58	67	77	87	96
20	0	2	4	6	8	10	19	38	58	77	96	115	135	154	173	192
30	0	3	6	9	12	14	29	58	87	115	144	173	202	231	260	288
40	0	4	8	12	15	19	38	77	115	154	192	231	269	308	346	385
50	0	5	10	14	19	24	48	96	144	192	240	288	337	385	433	481
60	0	6	12	17	23	29	58	115	173	231	288	346	404	462	519	577
70	0	7	13	20	27	34	67	135	202	269	337	404	471	538	606	673
80	0	8	15	23	31	38	77	154	231	308	385	462	538	615	692	769
90	0	9	17	26	35	43	87	173	260	346	433	519	606	692	779	865
100	0	10	19	29	38	48	96	192	288	385	481	577	673	769	865	962

For the aerial digital estimate, using the autumn migration seasonal peak in the offshore wind farm area and a 2 km buffer of 566 individuals, the estimated number of razorbill which could be at risk of mortality from displacement is between two and 20 birds (Table 11-37).

Table 11-37: Digital aerial displacement matrix presenting the peak number of razorbill in the offshore wind farm area plus 2 km buffer, during the autumn migration period.

Displacement (%)	Mortality rates (%)															
	0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	1	1	2	2	3	3	4	5	5	6
10	0	1	1	2	2	3	6	11	17	23	28	34	40	45	51	57
20	0	1	2	3	5	6	11	23	34	45	57	68	79	91	102	113
30	0	2	3	5	7	8	17	34	51	68	85	102	119	136	153	170
40	0	2	5	7	9	11	23	45	68	91	113	136	158	181	204	226
50	0	3	6	8	11	14	28	57	85	113	141	170	198	226	255	283
60	0	3	7	10	14	17	34	68	102	136	170	204	238	272	306	340
70	0	4	8	12	16	20	40	79	119	158	198	238	277	317	356	396
80	0	5	9	14	18	23	45	91	136	181	226	272	317	362	407	453
90	0	5	10	15	20	25	51	102	153	204	255	306	356	407	458	509
100	0	6	11	17	23	28	57	113	170	226	283	340	396	453	509	566

The migration seasons regional BDMPS (Irish Sea) for razorbill was estimated to be 606,914 individuals. Using the average baseline mortality rate for razorbill (all age class mortality rate of 0.129; see Table 11-12), the baseline mortality during the spring and autumn migration period is 78,292. The addition of between two and 34 individuals per season represents a 0.04 % increase in mortality and would therefore be undetectable at a population level.

The impact of disturbance and displacement caused by operational and maintenance activities during the migration seasons is predicted to be of local spatial extent, long term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor both directly and indirectly. The magnitude is therefore considered to be negligible.

Sensitivity of razorbill

As detailed above as part of the breeding season assessment razorbill are deemed to be of high vulnerability, medium recoverability and high conservation value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect – migration seasons

Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of razorbill are considered to be high. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Magnitude of impact – winter season

For the boat-based estimate, using the winter seasonal peak in the offshore wind farm area plus 2 km buffer of 512 individuals, the estimated number of razorbill which could be at risk of mortality from displacement is between two and 18 birds (Table 11-38).

Table 11-38: Boat-based displacement matrix presenting the peak number of razorbill in the offshore wind farm area plus 2 km buffer, during the winter period.

Displacement (%)	Mortality rates (%)															
	0	1	2	3	4	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	1	1	2	2	3	3	4	4	5	5
10	0	1	1	2	2	3	5	10	15	20	26	31	36	41	46	51
20	0	1	2	3	4	5	10	20	31	41	51	61	72	82	92	102
30	0	2	3	5	6	8	15	31	46	61	77	92	108	123	138	154
40	0	2	4	6	8	10	20	41	61	82	102	123	143	164	184	205
50	0	3	5	8	10	13	26	51	77	102	128	154	179	205	230	256
60	0	3	6	9	12	15	31	61	92	123	154	184	215	246	276	307
70	0	4	7	11	14	18	36	72	108	143	179	215	251	287	323	358
80	0	4	8	12	16	20	41	82	123	164	205	246	287	328	369	410
90	0	5	9	14	18	23	46	92	138	184	230	276	323	369	415	461
100	0	5	10	15	20	26	51	102	154	205	256	307	358	410	461	512

The winter season regional BDMPS (Irish Sea) for razorbill was estimated to be 341,422 individuals. Using the average baseline mortality rate for razorbill (all age class mortality rate of 0.129; see Table 11-12), the baseline mortality during the winter period is 44,043 birds. The addition of between two and 18 individuals per season represents a 0.04 % increase in baseline mortality and would therefore be undetectable at a population level.

The impact of disturbance and displacement caused by operational and maintenance activities during the migration seasons is predicted to be of local spatial extent, long term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor both directly and indirectly. The magnitude is therefore considered to be negligible.

Sensitivity of razorbill

As detailed above as part of the breeding season assessment razorbill are deemed to be of high vulnerability, medium recoverability and high conservation value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect – winter season

Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of razorbill are considered to be high. The effect will therefore be of **slight adverse significance,** which is not significant in EIA terms.

Decommissioning phase

Magnitude of impact

The effects of decommissioning activities are not expected to be of greater magnitude to those described above arising from construction. Certain activities such as piling would not be required, as the decommissioning phase would involve the removal of the structures and materials originally installed. As this process would require the opposite to construction activities, it is anticipated that the same number and type of vessels and equipment will be required. These activities have already been assessed in the construction section of this assessment and have been deemed to be of low or negligible magnitude.

The impact is predicted to be of local spatial extent, short term duration, continuous and high reversibility. It is predicted that the impact will affect the receptors directly. The magnitude is therefore considered to be negligible.

Sensitivity of seabirds

As for the construction phase the receptors are deemed to be of medium to high vulnerability, medium to high recoverability and high value. The sensitivity of the receptors is considered to be medium to high.

Significance of the effect

The magnitude of the impact is considered to be negligible and the sensitivity of the receptor species are considered to range between medium to high. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

11.10.2 Indirect displacement resulting from changes to prey and habitats

Potential effects on the fish assemblages during the construction and decommissioning phases of the Project, as identified in chapter 9: Fish and Shellfish Ecology, may have indirect effects on offshore ornithology IEFs. Potential effects resulting from changes to prey and habitats during the operational and maintenance phase have been scoped out of the assessment (see Table 11-5 for justification).

The Fish and Shellfish Ecology assessment (chapter 9) identified whitefish (including whiting and mackerel) and shellfish (including edible cockles, *Nephrops* and queen scallops) as important commercial fisheries in the Fish and Shellfish Ecology Study Area. The area was also identified as an important spawning and nursery ground for a number of whitefish species and a recovery ground for cod. High abundances of cod and plaice eggs recorded from the northwestern Irish Sea and in particular due east of Dundalk Bay were identified (Roden *and* Ludgate*,* 2003). The area is also known as a spawning ground for whiting and herring. Other prey species found in the Fish and Shellfish Ecology Study Area include Atlantic salmon, pollack, mackerel, haddock and European eel.

Construction phase

Seabirds may be indirectly disturbed and displaced during the construction phase as a result of direct impacts on prey species or habitat, which may result in the loss of a food resource to birds in the offshore wind farm area and offshore cable corridor.

As a result, it is possible that birds may be indirectly displaced by changing foraging movements or other behavioural traits, resulting in a loss of demographic fitness, as well as potentially impacting on birds in areas that displaced birds move to.

The potential construction phase impacts on fish and shellfish receptors are provided in chapter 9: Fish and Shellfish Ecology and include temporary subtidal habitat loss/disturbance, injury and/or disturbance to fish from underwater noise during pile driving and increased Suspended Sediment Concentrations (SSC) and associated sediment deposition. The main fish prey considered in the offshore ornithological assessment include herring, sprat and sandeel.

Magnitude of impact

Temporary habitat loss could potentially affect spawning, nursery or feeding grounds of fish and shellfish receptors, with demersal fish and shellfish, and demersal spawning species the most vulnerable. The project design parameters assessed in chapter 9: Fish and Shellfish Ecology represented a very small proportion of the Project. The assessment concluded that temporary loss of habitat was considered unlikely to diminish ecosystem functions for fish and shellfish species, and therefore the overall significance of the effect was deemed to be slight adverse which would have an undetectable indirect impact on seabird species.

In relation to the influence of underwater noise affecting fish and shellfish populations, the assessment (chapter 9: Fish and Shellfish Ecology) reported that proposed piling activities will unlikely result in mortality, but some recoverable injury is possible within approximately 1 km of the piling works, particularly for salmonids, scombridae, gadoids and eels, herring, sprat and shads. Behavioural responses were reported to be more likely for gadoids and eels, herring, sprat and shads within hundreds to thousands of metres from the piling source. The overall significance of the effect was deemed to be slight adverse which would have an undetectable indirect impact on seabird species.

With regards to an increase in SSC, this may lead to a short-term avoidance of affected areas by sensitive fish and shellfish species, although many species are considered to be tolerant of turbid environments and regularly experience changes in the SSC due to the natural variability in the Irish Sea. The assessment concluded that based on the low levels of increased SSC, the localised nature of the impact, and the tolerance of fish and shellfish receptors, the overall significance of the effect was deemed to be imperceptible, which would have an undetectable indirect impact on seabird species.

Therefore, the overall impact for seabird receptors is predicted to be of local spatial extent, short-term duration, intermittent and high reversibility. It is predicted that the impact will affect seabirds indirectly. The magnitude is therefore considered to be negligible.

Sensitivity of seabirds

The vulnerability of bird species to the habitat loss of their prey depends on their foraging flexibility, in particular their specific habitat and dietary requirements. Seabirds with highly specialised habitat requirements, such as seaducks and diver species are more likely to be vulnerable to such effects, compared to auk and gull species (Furness *et al.,* 2013).

Due to the proximity of the offshore wind farm area to land and the connectivity with Irish SPA sites (see Table 11-18), some species are considered to have a higher conservation value, including guillemot, razorbill, gannet and kittiwake.

All seabird species are deemed to be of low to high vulnerability, medium to high recoverability and medium to high value. Therefore, the sensitivity of all seabird receptors is considered to range from low to high.

Significance of the effect

Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of seabird species is considered to range between low to high. The effect will therefore be of **imperceptible or slight adverse significance**, which is not significant in EIA terms.

Operational and maintenance phase

Seabirds may also be indirectly disturbed and displaced during the operational and maintenance phase as a result of direct impacts on prey species or habitat, which may result in the loss of a food resource to birds in the offshore wind farm area. Indirect impacts as a result of the operation of the offshore cable are highly unlikely to occur during this phase.

As a result, it is possible that birds may be indirectly displaced by changing foraging movements or other behavioural traits, resulting in a loss of demographic fitness, as well as potentially impacting on birds in areas that displaced birds move to.

The potential operational and maintenance phase impacts on fish and shellfish receptors are provided in chapter 9: Fish and Shellfish Ecology. Those of more than negligible magnitude include long-term subtidal habitat loss, increased suspended sediment concentrations and associated sediment deposition and Electromagnetic Fields (EMF) from subsea electrical cabling. The main fish prey considered in the offshore ornithological assessment include herring, sprat and sandeel.

Magnitude of impact

Habitat loss could potentially affect spawning, nursery or feeding grounds of fish and shellfish receptors, with demersal fish and shellfish, and demersal spawning species the most vulnerable. The project design parameters assessed in chapter 9: Fish and Shellfish Ecology represented a very small proportion of the offshore wind farm area and offshore cable corridor. The assessment concluded that temporary loss of habitat was predicted to be of highly localised spatial extent and reversible and therefore the overall significance of the effect was deemed to be imperceptible to slight adverse which would have an undetectable indirect impact on seabird species.

With regards to an increase in SSC, this may lead to avoidance of affected areas by sensitive fish and shellfish species, although many species are considered to be tolerant of turbid environments and regularly experience changes in the SSC due to the natural variability in the Irish Sea. The assessment (chapter 9:

Fish and Shellfish Ecology) concluded that based on the low levels of increased SSC, the localised nature of the impact, and the tolerance of fish and shellfish receptors, the overall significance of the effect was deemed to be imperceptible adverse, which would have an undetectable indirect impact on seabird species.

Localised EMF may result from the presence and operation of inter-array cables and offshore cable which could potentially affect the sensory mechanisms of some species of fish and shellfish. Based on the localised nature of the impact (metres from the cables), the rapid decay of EMF and the ability of receptors to detect and therefore avoid EMF, the assessment in chapter 9: Fish and Shellfish Ecology concluded the overall significance of the effect to be imperceptible adverse, which would have an undetectable indirect impact on seabird species.

Therefore, the overall impact for seabird receptors is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect seabirds indirectly. The magnitude is considered to be negligible.

Sensitivity of seabirds

The vulnerability of bird species to the habitat loss of their prey depends on their foraging flexibility, in particular their specific habitat and dietary requirements. Seabirds with highly specialised habitat requirements, such as seaducks and diver species are more likely to be vulnerable to such effects, compared to auk and gull species (Furness *et al.,* 2013).

Due to the proximity of the offshore wind farm area to land and the connectivity with Irish SPA sites (see Table 11-18), some species are considered to have a higher conservation value, including guillemot, razorbill, gannet and kittiwake.

All seabird species are deemed to be of low to high vulnerability, medium to high recoverability and medium to high value. Therefore, the sensitivity of all seabird receptors is considered to range from low to high.

Significance of the effect

Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of seabird species is considered to range between low to high. The effect will therefore be of **imperceptible or slight adverse significance**, which is not significant in EIA terms.

Decommissioning phase

The effects of decommissioning activities are expected to be the same as, but not greater than, the effects from construction. The significance of the effect is therefore **imperceptible or slight adverse significance**, which is not significant in EIA terms.

11.10.3 Collision risk

During the operational phase of the Project, the turning rotors of the wind turbines may present a risk of collision for seabirds. Stationary structures, such as the tower, nacelle or when rotors are not operating, are not expected to result in a material risk of collision. When a collision occurs between the turning rotor blade and the bird, it is assumed to result in direct mortality of the bird, which potentially could result in population level impacts.

The ability of seabirds to detect and manoeuvre around wind turbine blades is a factor that is considered when modelling and assessing the risk. In response to this it is standard practice to calculate differing levels of avoidance for different species or species groups. Avoidance rates are applied to collision risk models to predict levels of impact more realistically, based on available literature and expert advice about seabird behaviour and their flight response to wind turbines.

Species differ in their susceptibility to collision risk, depending on their flight behaviour and avoidance responses, and the vulnerability of their populations (Garthe and Hüppop, 2004; Furness and Wade, 2012; Bradbury *et al*., 2014; Wade *et al*., 2016; Ozsanlav-Harris *et al*., 2023). As sensitivity to collision differs considerably between species, species were screened and progressed for assessment of significance on the basis of the density of flying birds recorded within the Offshore Ornithology Study Area and consideration of their perceived risk from collision (Garthe and Hüppop, 2004; Furness and Wade, 2012; Bradbury *et al*., 2014; Wade *et al*., 2016) (Table 11-39).

Five seabird species were identified as potentially at risk due to their recorded abundance in the Offshore Ornithology Study Area and their likelihood of flying at Potential Collision Height (PCH) between the lowest and highest sweep of the wind turbine rotor blades above sea level. The magnitude of change was determined by calculating the estimated number of collisions with the wind turbines and the resulting percentage increase in the background mortality rate.

There is the potential that aviation and navigation lighting on wind turbines might attract seabirds and thus increase the risk of collision. Conversely, aviation and navigation lighting could repel birds moving through the Project. There is little published evidence showing the effects of lighting on seabird collision and displacement, although earlier work on seaducks by Desholm and Kahlert (2005) showed that migrating flocks were more prone to enter the wind farm but the higher risk of collision in the dark was counteracted by increasing distance from individual turbines and flying in the corridors between turbines. For true seabirds, there is published evidence showing that seabirds are less active at night compared to daytime (Kotzerka *et al.,* 2010; Furness *et al.*, 2018). Wade *et al*. (2016) ranked vulnerability of seabirds to collision by accounting for the nocturnal activity rate of seabirds. A species was screened in for assessment if the sensitivity of collision is moderate or greater and also an abundance of at least moderate.

Collision Risk Modelling (CRM) was undertaken using the Stochastic Collision Risk Model (sCRM) developed by Marine Scotland (McGregor *et al*., 2018). The User Guide for the sCRM Shiny App provided by Marine Scotland (Donovan, 2017) has been followed for the modelling of collision impacts predicted for the Project. The full methodology is provided in appendix 11-4: Offshore Ornithology Collision Risk Modelling.

All non-seabird species have been screened out on the basis that the Project will have a negligible effect (almost undetectable) as a result of collision risk on migratory non-seabird species (see appendix 11-6: Offshore Ornithology Migratory Non-Seabirds Collision Risk Modelling). For all species assessed within the migratory non-seabird species CRM, the annual collision risk was less than one bird per year.

Table 11-39: Screening for collision risk assessment.

Ornithological receptor	Sensitivity to collision	Abundance recorded in offshore wind farm area	Screened IN or OUT
Arctic tern	Low	Very low	Low risk of collision; very low abundance recorded during site-specific surveys. **Screened OUT**
Black-headed gull	Moderate	Very low	Medium risk of collision however very low abundance recorded during site-specific surveys in offshore wind farm area. **Screened OUT**
Black guillemot	Very low	High	Very low risk of collision. Recorded in relatively high numbers within the Offshore Ornithology Study Area but low numbers and infrequent within the offshore wind farm area **Screened OUT**
Common gull	High	Moderate	High risk of collision and recorded in moderate numbers within the offshore wind farm area. **Screened IN**
Common scoter	Low	Very low	Low risk of collision and very low abundance recorded during site-specific surveys in offshore wind farm area. **Screened OUT**
Common tern	Moderate	Low	Moderate risk of collision and low abundance recorded during site-specific surveys.

Ornithological receptor	Sensitivity to collision	Abundance recorded in offshore wind farm area	Screened IN or OUT
			Screened OUT
Cormorant	Low	Very low	Low risk of collision and very low abundance recorded during site-specific surveys. **Screened OUT**
Fulmar	Very low	Very low	Very low risk of collision and very low abundance recorded during site-specific surveys. **Screened OUT**
Gannet	High	High	High risk of collision and high abundance recorded during site-specific surveys. **Screened IN**
Great black-backed gull	Very high	Moderate	Very high risk of collision and moderate abundance recorded during site-specific surveys. **Screened IN**
Great northern diver	Low	Moderate	Low risk of collision and moderate abundance recorded during site-specific surveys. **Screened OUT**
Great skua	Moderate	Very low	Medium risk of collision, however very low abundance recorded during site-specific surveys. **Screened OUT**
Guillemot	Very low	Very high	Very high numbers of guillemot were recorded in the offshore wind farm area, however the risk of collision is very low. **Screened OUT**
Herring gull	Very high	Moderate	Very high risk of collision, moderate abundance recorded during site-specific surveys. **Screened IN**
Kittiwake	High	Moderate	High risk of collision and moderate abundance recorded during site-specific surveys. **Screened IN**
Lesser black-backed gull	Very high	Very low	Very high risk of collision however very low abundance recorded within the offshore wind farm area. **Screened OUT**
Manx shearwater	Very low	Very high	Very high abundance recorded in the offshore wind farm area but very low collision risk. **Screened OUT**
Puffin	Very low	Low	Very low risk of collision and low abundance recorded during site-specific surveys. **Screened OUT**
Razorbill	Very low	High	High numbers of razorbill were recorded in the offshore wind farm area, however the risk of collision is very low. **Screened OUT**
Red-breasted merganser	Low	Very low	Low risk of collision and very low abundance recorded during site-specific surveys.

Ornithological receptor	Sensitivity to collision	Abundance recorded in offshore wind farm area	Screened IN or OUT
			Screened OUT
Red-throated diver	Very low	Low	Very low risk of collision and low abundance recorded during site-specific surveys. **Screened OUT**
Roseate tern	Moderate	Very low	Moderate risk of collision and very low abundance recorded during site-specific surveys. **Screened OUT**
Sandwich tern	Moderate	Very low	Moderate risk of collision and very low abundance recorded during site-specific surveys. **Screened OUT**
Shag	Moderate	Low	Moderate risk of collision and low abundance recorded during site-specific surveys. **Screened OUT**

CRM was undertaken using the Band model (Band, 2012), Options 1 and 2 for the boat-based data and Option 2 for the aerial digital data. The basic band model (Option 1) applies a uniform distribution of bird flights between the lowest and the highest levels of the rotors; the percentage of bird flights passing between the lowest and the highest levels of the rotors (i.e. the proportion of birds at PCH) is determined from observations of bird flight heights made during the baseline boat-based surveys. Option 2 uses generic flight height estimates published by Johnston *et al.* (2014) to determine the proportion of flight activity at PCH.

There is currently no detailed Irish guidance regarding the use of collision risk models or Avoidance Rates (Ars) in the assessment of offshore wind farms on seabirds. The collision risk model incorporated interim guidance on recommended Ars, bird size, flight speed, flight type and nocturnal activity scores (Natural England, 2022). Throughout the assessment, outputs will be contrasted with recently published parameters from JNCC (Ozanlav-Harris *et al.,* 2023). All proposed parameters are set out Table 11-40.

The AR for all species follow guidance from Natural England (2022) and the subsequent JNCC report (Ozsanlav-Harris *et al*., 2023), in the absence of detailed guidance from regulators in Ireland. Within this document, these two Ars will be referred to as “Natural England AR” and “JNCC AR”. The SD is presented alongside the AR, to provide variation around the mean value. The Natural England rates are grouped into species type, with gannet and kittiwake included within the “all gulls rate”, herring gull and great black-backed gull as “large gulls” and common gull as “small gulls”. Species specific AR are provided within the JNCC report for kittiwake, herring gull and great black-backed gull, but gannet and common gull use the “large gull” and “small gull”, respectively.

The biometrics for all species were derived from McGregor *et al*. (2018) and Natural England (2022). Estimates of flight speeds for kittiwake, herring gull, and great black-backed gull were derived from Cook *et al*. (2014), which presents flight speed values taken from Pennycuick (1997) and Alerstam *et al.* (2007). Flight speed for common gull was derived directly from Alerstam *et al.* (2007), due to a suspected error in the Cook *et al.* (2014) data. Flight speed for gannet was derived from both Cook *et al.* (2014) and more recent data present by Skov *et al.* (2018). The nocturnal activity factor are all based on Garthe and Hüppop (2004) other than gannet which is from Furness *et al*. (2018).

Table 11-40: Species parameters (± 1 SD) used for CRM for all five species.

Species	Natural England AR	JNCC AR	Body Length (m)	Wingspan (m)	Flight speed (ms^{-1})	Nocturnal activity
Gannet	0.993 (± 0.0003)	0.9939 (± 0.0004)	0.94 (±0.0325)	1.72 (±0.0375)	14.9 (± 0)	0.08 (±0.1)
Kittiwake	0.993	0.9979	0.39	1.08	13.1	0.375

Species	Natural England AR	JNCC AR	Body Length (m)	Wingspan (m)	Flight speed (ms^{-1})	Nocturnal activity
	(± 0.0003)	(± 0.0013)	(±0.005)	(±0.0625)	(± 0.4)	(±0.0637)
Common Gull	0.995 (± 0.0002)	0.9949 (± 0.0002)	0.41 (±0.005)	1.20 (±0.05)	13.4 (± 0.4)	0.375 (±0.0637)
Herring gull	0.994 (± 0.0004)	0.9952 (± 0.0003)	0.595 (±0.0225)	1.44 (±0.03)	12.8 (± 1.8)	0.375 (±0.0637)
Great black-backed gull	0.994 (± 0.0004)	0.9991 (± 0.0002)	0.71 (±0.035)	1.58 (±0.0375)	12.8 (± 1.2)	0.375 (±0.0637)

Collision risk estimates have been calculated using the mean density (± 1 SD) associated with survey data for the 19 months of baseline boat surveys (carried out between May 2018 and May 2020) and six months of aerial digital surveys (carried out between April 2020 and September 2020). For boat-based survey data with more than one survey in a calendar month (irrespective of year), the mean density estimate of the two surveys was used.

The species-specific impacts have been assessed in relation to the relevant seasonal populations as defined in Table 11-10. The breeding season assumes those individuals within foraging range of the Offshore Ornithology Study Area during the breeding season. The non-breeding seasons assumes the estimated non-breeding population present within the region. A summary of the outputs from the assessment is provided in the sections below and shown in Table 11-41.

Table 11-41: Estimated collisions (both Natural England and JNCC AR) during the breeding and non-breeding season for Band Option 1 and 2 for both the boat-based and DAS density estimate.

Ornithological receptor	Band Model Option	Density estimate	Natural England AR			JNCC AR		
			Breeding season	Non-breeding	Annual	Breeding season	Non-breeding	Annual
Common gull	1	Boat-based	0	10.71	10.71	0	10.78	10.78
	2	Boat-based	0	20.27	20.27	0	20.45	20.45
Gannet (70% macro-avoidance included)	1	Boat-based	10.31	10.40	20.71	8.96	9.01	17.96
	2	Boat-based	5.08	5.10	10.18	4.34	4.38	8.72
	2	DAS	4.10	N/A	N/A	3.61	N/A	N/A
Great black-backed gull	1	Boat-based	12.68	40.47	53.16	1.95	6.09	8.03
	2	Boat-based	15.70	50.21	65.91	2.44	7.54	9.98
	2	DAS	2.00	N/A	N/A	0.30	N/A	N/A
Herring gull	1	Boat-based	26.32	50.79	77.11	20.99	40.64	61.63
	2	Boat-based	31.34	60.46	91.80	25.12	48.38	73.50
Kittiwake	1	Boat-based	3.99	43.83	47.82	1.52	13.45	14.97
	2	Boat-based	5.83	50.45	56.28	1.74	15.37	17.11
	2	DAS	3.68	N/A	N/A	1.12	N/A	N/A

Operational and maintenance phase

Common gull

There were no predicted common gull collisions during the breeding season for either Band Option 1 or Band Option 2, therefore no assessment is required for that bio-season.

Magnitude of impact – non-breeding season

During the common gull non-breeding season (September to March), between 10.71 (when using Natural England AR, Band Option 1 and the boat-based survey density estimates) and 20.24 (when using the JNCC AR, Band Option 2 and the boat-based survey density estimates) collisions were predicted to occur due to the Project (Table 11-41).

During the 2016/2017 ObSERVE surveys, Jessopp *et al.* (2018) estimated that the abundance of common gull and herring gull (combined due to difficulties differentiating between the two species in the field) was over 35,000 individuals. The latest winter population estimation of common gull within Ireland from Lewis *et al*. (2019) was 21,438 birds. Using the average baseline mortality rate for common gull (all age class mortality rate of 0.253; see Table 11-12), the baseline mortality during the non-breeding season is 5,423 birds (when using the lower, Lewis *et al.* (2019), population estimate). The additional mortality of between 10.71 and 20.24 individual collisions represents a 0.37 % increase in baseline mortality.

As the birds are present within winter there is no restriction of where the species could occur, allowing birds to follow weather and food patterns. Therefore, it is appropriate to compare the impacts from the Project on the national population due to large movements of birds within winter and during migration from the northwest breeding population (Scotland through to Norway). In addition to the Irish birds, birds from the UK and continent Europe come to Ireland to winter (Pedersen *et al*., 2000), therefore the Irish population estimate is appropriate to compare against.

The impact of collisions is predicted to be of moderate spatial extent, long term duration, continuous and high reversibility. Although there is some uncertainty over the non-breeding population abundance of common gull in the Irish Sea and given that there are no predicted collisions during the breeding season, an increase in mortality of between 10.71 and 20.24 individual collisions is predicted. Therefore, the magnitude is considered to be low.

Sensitivity of the receptor

Common gull (alongside most gull species) are considered to have high vulnerability to collision in relation to operational offshore wind farms (Bradbury *et al*., 2014).

The species has a medium reproductive success (i.e. laying three eggs and breeding at three years old) (Robinson, 2005), common gull have a high recoverability given their short-term increasing trend in abundance and productivity in Ireland and the UK (Cummins *et al*., 2019 and JNCC, 2021).

Due to the Project's connectivity with nearby designated SPA sites, common gull are considered to have an international (high) conservation value as those individuals present within the offshore wind farm area are likely to form part of the wintering population of the nearby SPA populations.

Common gull are deemed to be of high vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect – non-breeding season

Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Gannet

The estimated collisions within this section have had a 70 % macro-avoidance applied due to gannet also being susceptible to disturbance and displacement (see section 11.10.1). A combined disturbance and displacement and collision risk assessment is presented within section 11.10.4.

Magnitude of impact – breeding season

During the gannet breeding season (April to August), between 3.61 (when using JNCC AR, Band Option 2 and the DAS density estimates) and 10.31 (when using the Natural England AR, Band Option 1 and the boat-based survey density estimates) collisions were predicted to occur due to the Project (Table 11-41).

The breeding population of gannet within mean maximum foraging range plus one SD (509.4 km) of the offshore wind farm area was estimated to be 150,897 breeding adults (SMP, 2022 and Burnell *et al.*, 2023). There are both SPA and non-SPA breeding colonies within the mean max foraging range (see Table 11-8). Within the population present within the impacted area during the breeding season there are immatures in addition to the adults. Horswill and Robinson (2015) estimated that for every adult there is 0.761 juveniles in the breeding season population, therefore the breeding season population within the mean maximum foraging range of the Project is 265,730 birds.

Using the published figures provided above and the baseline mortality rate (all age class mortality rate of 0.181; see Table 11-12) during the breeding season an estimated 48,097 gannet would die naturally. The additional mortality of 10.31 birds during the breeding season as a result of collisions is of negligible magnitude (a 0.02 % increase in mortality), which would be undetectable in the populations.

The impact of collisions is predicted to be of local spatial extent, long term duration, continuous and high reversibility. Therefore, the magnitude is considered to be negligible.

Sensitivity of the receptor

Gannet are considered to have high vulnerability to collision in relation to operational offshore wind farms (Bradbury *et al* 2014). In terms of behavioural response to wind farm structures, gannet are considered to be of high vulnerability, with a score of four out of five assigned by Wade *et al*. (2016). Recent studies have shown that during the breeding season, gannet showed a strong avoidance of offshore wind farms (Lane *et al*., 2020; Peschko *et al*., 2021). Therefore the 70 % macro-avoidance within the sCRM accounts of this strong avoidance.

Gannet are considered to have an international (high) conservation value as those individuals present within the wind farm array area are likely to form part of the breeding colonies of SPA populations (see Table 11-8). These SPAs are designated for their breeding populations of gannet and fall within the mean maximum foraging range plus one SD from the offshore wind farm area.

Although gannet has a low reproductive success (only laying one egg) and does not breed until five years old (Robinson, 2005), the species is deemed to have a medium recoverability given the consistent increasing trend in abundance in Ireland and the UK (Cummins *et al*., 2019 and JNCC, 2021). However, the species has suffered from the outbreak of avian flu during the 2022 breeding season. The consequences of this will not be known for several seasons, when breeding birds return to colonies.

Gannet are deemed to be of high vulnerability, medium recoverability and high conservation value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect – breeding season

Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will therefore be of **slight adverse significance,** which is not significant in EIA terms.

Magnitude of impact – non-breeding season

During the gannet non-breeding season (September to March), between 4.34 (when using JNCC AR, Band Option 2 and the DAS density estimates) and 10.40 (when using the Natural England AR, Band Option 1 and the boat-based survey density estimates) collisions were predicted to occur due to the Project (Table 11-41). The non-breeding BDMPS for gannet was estimated to be between 536,005 (autumn migration) and 644,739 (spring migration) (see Table 11-11). Using the published figures provided above and the baseline mortality rate (all age class mortality rate of 0.181; see Table 11-12) an estimated 97,017 gannet would die (using the autumn migration population) naturally and an estimated 116,698 gannet would die (using the spring migration population). The addition of 10.40 individual collisions represents a 0.01 % increase in mortality (when using the smaller autumn migration population).

The impact of collisions is predicted to be of local spatial extent, long term duration, continuous and high reversibility. Therefore, the magnitude is considered to be negligible.

Sensitivity of the receptor

As detailed above as part of the breeding season assessment gannet are deemed to be of high vulnerability, medium recoverability and high conservation value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect – non-breeding season

Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Great black-backed gull

Magnitude of impact –breeding season

During the great black-backed gull breeding season (April to August), between 0.3 (when using JNCC AR, Band Option 2 and the DAS density estimates) and 15.70 (when using the Natural England AR, Band Option 1 and the boat-based survey density estimates) collisions were predicted to occur due to the Project (Table 11-41). The breeding population of great black-backed gull within mean maximum foraging range plus one SD of the offshore wind farm area was estimated to be 1,192 breeding adults (SMP, 2022 and Burnell *et al.*, 2023). For each adult bird there is approximately 1.538 immature birds within the population (Horswill and Robinson, 2015). The breeding season population is therefore approximately 3,025 individual birds.

Using the published figures provided above and the baseline mortality rate (all age class mortality rate of 0.095; see Table 11-12) during the breeding season an estimated 287 great black-backed gull would die naturally. The addition of between 0.30 and 15.70 individual collisions represents between a 0.10 % and 5.46 % increase in mortality. Natural England AR are presented as “species group” and therefore are using all large gull species combined (lesser black-backed gull, great black-backed gull and herring gull combined) whereas the JNCC AR are specific to great black-backed gull. Therefore the applicant considers the JNCC AR as the latest available scientific evidence as to great black-backed gull sensitivity to collisions. The maximum impact predicted when using the JNCC AR was 2.44 birds (when using JNCC AR, Band Option 2 and the boat-based density estimates). The addition of 2.44 birds represents an increase in baseline mortality of 0.85 %. An increase in natural mortality of 1% is considered to be the threshold for detectability within a population, therefore if the higher number of individuals were to be impacted a detectable change in the local population may be observed.

Five colonies of great black-backed gull were identified within the mean maximum foraging range (73 km) of the Project. The five colonies are on the islands off Skerries near Dublin, Strangford Lough, Dalkey Island Ireland's Eye and Lambay Island. Within the latest Seabirds Count (JNCC, 2023) the population of three of the sites, Strangford Lough, Dalkey Island and Ireland’s Eye have increased by 161, 757 and 60 %, respectively. Lambay Island is the only colony which reported a decline, which was down by 7 %. There is no recent estimate for the islands off Skerries, with the most recent count (95 pairs) from 2010. Both populations from Strangford Lough and Ireland’s Eye are at least double the size of the population off Skerries and therefore the increase in these two larger population indicates the general pattern of increase within the area. Therefore as the local population is not designated and is increasing in size the increase in mortality of ~3 birds is highly unlikely to impact this trend. As no SPA colonies are present within the mean max foraging range (nor Ireland), no PVA analysis has been undertaken on the apportioned impacts.

The impact of collisions is predicted to be of local spatial extent, long term duration, continuous and medium reversibility. Therefore, the magnitude is considered to be low.

Sensitivity of the receptor

Great black-backed gull (alongside most gull species) are considered to have high vulnerability to collision in relation to operational offshore wind farms (Bradbury *et al*., 2014).

The species has a medium reproductive success (i.e. laying two to three eggs annually, but breeding from the fourth year) (Robinson, 2005), great black-backed gull have an overall high recoverability given their short-term increasing trend in abundance and productivity in Ireland (Cummins *et al*., 2019).

Great black-backed gull are considered to have a low (regional) conservation value during the breeding season as the species is listed as green on BoCCI, with no designated sites within the species mean max foraging range but was recorded in numbers more than 1 % of the regional population during the transect surveys.

Great black-backed gull are deemed to be of high vulnerability, high recoverability and low conservation value. The sensitivity of the receptor is therefore considered to be low to medium.

Significance of the effect – breeding season

Overall, the magnitude of the impact is deemed to be low to medium and the sensitivity of the receptor is considered to be low. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Magnitude of impact –non-breeding season

During the great black-backed gull breeding season (September to March), between 6.09 (when using JNCC AR, Band Option 1 and the boat-based density estimates) and 50.21 (when using the Natural England AR, Band Option 2 and the boat-based survey density estimates) collisions were predicted to occur due to the Project (Table 11-41)

The non-breeding BDMPS for great black-backed gull was estimated to be 53,181 individuals (see Table 11-11). Using the published figures provided above and the baseline mortality rate (all age class mortality rate of 0.095; see Table 11-12) during the non-breeding period an estimated 5,052 great black-backed gull would die naturally. The addition of 50.21 individual collisions represents a 0.99 % increase in mortality. An increase in natural mortality of 1 % is considered to be the threshold for detectability within a population, therefore even with the higher estimate individual collisions this is still below this threshold.

As previously stated during the breeding period the Natural England AR are presented as “species group” and therefore are using all large gull species combined (lesser black-backed gull, great black-backed gull and herring gull combined) whereas the JNCC AR are specific to great black-backed gull. Therefore the applicant considers the JNCC AR as the latest available scientific evidence as to great black-backed gull sensitivity to collisions. The maximum impact predicted when using the JNCC AR was 7.54 birds (when using JNCC AR, Band Option 2 and the boat-based density estimates). The addition of 7.54 birds represents an increase in baseline mortality of 0.15 %.

The impact of collisions is predicted to be of local spatial extent, long term duration, continuous and high reversibility. Therefore, the magnitude is considered to be low.

Sensitivity of the receptor

During the non-breeding season great black-backed gull are designated as a feature of the North West Irish Sea cSPA (see Table 11-8), therefore the value of the species increases. Due to the Project’s connectivity with nearby designated SPA sites during the non-breeding period, great black-backed gull are considered to have an international (high) conservation value as those individuals present within the offshore wind farm area are likely to form part of the wintering population of the nearby SPA populations (North-west Irish Sea SPA).

As detailed above as part of the breeding season assessment great black-backed gull are deemed to be of high vulnerability, high recoverability and high conservation value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect – non-breeding season

Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Herring gull

Magnitude of impact – breeding season

During the herring gull breeding season (March to August), between 20.99 (when using JNCC AR, Band Option 1 and the boat-based density estimates) and 31.34 (when using the Natural England AR, Band Option 2 and the boat-based survey density estimates) collisions were predicted to occur due to the Project (Table 11-41).

The breeding population of herring gull within mean maximum foraging range plus one SD of the offshore wind farm area was estimated to be 9,666 breeding adults (SMP, 2022 and Burnell *et al.*, 2023). For each adult bird there is approximately 1.37 immature birds within the population (Horswill and Robinson, 2015). The breeding season population is therefore approximately 22,908 individual birds.

Using the published figures provided above and the baseline mortality rate (all age class mortality rate of 0.172; see Table 11-12) during the breeding season an estimated 4,215 herring gull would die naturally. The addition of between 20.99 and 31.34 individual collisions represents between a 0.50 % and 0.74 % increase in mortality. An increase in natural mortality of 1% is considered to be the threshold for detectability within a population.

The impact of collisions is predicted to be of local spatial extent, long term duration, continuous and high reversibility. Therefore, the magnitude is considered to be low.

Sensitivity of the receptor

Herring gull (alongside most gull species) are considered to have high vulnerability to collision in relation to operational offshore wind farms (Bradbury *et al*., 2014).

Although the species has a low reproductive success as they lay three eggs but overall there is a low productivity of 0.6 chicks fledged per pair in the UK (Robinson, 2005; JNCC, 2021), the species is deemed to have a medium recoverability given the increasing short-term trend in abundance in Ireland (Cummins *et al*., 2019).

Herring gull are considered to have an international (high) conservation value as those individuals present within the wind farm array area are likely to form part of the breeding colonies of SPA populations (see Table 11-8). These SPAs are designated for their breeding populations of herring gull and fall within the mean maximum foraging range plus one SD from the offshore wind farm area.

Herring gull are deemed to be of high vulnerability, medium recoverability and high value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect – breeding season

Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Magnitude of impact – non-breeding season

During the herring gull non-breeding season (September to February), between 40.64 (when using JNCC AR, Band Option 1 and the boat-based density estimates) and 60.46 (when using the Natural England AR, Band Option 2 and the boat-based survey density estimates) collisions were predicted to occur due to the Project (Table 11-41).

The non-breeding BDMPS for herring gull was estimated to be 196,791 individuals (see Table 11-11). Using the published figures provided above and the baseline mortality rate (all age class mortality rate of 0.172; see Table 11-12) during the non-breeding period an estimated 38,848 herring gull would die naturally. The addition of 60.46 individual collisions represents a 0.18 % increase in mortality. An increase in natural mortality of 1 % is considered to be the threshold for detectability within a population.

The impact of collisions is predicted to be of local spatial extent, long term duration, continuous and high reversibility. Therefore, the magnitude is considered to be low.

Sensitivity of the receptor

As detailed above as part of the breeding season assessment herring gull are deemed to be of high vulnerability, medium recoverability and high conservation value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect – non-breeding season

Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Kittiwake

Magnitude of impact – breeding season

During the kittiwake breeding season (May to July), between 1.12 (when using JNCC AR, Band Option 2 and the DAS density estimates) and 5.89 (when using the Natural England AR, Band Option 2 and the boat-based survey density estimates) collisions were predicted to occur due to the Project (Table 11-41).

The breeding population of kittiwake within mean maximum foraging range plus one SD (300.6 km) of the offshore wind farm area was estimated to be 78,274 breeding adults (SMP, 2022 and Burnell *et al.*, 2023). For each adult bird there is approximately 0.898 immature birds within the population (Horswill and Robinson, 2015). The breeding season population is therefore approximately 148,564 individual birds.

Using the published figures provided above and the baseline mortality rate (all age class mortality rate of 0.156; see Table 11-12) during the breeding season an estimated 23,176 kittiwake would die naturally. The addition of between 1.12 and 5.89 individual collisions represents between a <0.01 % and 0.03 % increase in mortality.

The impact of collisions is predicted to be of local spatial extent, long term duration, continuous and high reversibility. Therefore, the magnitude is considered to be negligible.

Sensitivity of the receptor

Kittiwake (alongside all gull species) are considered to have high vulnerability to collision in relation to operational offshore wind farms (Bradbury *et al*., 2014).

The species has a low reproductive success as they lay two eggs per year, breed after 4 years and overall productivity of < 1 chick fledged per pair in the UK and Ireland (Robinson, 2005; JNCC, 2021) In addition the species has a decreasing trend in abundance within Ireland and the UK (Cummins *et al*., 2019 and JNCC, 2021). Therefore, this species is deemed to have a low recoverability.

Kittiwake are considered to have an international (high) conservation value as those individuals present within the wind farm array area are likely to form part of the breeding colonies of SPA populations (see Table 11-8). These SPAs are designated for their breeding populations of herring gull and fall within the mean maximum foraging range plus one SD from the offshore wind farm area.

Kittiwake are deemed to be of high vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect – breeding season

Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **slight adverse significance**, which is not significant in EIA terms.

Magnitude of impact – non-breeding season

During the kittiwake breeding season (August to April), between 13.45 (when using JNCC AR, Band Option 2 and the boat-based density estimates) and 50.45 (when using the Natural England AR, Band Option 2 and the boat-based survey density estimates) collisions were predicted to occur due to the Project (Table 11-41).

The non-breeding BDMPS for kittiwake was estimated to be between 928,207 (autumn migration) and 708,147 (spring migration) (see Table 11-11). Using the published figures provided above and the baseline mortality rate (all age class mortality rate of 0.156; see Table 11-12) during the autumn migration an estimated 144,800 kittiwake would die naturally and during the spring migration an estimated 110,471 kittiwake would die naturally. The addition of 50.45 individual collisions represents a 0.03 % increase in mortality during spring migration and 0.05 % increase in mortality during autumn migration. An increase in natural mortality of 1 % is considered to be the threshold for detectability within a population.

The impact of collisions is predicted to be of local spatial extent, long term duration, continuous and high reversibility. Therefore, the magnitude is considered to be negligible.

Sensitivity of the receptor

As detailed above as part of the breeding season assessment kittiwake are deemed to be of high vulnerability, low recoverability and high conservation value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect – non-breeding season

Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **slight adverse significance**, which is not significant in EIA terms.

11.10.4 Combined disturbance and displacement and collision risk for gannet

Gannet are susceptible to both collision risk and disturbance and displacement. Within the collision risk assessment a macro-avoidance value of 70% was used to account for this. However, the two impacts need to be combined to understand the full impact on gannet during both the breeding and non-breeding season (Table 11-42).

It is recognised that assessing these two potential impacts together could amount to double counting, as birds that are subject to displacement would not be subject to potential collision risk as they are already assumed to have not entered the array area. Equally, birds estimated to be subject to collision risk mortality would not be able to be subjected to displacement consequent mortality as well. As such, the collision estimates are presented with a 70 % macro-avoidance applied.

Table 11-42: Estimated combined collision and disturbance and displacement mortalities to gannet.

Season	Band Model Option	Disturbance and displacement mortality	Collison mortality	Combined mortality
Breeding	Minimum estimate	1	3.61	4.61
	Maximum estimate	2	10.31	12.31
Non-breeding	Minimum estimate	2	4.38	6.38
	Maximum estimate	3	10.40	13.40

During the gannet breeding season (April to August), between 4.61 and 12.31 gannet would be subject to additional mortality (Table 11-42). As previously stated, the baseline mortality of gannet during the breeding season is 48,097 birds. An increase of mortality of 12.31 birds would be approximately a 0.03% increase in baseline mortality.

During the gannet non-breeding season, between 4.38 and 13.40 gannet would be subject to additional mortality (Table 11-42). As previously stated, the baseline mortality of gannet during the non-breeding periods is between 97,017 and 116,698 birds. An increase of mortality of 13.40 birds would be a 0.01% increase in baseline mortality for both migration period populations.

As the increase in baseline mortality is <0.1 % a negligible magnitude is predicted. Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

11.10.5 Barrier effect

Operational and maintenance phase

Barrier effects may arise in addition to displacement however, unlike displacement, the effect refers to the disruption of preferred flight lines, so that birds are forced to navigate around an obstacle using alternative routes, which then imposes an additional energetic cost to daily movements (particularly during the breeding season) or migratory routes. This could have long-term implications to changes in bird movements and demographic fitness.

There is a general lack of empirical data to date on barrier effects of offshore wind farms around the Britain and Ireland (Humphreys *et al*., 2015) however studies have shown that a number of highly sensitive species such as seaducks and divers show avoidance responses to offshore wind farms, adjusting their flight trajectories to avoid the offshore wind-farm area post-construction (Peterson *et al.,* 2006 and Masden *et al*., 2010), which under some circumstances may negatively impact on survival rates. In the case of migrating birds, avoidance of a single wind farm may be trivial relative to the total length and cost of the journey, however during the breeding season (as birds travel between foraging grounds and roosting/nesting sites), the impact could be more significant (Masden *et al*., 2010 and Green *et al.,* 2019).

Magnitude of impact

For seabird species within mean maximum foraging range of the Project, there could be adverse impacts arising from barrier effects if the presence of offshore wind farm structures (i.e. turbines) prevented access to foraging grounds or forced the individual to circumnavigate the wind farm to/from foraging grounds, as this would lead to higher energy expenditure. The Project is within the mean maximum foraging range of several breeding colonies of gannet, kittiwake, guillemot and razorbill which are qualifying features of nearby SPAs (see Table 11-8), and could therefore be at risk of a barrier effect.

Gannet and kittiwake have large mean maximum foraging ranges from breeding colonies and generally forage widely. In addition, both gannet and kittiwake have low sensitivity to barrier effects and a low score for habitat flexibility (Maclean *et al*., 2009 and Furness *et al*., 2012), therefore the Project is unlikely to provide a significant barrier to foraging gannets and kittiwakes from these colonies given the species extensive foraging range and efficient flying capabilities. The magnitude for gannets and kittiwakes is therefore considered to be negligible.

For species with a higher sensitivity to barrier effects and that score medium for habitat flexibility, such as guillemot and razorbill (Maclean *et al*., 2009), the offshore wind farm area is unlikely to form a significant part of these species' foraging grounds because the offshore wind farm area is relatively small in the context of their overall ranges. A medium score of '3' means that these species have some flexibility in their habitat ranges and so would be able to move elsewhere. The magnitude for guillemot and razorbill are therefore considered to be low.

The impact of a barrier effect is predicted to be of local spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect seabirds directly. The magnitude is therefore considered to be negligible or low.

Sensitivity of seabirds

The vulnerability of a species to barrier effects is most likely to be reflected in the species' reaction to the presence of structures (Maclean *et al.,* 2009). For example, studies at operational wind farms (Krijgsveld *et al.,* 2011) have shown that gulls, terns and skuas are unlikely to see turbines as a barrier to movement, with some evidence of attraction in some species.

In general, seabirds are deemed to be of low to high vulnerability, medium to high recoverability and medium to high value. The sensitivity of the receptor is therefore considered to be low to high.

Significance of the effect

Overall, the magnitude of the impact is deemed to be negligible or low and the sensitivity of seabird species is considered to range between low to high. The effect will therefore be between an imperceptible to slight or moderate adverse significance, however based on the previously reported conservation status and recoverability levels for each species and in combination with vulnerability, it is unlikely that the effects would be significant in EIA terms, i.e. **imperceptible to slight adverse significance**.

11.10.6 Mitigation and residual effects

The assessment of impacts has concluded that there are no significant effects with the implementation of the measures included in the Project. Therefore, no measures over those outlined in section 11.8.2 are required.

Residual effects

With the implementation of the measures included in the Project (section 11.8.2), the residual effects are as outlined in the assessment provided in section 11.10.

11.10.7 Future monitoring

The Project proposes to continue monitoring the population distribution and abundance of the Offshore Ornithology Study Area. This monitoring is proposed to consist of DAS before construction (Year 0) and Years 1, 3, 5 and 15 following construction, following the same scope, methods and analysis of the baseline surveys.

This monitoring requirement is set out in DCCAE's guidance to inform ecological monitoring (DCCAE, 2018). Assessment of the Project alone concluded that there would be a slight adverse, but non-significant impact and therefore no additional monitoring of a specific receptor is proposed at this stage. The level of monitoring proposed will help provide scientific evidence of how birds within the Irish Sea respond to offshore wind farms.

11.11 Cumulative Impact Assessment

11.11.1 Methodology

The Cumulative Impact Assessment (CIA) takes into account the impact associated with the Project together with other projects. The projects selected as relevant to the CIA presented within this chapter are based upon the results of a screening exercise (see volume 2A, appendix 3-1: CIA Screening Annex). Each project has been considered on a case-by-case basis for screening in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.

The approach to CIA examines the effects of the Project alongside the following projects if they fall within the Cumulative Offshore Ornithology Study Area (see section 11.3).

- Other projects with consent but not yet constructed/construction not completed;
- Other projects in a consent application process but not yet determined (including planning applications, foreshore lease/licence applications, Dumping at Sea Permit applications;
- Other projects currently operational that were not operational when baseline data were collected, and/or those that are operational but have an ongoing impact; and
- Projects, which satisfy the definition of ‘relevant maritime usage’ under the Maritime Area Planning Act (2021) (i.e. wind farm projects designated as ‘Relevant Projects’ or ‘Phase 1 Projects’) including Arklow Bank II, Bray Bank and Kish Bank; North Irish Sea Array (NISA), Codling Wind Park (I and II).

The specific projects screened into this CIA, are outlined in Table 11-43 and are illustrated in Figure 11-2.

Table 11-43: List of other projects considered within the CIA.

Project	Status	Distance from offshore wind farm area (km)	Distance from offshore cable corridor (km)	Description of Project	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with Project
North Irish Sea Array (NISA) offshore wind farm	Maritime Area Consent	16.2	18.1	EIA Scoping Report (2021) refers to the construction of an offshore wind farm of up to 500 MW, consisting of 36 turbines with a maximum height of 320 m and rotor diameter of up to 290 m. Offshore substation platforms may be required.[3]	Unknown	Unknown (Design life minimum 35 years)	Potential for construction, operation and maintenance and decommissioning phases to overlap with the Project.
Dublin Array offshore wind farm	Maritime Area Consent	61.2	56.9	Scoping report (2020) refers to the construction of Bray and Kish offshore wind farm of up to 900 MW, consisting of up to 61 turbines with a maximum height of 308 m and rotor diameter of up to 285 m and up to three offshore substation platforms.[4]	Unknown	Unknown (Design life minimum 35 years)	Potential for construction, operation and maintenance and decommissioning phases to overlap with the Project.
Codling Wind Park	Maritime Area Consent	61.4	57.1	EIA Scoping report (2020) refers to the construction of an offshore wind farm of up to 1500 MW, consisting of up to 140 turbines with a maximum height of 320 m and rotor diameter of up to 288 m. The project will also contain up to five offshore substation platforms.[5]	Unknown	Unknown (Design life minimum 35 years)	Potential for overlap with construction, operation and maintenance and decommissioning phases.
Arklow Bank Wind Farm (Phase 2)	Maritime Area Consent	107.1	104.6	EIA Scoping Report: The project will include between 37 and 56 turbines ad up to two Offshore Substation Platforms (OSP) and foundation substructures. The area in which the proposed wind turbines, inter-array cables and OSP(s) will be located on Arklow Bank covers an area of seabed approximately 64km^2.[6]	Unknown	Unknown (Design life minimum 35 years)	Potential for overlap with construction, operation and maintenance and decommissioning phases.
Holyhead Deep – Phase 1 (Minesto Tidal Kite)	Operational (partial)	105.7	108	Underwater tidal kites, one 0.5 MW tidal kite operational in 2017, plans for 60 1.2 MW devices.	2017 to *ongoing*	2018 to *ongoing*	Potential for overlap with construction, operation and maintenance and decommissioning phases.
Morgan Offshore Wind Farm – Generation Assets	Planning – Preliminary Environmental Information Report (PEIR) submitted	119.5	124	PEIR indicates 107 wind turbines. 1,500 MW capacity.	Unknown	Unknown	Potential for overlap with construction, operation and maintenance and decommissioning phases.
Arklow Bank Wind Farm Phase 1	Operational	120.2	117.5	Seven 3.6 MW turbines. Hub height 73.5 m. Rotor diameter 124 m.	2002 to 2003	2004 to *2028*	Potential for overlap with operation and maintenance phase.
Mona Offshore Wind Farm	Planning – PEIR submitted	127.1	131.4	PEIR report indicates 107 wind turbines. 1,500 MW capacity.	Unknown	Unknown	Potential for overlap with construction, operation and maintenance and decommissioning phases.
Walney Extension 3 Offshore Wind Farm	Operational	139.9	144.6	40 8.25 MW turbines. Hub height 113 m. Rotor diameter 164 m	2017	2018 to 2039	Potential for overlap with operation and maintenance phase.
Awel y Môr Offshore Wind Farm	Planning - consented	142.4	145.2	50 turbines. Rotor diameter 306 m and a minimum of 11.5 MW per turbine.	*2026 to 2029*	2030 to *2065*	Potential for overlap with construction, operation and maintenance and decommissioning phases.
Walney Extension 4 Offshore Wind Farm	Operational	146	150.6	47 7 MW turbines. Hub height 111 m. Rotor diameter 154 m	2017	2018 to *2039*	Potential for overlap with operation and maintenance phase.
Morecambe Offshore Wind Farm - Generation Assets	Planning – PEIR submitted	151.3	155.2	PEIR report indicates 40 wind turbines. 480 MW capacity.	Unknown	Unknown	Potential for overlap with construction, operation and maintenance and decommissioning phases.
Walney 2 Offshore Wind Farm	Operational	155.8	160.5	51 3.6 MW turbines. Hub height 84 m. Rotor diameter 107 m.	2011	2012 to *2032*	Potential for overlap with operation and maintenance phase.
Walney 1 Offshore Wind Farm	Operational	162.5	166.7	51 3.6 MW turbines. Hub height 84 m. Rotor diameter 107 m.	2010	2010 to *2032*	Potential for overlap with operation and maintenance phase.
West of Duddon Sands Offshore Wind Farm	Operational	162.3	166.7	108 3.6 MW turbines. Hub height 90 m Rotor diameter 120 m.	2013 to 2014	2014 to *2033*	Potential for overlap with operation and maintenance phase.

[3] Project website https://northirishseaarray.ie/ states that wind farm will consist of 35 to 46 turbines.

[4] Project website: https://dublinarray.com/project-information/key-facts/ between 39 and 50 turbines, individual turbine capacity 15 MW+, total project capacity 824 MW, individual tip heights between approx. 270 m and 310 m

[5] Project website: https://codlingwindpark.ie/the-project/ max energy output 1300 MW, 100 turbines, turbine tip height max 320 m, states preferred O&M base is Wicklow Town

[6] Project website: The development area for the wind farm covers an area of seabed approximately 27 km long and 2.5 km wide. Between 36 and 60 turbines will be deployed on the site, each comprising a foundation, tower, nacelle, and rotor assembly. A number of different turbine models and layouts are being explored to deliver a power generation output from the site of up to 800MW. One to two Offshore Substation Platforms (OSP) and foundation substructures, a network of inter-array cabling and two offshore export cables will also form part of the offshore infrastructure.

Project	Status	Distance from offshore wind farm area (km)	Distance from offshore cable corridor (km)	Description of Project	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with Project
Gwynt y Mor Offshore Wind Farm	Operational	163.4	166.3	160 3.6 MW turbines. Hub height 98 m. Rotor diameter 107 m.	2012	2015 to *2032*	Potential for overlap with operation and maintenance phase.
Rhyl Flats Offshore Wind Farm	Operational	165.6	168.3	25 3.6 MW turbines. Hub height 80 m. Rotor diameter 107 m.	2007	2009 to *2027*	Potential for overlap with operation and maintenance and decommissioning phases.
Ormonde Offshore Wind Farm	Operational	168.6	173.2	30 5 MW turbines. Hub Height 100 m. Rotor diameter 126 m.	2010	2012 to *2036*	Potential for overlap with operation and maintenance phase.
Robin Rigg Offshore Wind Farm	Operational	173.3	178.5	58 3 MW turbines. Hub height 80 m Rotor diameter 90 m.	2009	2010 to *2030*	Potential for overlap with operation and maintenance phase.
North Hoyle Offshore Wind Farm	Operational	177.1	180.0	30 2 MW turbines. Hub height 70 m. Rotor diameter 80 m.	2003	2004 to *2028*	Potential for overlap with operation and maintenance phase.
Barrow Offshore Wind Farm	Operational	177.2	181.6	30 3 MW turbines. Hub height 75 m. Rotor diameter 90 m.	2005	2006 to *2028*	Potential for overlap with operation and maintenance phase.
Burbo Bank Offshore Wind Farm Extension	Operational	181.1	184.3	32 8.0 MW turbines. Hub height 105 m. Rotor diameter 160 m	2016	2017 to *2045*	Potential for overlap with operation and maintenance phase.
Burbo Bank Offshore Wind Farm	Operational	191.1	194.4	23 3.6 MW turbines. Hub height 78 m. Rotor diameters 107 m.	2006	2007 to *2039*	Potential for overlap with operation and maintenance phase.
Marine Energy Test Areas (META) Pembrokeshire	Operational	253.9	~250	Tidal, wave and floating offshore wind test site.	2019	2019 to *2029*	Potential for overlap with operation and maintenance phase.
Erebus Offshore Wind Farm	Consented (not yet constructed)	267.9	265.4	100 MW capacity demonstration and testing site for floating wind.	*2025*	*2026 to 2051*	Potential for overlap with construction, operation and maintenance and decommissioning phases.
South Pembrokeshire Demonstration Zone – Wave Hub	Planning	273.8	~270	Wave energy test site of 100 MW	2019	*2019 to 2048*	Potential for overlap with construction, operation and maintenance and decommissioning phases.

Table 11-44 presents the relevant project design parameters from Table 11-13, which are used to assess the potential cumulative impact of the Project with the other projects identified in Table 11-43 (where information is available).

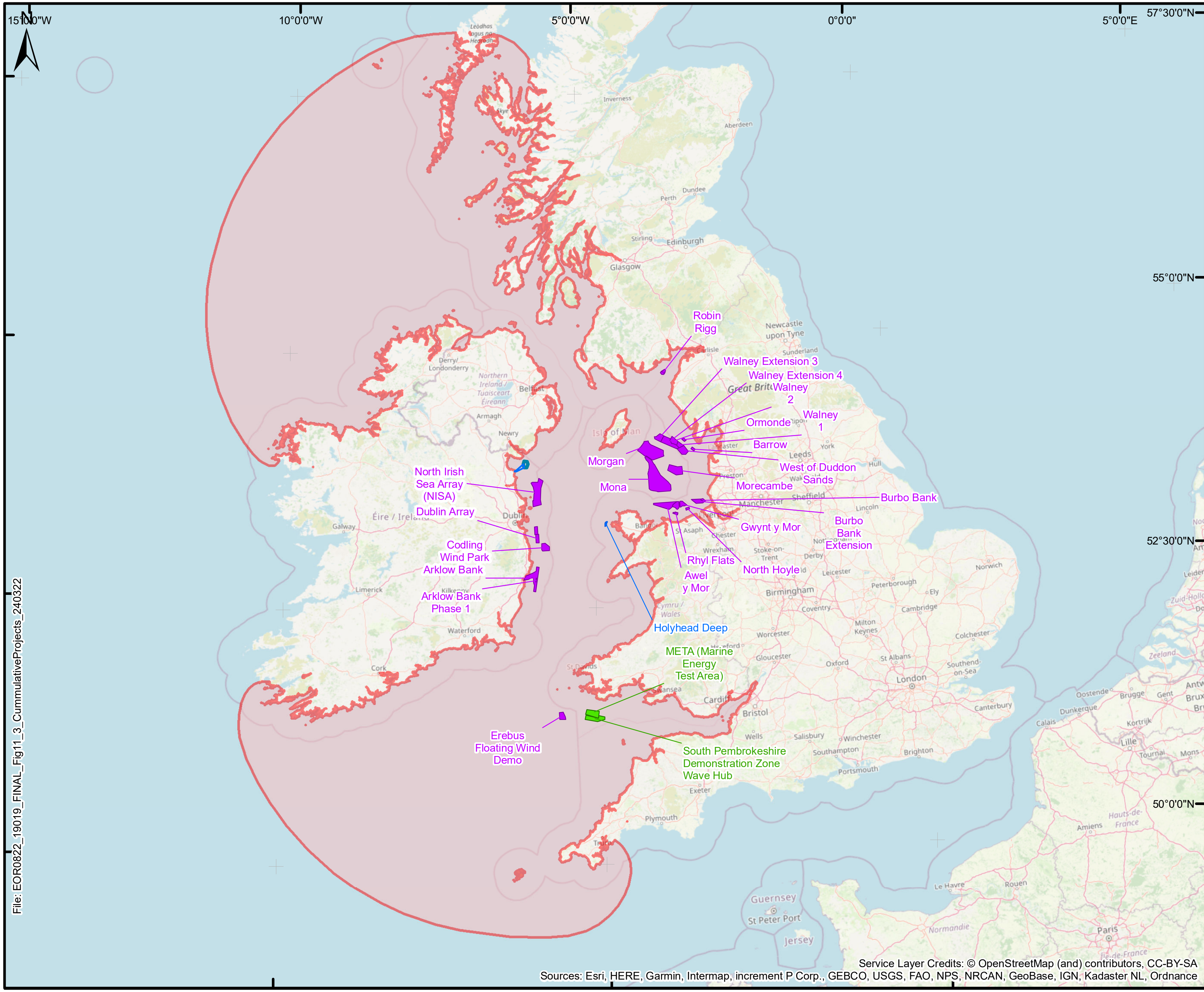
Impacts have been carried forward for assessment where there is potential for an effect to occur from the Project alone over a scale that could impact cumulatively with other projects within the Cumulative Offshore Ornithology Study Area. This has been applied whereby the Project could contribute to an increase in baseline mortality of >0.05 %. All impacts <0.05 % are considered inconsequential with no potential to interact cumulatively with other projects.

Other aspects, namely indirect impacts associated with prey distribution and availability are very difficult to quantify, and although it is acknowledged that cumulative effects are possible, the magnitude of these impacts is not considered to be significant at a population level for any offshore ornithology receptor and is therefore not considered further within the CIA. The impacts excluded from the cumulative assessment are:

- Indirect impacts (affecting prey species) from airborne noise, underwater sound and the presence of vessels at any phase of the Project as they will be spatially limited and all were predicted as negligible;
- Barrier effects have not been included in the CIA; although it is acknowledged that cumulative impacts are possible, the magnitude of these impacts is not considered to be significant at a population level for any ornithological receptor when considered alongside the other proposed Irish Sea wind farms due to a separation distance of a least 16 km; and
- Disturbance and displacement during the construction and decommissioning phases; although it is acknowledged that impacts are possible, the spatial magnitude of these impacts is not considered to be cumulative in nature due to the small area over which construction activities occur (point source impacts). There is low likelihood that temporal overlap might occur and if it does there is at least 16 km between the two construction locations. It is not considered significant at a population level for any ornithological receptor when considered alongside the other proposed projects.

Table 11-44: Project design parameters considered for the assessment of potential cumulative impacts on offshore ornithology.

Potential cumulative impact	Phase C	Phase O	Phase D	Project design parameters	Justification
Disturbance and displacement	✗	✓	✗	Project design parameters as described for the Project assessed cumulatively with the other projects (Table 11-13).	Outcome of the CIA will be greatest when the greatest number of other wind farms are considered.
Collision risk	✗	✓	✗	Project design parameters as described for the Project assessed cumulatively with the other projects (Table 11-13).	Outcome of the CIA will be greatest when the greatest number of other wind farms are considered.



Legend

- Project Offshore Wind Farm Area
- Project Offshore Cable Corridor
- Cumulative Offshore Ornithology Study Area
- Offshore Wind Farm
- Tidal Project
- Wave Project

Data Sources: Client,

Client

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project

Oriel Wind Farm Project

Title

Figure 11-2
Other projects screened into the Cumulative Impact Assessment

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Issue Details

Drawn By:	NG	**Project No.**	EOR0822 (MDR1520B)
Checked By:	NG	**File Ref:**	
Approved By:	AOS		EOR0822_ORN_E_19019_FINAL
Scale:	1:5,500,000 @ A4	**Projection:**	ITM (IRENET95) Geographic Co-ordinates: ETRS89
Date:	22/03/2024		

11.11.2 Assessment of significance

A description of the significance of cumulative effects upon offshore ornithology receptors arising from each identified impact is given below.

The CIA is limited by the publicly available data upon which to base the assessment. Due to the age of developments in the Irish Sea and surrounding areas which have the potential to have a cumulative impact upon receptors, few have comparable datasets upon which to base an assessment. Additionally, older developments did not carry out certain impact assessments (e.g. displacement and/or collision risk). No attempt has been made to calculate the impacts of these older projects with a large proportion of the impact already present within a species survival rate. As such the CIA is carried out using data from wind farms with available species data to do so.

The Applicant has engaged with the other four Phase 1 offshore wind farm developers on the east coast of Ireland (who hold a Maritime Area Consent) (see Table 11-43) to inform the CIA. A single output for these projects is presented. These projects shared data and outputs from collisions risk modelling and displacement to inform the assessment of potential cumulative impacts on offshore ornithology.

When the assessment of the Project alone (section 11.10) concluded that the Project would have an increase in baseline mortality of <0.05 % the impact from the Project alone is considered inconsequential and not proportionate to include within the CIA. The Project would not materially or measurable contribute to the cumulative impact. All assessments which conclude a <0.05 % increase in baseline mortality are within the natural variation and confidence intervals within which the estimates of density, survival and impacts have been produced. Therefore following the assessment of the gannet alone assessment no CIA was undertaken. Impacts on great northern diver, guillemot, razorbill, common gull, great black-backed gull and herring gull are presented within the CIA.

Disturbance and displacement during the operational and maintenance phase

There is potential for cumulative displacement as a result of operational activities associated with the Project along with other developments (Table 11-43).

The level of data available and the ease with which disturbance and displacement impacts can be combined across the wind farms is quite variable, reflecting the availability of relevant data for other projects and the approach to assessment taken. During the operational and maintenance phase, the presence of offshore turbines has the potential to directly disturb and displace seabirds that would normally reside within and around the area of sea where offshore wind farms are located. Displacement may contribute to individual birds experiencing fitness consequences, which at an extreme level could lead to the mortality of individuals. Cumulative displacement therefore has the potential to lead to effects on a wider scale.

The species assessed for cumulative displacement impacts were great northern diver, guillemot and razorbill.

With regards to this CIA of displacement effects, suitable information was obtained from each relevant project publicly available documentation. It should be noted that the amount of data available and the practicality of combining impacts across projects is variable. Wherever possible, the cumulative assessment is quantitative, however where no data is available, the cumulative assessment is qualitative.

Great northern diver

Magnitude of impact

There are no estimates available for the number of great northern diver likely to be affected by the other projects within the Cumulative Offshore Ornithology Study Area. The timing of observations recorded during the site-specific surveys primarily indicates overwintering presence and passage movements through the region on spring and autumn migration. The absence of reporting of potential impacts on this species in the other parts of the Irish Sea, suggests that the magnitude of potential impacts on great northern diver at those sites was deemed to be negligible, if present during their site-specific surveys at all. Potential impacts arising from some projects are unknown but may add to the cumulative impact. As there is no additional information on any cumulative impacts the magnitude of impact, is deemed to be the same for the Project alone, and therefore the magnitude is considered to be low.

Sensitivity of receptor

As detailed above within the alone assessment, great northern diver are deemed to be of high vulnerability and high conservation value. The sensitivity of the receptor is therefore, considered to be high.

Significance of the effect

Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of great northern diver is considered to be high. The cumulative effect will, therefore, be of **slight adverse significance** depending on the degree of overlap between the operation phase of the projects, which is currently unknown.

Guillemot

Magnitude of impact

The estimated cumulative abundance of guillemot from the CIA projects, for which data is available is presented in Table 11-45. There are a number of projects for which there are no, or limited, data on the number of guillemot predicted to be displaced, in particular, for some of the earlier developments. The abundances presented for the Project are the larger of the boat-based or DAS estimates.

Table 11-45: Guillemot cumulative abundances for offshore wind projects for disturbance and displacement assessment during operation.

Project	Annual cumulative abundance	Breeding season cumulative abundance	Non-breeding season cumulative abundance
Holyhead Deep – Phase 1 (Minesto Tidal Kite)	7.9 (underwater collisions)	Not presented	
Arklow Bank Wind Farm Phase 1	No data presented		
Walney Extension 3 + 4 Offshore Wind Farms	6,093	4,167	1,926
Awel y Môr Offshore Wind Farm	4,488	1,569	2,919
Walney 1 + 2 Offshore Wind Farms	No data presented		
West of Duddon Sands Offshore Wind Farm	833	347	486
Gwynt y Mor Offshore Wind Farm	No data presented		
Rhyl Flats Offshore Wind Farm	No data presented		
Ormonde Offshore Wind Farm	238	238	Not presented
Robin Rigg Offshore Wind Farm	28	28	Not presented
North Hoyle Offshore Wind Farm	No data presented		
Barrow Offshore Wind Farm	No data presented		
Burbo Bank Offshore Wind Farm Extension	5,963	2,414	3,549
Burbo Bank Offshore Wind Farm	No data presented		
Erebus Offshore Wind Farm	35,339	7,001	28,338
Total (consented)	**52,982**	***15,764***	***37,218***
Mona	11,912	Not presented	Not presented
Morgan	8,994	Not presented	Not presented

Project	Annual cumulative abundance	Breeding season cumulative abundance	Non-breeding season cumulative abundance
Morecambe	11,697	Not presented	Not presented
Other Phase 1 Projects	77,404	27,157	50,247
Total (non-consented)	**162,989**	***42,921***	***87,465***
The Project	3,490	820	2,670
Cumulative total (all projects)	**166,479**	**43,741**	**90,135**

For the cumulative displacement assessment, 50% displacement and 1% mortality was used to be in line with recent evidence from Hornsea projects which indicate the level of displacement is not as high as stated within the SNCB document (SNCB, 2022).

As the data was not presented consistently with some data not presented for a specific season, an assessment of the annual total is included. Annually, the displacement from operation of all projects would results in an estimated 832 additional mortalities (using 50% displacement and 1% morality). Holyhead Deep tidal project predicted an addition of 7.9 underwater collisions; therefore the total cumulative impact would be 841.

Using the largest BDMPS population of 1,567,398 individuals (non-breeding period, adapted from Furness, 2015 – see Table 11-11) and the average baseline mortality of 0.198, the background predicted mortality would be 310,345. The addition of an estimated 841 mortalities would increase the baseline morality rate by 0.27 %. It is considered that a reduction of 0.27 % to be of low significance.

These numbers demonstrate that the operations and maintenance phase of the Project combined with the operations phase of the surrounding projects in the Irish Sea would cumulatively not cause a significant impact to the regionally guillemot population.

Sensitivity of receptor

As detailed above within the alone assessment, guillemot are deemed to be of high vulnerability, medium recoverability and high conservation value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect

Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of guillemot are considered to be high. The cumulative effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Razorbill

Magnitude of impact

The estimated cumulative abundance of razorbill from the CIA projects, for which data is available is presented in Table 11-46.

There are a number of projects for which there are no, or limited, data on the number of guillemot predicted to be displaced, in particular, for some of the earlier developments. The abundance presented for the Project are the larger of the boat-based or DAS estimate.

Table 11-46: Razorbill cumulative abundances for offshore wind projects for disturbance and displacement assessment during operation.

Project	Annual cumulative abundance	Breeding season cumulative abundance	Non-breeding season cumulative abundance
Holyhead Deep – Phase 1 (Minesto Tidal Kite)	0.8 (underwater collisions)	Not presented	

Arklow Bank Wind Farm Phase 1	No data presented		
Walney Extension 3 + 4 Offshore Wind Farms	3,938	0	3,938
Awel y Môr Offshore Wind Farm	692	140	552
Walney 1 + 2 Offshore Wind Farms	No data presented		
West of Duddon Sands Offshore Wind Farm	455	91	364
Gwynt y Mor Offshore Wind Farm	No data presented		
Rhyl Flats Offshore Wind Farm	No data presented		
Ormonde Offshore Wind Farm	85	85	Not presented
Robin Rigg Offshore Wind Farm	7	7	Not presented
North Hoyle Offshore Wind Farm	No data presented		
Barrow Offshore Wind Farm	No data presented		
Burbo Bank Offshore Wind Farm Extension	2,354	534	1,820
Burbo Bank Offshore Wind Farm	No data presented		
Erebus Offshore Wind Farm	3,867	194	3,673
Total (consented)	**11,398**	**1,051**	**10,347**
Mona	2,883	Not presented	
Morgan	622	Not presented	
Morecambe	1,881	Not presented	
Other Phase 1 Projects	24,319	2,046	22,274
Total (non-consented)	**41,103**	**3,097**	**32,621**
The Project	3,490	820	2,670
Cumulative total (all projects)	**44,593**	**3,917**	**35,291**

For the cumulative displacement assessment, 50 % displacement and 1 % mortality was used to be in line with recent evidence from Hornsea projects which indicate the level of displacement is not as high as stated within the SNCB document (SNCB, 2022).

As the data was not presented consistently with some data not presented for a specific season, an assessment of the annual total is included. Annually, the displacement from operation of all projects would results in an estimated 223 additional mortalities (using 50% displacement and 1% morality). Holyhead Deep tidal project predicted an addition of 0.8 underwater collisions, therefore the total cumulative impact would be 224.

Using the largest BDMPS population of 606,914 individuals (post- and pre-breeding migration, adapted from Furness, 2015 – see Table 11-11) and the average baseline mortality of 0.129, the background predicted mortality would be 78,292. The addition of an estimated 224 mortalities would increase the baseline morality rate by 0.29 %. It is considered that a reduction of 0.29 % to be of **low significance**.

These numbers demonstrate that the operational and maintenance phase of the Project combined with the operations phase of the surrounding projects in the Irish Sea would cumulatively not cause a significant impact to the regional razorbill population.

Sensitivity of receptor

As detailed above within the alone assessment, razorbill are deemed to be of high vulnerability, medium recoverability and high conservation value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect

Overall, the magnitude of the cumulative impact is deemed to be low and the sensitivity of razorbill are considered to be high. The cumulative effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Collision risk during the operational and maintenance phase

The offshore wind farm area, together with that of other offshore wind farms may contribute to cumulative collision risk during the operational and maintenance phase of the developments. Other projects screened into the assessment within the Cumulative Offshore Ornithology Study Area are presented in Table 11-43. The five species identified as potentially impacts by the Project alone during operational and maintenance phase were common gull, gannet, great black-backed gull, herring gull and kittiwake; these species have therefore been assessed for cumulative impacts. The five species selected for CRM were screened in for assessment based on their perceived vulnerability to collision (e.g. Furness *et al*., 2013), together with their abundance within the baseline dataset. The annual estimate of number of collisions presented for the Project is from Band Option 2, to allow direct comparisons with the other projects. In addition the number of predicted collisions has been amended

Collision estimates were available for some of the above species for some of the offshore wind farms located in UK and Irish waters; together with the Project alone annual collision risk estimates (the largest risk from the Project is presented, from the differing Band Model options and survey methods), these are summarised in Table 11-47 below.

Table 11-47: Annual collision risk of other wind farm sites included in the CIA.

Project	Kittiwake collisions	Great black-backed gull collisions	Common gull collisions	Herring gull collisions
Holyhead Deep – Phase 1 (Minesto Tidal Kite)	No collisions predicted due to nature of the technology			
Arklow Bank Wind Farm Phase 1	Not presented			
Walney Extension 3 + 4 Offshore Wind Farms	117.03	16.2	21.2	32.7
Awel y Môr Offshore Wind Farm	53.86	2.89	0.14	1.49
Walney 1 + 2 Offshore Wind Farms	Not presented	Not presented	Not presented	Not presented
West of Duddon Sands Offshore Wind Farm	Not presented	Not presented	Not presented	Not presented
Gwynt y Mor Offshore Wind Farm	Not presented	Not presented	Not presented	Not presented
Rhyl Flats Offshore Wind Farm	Not presented	Not presented	Not presented	Not presented
Ormonde Offshore Wind Farm	4.99	0.24	Not presented	0.36
Robin Rigg Offshore Wind Farm	Not presented	Not presented	Not presented	Not presented
North Hoyle Offshore Wind Farm	Not presented	Not presented	Not presented	Not presented
Barrow Offshore Wind Farm	Not presented	Not presented	Not presented	Not presented

Project	Kittiwake collisions	Great black-backed gull collisions	Common gull collisions	Herring gull collisions
Burbo Bank Offshore Wind Farm Extension	22.26	Not presented	Not presented	23.75
Burbo Bank Offshore Wind Farm	Not presented	Not presented	Not presented	Not presented
Erebus Offshore Wind Farm	57.52	0.67	Not presented	3.77
Total (consented)	**255.66**	**32**	**21.34**	**62.07**
Mona	37.1	7.4	Not presented	2.0
Morgan	39.81	2.81	Not presented	11.8
Morecambe	32.0	0.98	3.41	3.42
Other Phase 1 Projects (where information presented)	332.55	29.55	139.96	121.1
Total (non-consented)	**697.12**	**72.74**	**164.71**	**200.39**
The Project	55.05	65.91	20.27	91.8
Cumulative total (all projects)	**752.17**	**138.65**	**184.98**	**292.19**

Common gull

Magnitude of impact

Using an amalgamated UK and Ireland winter population estimated of 734,567 individuals (713,129 from the UK, Channel Isles and Isle of Man (Banks *et al.*, 2007) and an additional 21,438 from Ireland (Burke *et al.*, 2018)) and the average baseline mortality of 0.253, the background predicted mortality would be 185,845. The addition of an estimated 184.98 mortalities would increase the baseline mortality rate by 0.10 %. Using both the UK and Ireland population is appropriate due to many of the cumulative projects occurring within UK waters.

The impact of collisions is predicted to be of international spatial extent, long term duration, continuous and high reversibility. Therefore, the magnitude is considered to be low.

Sensitivity of receptor

As detailed above within the alone assessment, common gull are deemed to be of high vulnerability, high recoverability and high conservation value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect

Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **slight adverse significance**, which is not significant in EIA terms.

Great black-backed gull

Magnitude of impact

Using the largest BDMPS population of 53,181 individuals (winter population, adapted from Furness, 2015 – see Table 11-11) and the average baseline mortality of 0.095, the background predicted mortality would be 5,052. The addition of an estimated 138.65 mortalities would increase the baseline mortality rate by 2.74 %.

Within the cumulative assessment for great black-backed gull an AR of 0.994 presented within Table 11-47. This is in line with the Natural England AR (Table 11-40). However as presented within the alone assessment the latest evidence as to the species specific AR (Ozsanlav-Harris *et al.*, 2023), an AR of 0.9979 is presented and evidenced from empirical data. Using the latest available evidence as to the susceptibility of great black-backed gull the estimated collisions would be 48.5 birds. Using the most recent AR, the addition of an estimated 48.5 mortalities would increase the baseline mortality rate by 0.96 %.

The impact of collisions is predicted to be of national spatial extent, long term duration, continuous and high reversibility. Therefore, the magnitude is considered to be low.

Sensitivity of the receptor

As detailed above as part of the alone assessment during the non-breeding season great black-backed gull are deemed to be of high vulnerability, high recoverability and high conservation value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect

Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Herring gull

Magnitude of impact

The non-breeding BDMPS for herring gull was estimated to be 196,791 individuals (see Table 11-11). Using the published figures provided above and the baseline mortality rate (all age class mortality rate of 0.172; see Table 11-12) during the non-breeding period an estimated 38,848 herring gull would die naturally. The addition of 292.19 individual collisions represents a 0.75 % increase in mortality. An increase in natural mortality of 1 % is considered to be the threshold for detectability within a population.

The impact of collisions is predicted to be of international spatial extent, long term duration, continuous and high reversibility. Therefore, the magnitude is considered to be low.

Sensitivity of the receptor

As detailed above as part of the alone assessment herring gull are deemed to be of high vulnerability, medium recoverability and high conservation value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect

Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will therefore be of **slight adverse significance**, which is not significant in EIA terms.

Kittiwake

Magnitude of impact

Using the largest BDMPS population of 928,207 individuals (autumn migration population, adapted from Furness, 2015 – see Table 11-11) and the average baseline mortality of 0.156, the background predicted mortality would be 144,800. The addition of 752.17 mortalities would increase the baseline mortality rate by 0.52 %.

The impact of collisions is predicted to be of international spatial extent, long term duration, continuous and high reversibility. Therefore, the magnitude is considered to be low.

Sensitivity of the receptor

As detailed above as part of the alone assessment kittiwake are deemed to be of high vulnerability, low recoverability and high conservation value. The sensitivity of the receptor is therefore considered to be high.

Significance of the effect

Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **slight adverse significance**, which is not significant in EIA terms.

11.12 Transboundary effects

The Cumulative Offshore Ornithology Study Area (see section 11.3) extends to 509.4 km and therefore includes the jurisdictions of Northern Ireland, England, Scotland and Wales. The potential cumulative transboundary impacts are addressed in section 11.11. These include, disturbance and displacement, indirect displacement, collision risk and barrier effect.

Overall, there is no potential for significant transboundary effects with regard to offshore ornithology from the Project upon the interests of the UK or other EEA States.

11.13 Interactions

A description of the likely inter-related effects arising from the Project on offshore ornithology is provided in volume 2C, chapter 32: Interactions.

11.14 Summary of impacts, mitigation measures and residual effects

This chapter has presented the results of the EIA for the potential impacts of the Project on offshore ornithology, covering all impacts during the construction, operational and maintenance, and decommissioning phases. Detailed technical information underpinning the impact assessments presented within this chapter is contained within appendix 11-1: Offshore Ornithology Technical Report; appendix 11-2: Ornithological and Marine Megafauna Aerial Survey Results; appendix 11-3: Migratory Geese Survey Report; appendix 11-4: Offshore Ornithology Collision Risk Modelling; appendix 11-5: Offshore Ornithology Displacement Analysis; appendix 11-6: Offshore Ornithology Migratory Non-Seabirds Collision Risk Modelling; and appendix 11-7: Offshore Ornithology Apportioning Impacts to Individual colonies.

Information on offshore ornithology within the Offshore Ornithology Study Area and Cumulative Offshore Ornithology Study Area was collected through a detailed desktop review of existing datasets and studies, Ireland and UK statutory guidance, detailed analysis of data collected during the site-specific surveys and consultation with relevant stakeholders.

Table 11-48 presents a summary of the potential impacts, mitigation measures and residual effects in respect to offshore ornithology. Table 11-49 presents a summary of the potential cumulative impacts, mitigation measures and residual effects.

The impacts assessed include:

- Disturbance and displacement;
- Indirect displacement resulting from changes to prey and habitat;
- Collision risk; and
- Barrier effect.

All impacts were found to have either imperceptible or slight adverse effects on offshore ornithology IEFs within the Offshore Ornithology Study Area (i.e. not significant in EIA terms).

No significant potential transboundary impacts have been identified in regard to effects of the Project.

Table 11-48: Summary of potential environment effects, mitigation and monitoring.

Description of impact	Receptor	Phase			Measures included in the project	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Residual effect	Proposed monitoring
		C	O	D							
Disturbance and displacement	Gannet	×	✓	×	EMP (volume 2A: Appendix 5-1: Environmental Management Plan)	O: Negligible	O: High	O: Slight adverse	None	O: Slight adverse	Monitoring - continual collection of abundance and distributional data in years 0, 1, 3, 5 and 15 post construction. The Year 0 survey is proposed so that an updated pre-construction population can be defined. No impacts are predicted to be significant in EIA terms, so this monitoring is proposed to be undertaken to help provide extra evidence within the Irish Sea to confirm the conclusions of this EIAR.
	Great northern diver	✓	✓	✓		C: Low O: Low D: Negligible	C: High O: High D: High	C: Slight adverse O: Slight adverse D: Slight adverse	None	C: Slight adverse O: Slight to moderate adverse D: Slight adverse	
	Guillemot	✓	✓	✓		C: Negligible O: Negligible D: Negligible	C: High O: High D: High	C: Slight adverse O: Slight adverse D: Slight adverse	None	C: Slight adverse O: Slight adverse D: Slight adverse	
	Razorbill	✓	✓	✓		C: Negligible O: Negligible D: Negligible	C: High O: High D: High	C: Slight adverse O: Slight adverse D: Slight adverse	None	C: Slight adverse O: Slight adverse D: Slight adverse	
Indirect displacement resulting from changes to prey and habitats	Seabirds	✓	✓	✓	EMP	C: Negligible O: Negligible D: Negligible	C: Low to high O: Low to high D: Low to high	C: Imperceptible or slight adverse O: Imperceptible or slight adverse D: Imperceptible or slight adverse	None	C: Imperceptible or slight adverse O: Imperceptible or slight adverse D: Imperceptible or slight adverse	
Collision risk	Common gull	×	✓	×	None	O: Low	O: High	O: Slight adverse	None	O: Slight adverse	
	Gannet	×	✓	×		O: Negligible	O: High	O: Slight adverse	None	O: Slight adverse	
	Great black-backed gull	×	✓	×		O: Low to medium (breeding) O: Low (non-breeding)	O: Low (breeding) O: High (non-breeding)	O: slight adverse (breeding) O: slight adverse (non-breeding)	None	O: Slight adverse	
	Herring gull	×	✓	×		O: Low	O: High	O: Slight adverse	None	O: Slight adverse	
	Kittiwake	×	✓	×		O: Negligible	O: High	O: Slight adverse	None	O: Slight adverse	
Barrier effect	Seabirds	×	✓	×	None	O: Negligible to low	O: Low to high	O: Imperceptible to slight adverse	None	O: Imperceptible to slight adverse	

Table 11-49: Summary of potential cumulative environment effects, mitigation and monitoring.

Description of impact	Receptor	Phase C	Phase O	Phase D	Measures included in the Project	Magnitude of impact	Sensitivity of receptor	Significance of effect	Mitigation measures	Residual effect	Proposed monitoring
Disturbance and displacement	Great northern diver	×	✓	✓	None	O: Low	O: High	O: Slight adverse	None	O: Slight adverse	Monitoring is limited to continual collection of abundance and distributional data in years 0, 1, 3, 5 and 15 post construction. The Year 0 survey is proposed so that an updated pre-construction population can be defined. No impacts are predicted to be significant in EIA terms, so this monitoring is proposed to be undertaken to help provide extra evidence within the Irish Sea to confirm the conclusions of this EIAR.
	Guillemot	×	✓	×		O: Low	O: High	O: Slight adverse	None	O: Slight adverse	
	Razorbill	×	✓	×		O: Low	O: High	O: Slight adverse	None	O: Slight adverse	
Collision risk	Common gull	×	✓	×	None	O: Low	O: High	O: Slight adverse	None	O: Slight adverse	
	Great black-backed gull	×	✓	×		O: Low	O: Low	O: Imperceptible	None	O: Slight adverse	
	Herring gull	×	✓	×		O: Low	O: High	O: Slight adverse	None	O: Slight adverse	
	Kittiwake	×	✓	×		O: Low	O: High	O: Slight adverse	None	O: Slight adverse	

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