Bowdun Offshore Wind Farm, Offshore EIA Report

Volume 2, Chapter 11: Offshore Ornithology

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Contents

List of Tables

List of Figures

Glossary

Defined Term	Definition
Annex I	Habitats of community interest whose conservation requires the designation of Special Areas of Conservation (SACs), as identified in Annex I of the Habitats Directive (Council Directive 92/43/EEC).
Applicant (the)	Bowdun Offshore Wind Farm Limited (BOWFL).
Appropriate Assessment (AA)	An assessment to determine the implications of a plan or project for a European site in view of that site's conservation objectives. An Appropriate Assessment forms part of the Habitats Regulations Appraisal (HRA) and is required when a plan or project (either alone or in combination with other plans or projects) is likely to have a significant adverse effect on a European site.
Array Area	The Array Area is the area in which the Offshore Generation Assets will be located.
Bowdun Offshore Wind Farm Limited (BOWFL)	A Special Purpose Vehicle (SPV) (legal entity) for the purpose of developing the Project. BOWFL are the Applicant for the Offshore Application.
Barrier Effects	The effect by which an animal or bird has to make longer transits between a breeding or roosting location to an area of foraging. An Offshore Wind Farm (OWF) could act as a barrier in which a species has to fly around to reach the other side, some species are unlikely to travel through or over.
Collision (Ornithology and Bat)	The effect by which a bird, or bat, may be impacted by direct collision. Birds passing through an OWF are at risk of colliding with the Wind Turbines (moving and stationary parts).
Cumulative Effects	The effects of the Proposed Development assessed together with effects from the Onshore Infrastructure forming the Project as well as one or more different projects on the same receptor/resource.
Digital Aerial Surveys (DAS)	A method for undertaking baseline ornithological and marine mammal data collection surveys. Usually undertaken over a period of 24 months.
Displacement	An impact that occurs when an animal is forced away from an area of habitual usage. This can be temporary (i.e. a ship moving) or permanent (i.e. the placement of offshore infrastructure).
Effect	Term used to express the consequence of an impact (i.e. the result of change or changes on specific environmental resources or receptors). The significance of an effect is determined by correlating the magnitude of the impact with the importance, or sensitivity of the receptor or resource in accordance with defined significance criteria.
Embedded Mitigation	Measures that are adopted as part of the Proposed Development and therefore assessed within the EIA. The proposed approach for the EIA for the Proposed Development is that Embedded Mitigation includes both primary mitigation and tertiary mitigation. These are defined by the ISEP as follows: Primary: Modifications to the location or design of the development made during the pre-application phase that are an inherent part of the project, and do not require additional action to be taken.

Defined Term	Definition
	Tertiary: Actions that would occur with or without input from the EIA feeding into the design process. These include actions that will be undertaken to meet other existing legislative requirements, or actions that are considered to be standard practices used to manage commonly occurring environmental effects.
Environmental Impact Assessment (EIA)	Process for the assessment of likely significant effects of the Proposed Development on the physical, biological, and human environment during construction, Operation and Maintenance (O&M) and decommissioning.
Environmental Impact Assessment Regulations (EIA Regulations)	Terminology used in this Offshore EIA Report to refer to three sets of regulations: • The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017; • The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017; and • The Marine Works (Environmental Impact Assessment) Regulations 2007.
Export Cable Corridor	The area seaward of Mean High Water Springs (MHWS), which connects the Array Area with the Landfall area within which the Offshore Export Cables will be installed.
Habitats Regulations	A term that refers to the collective legislation that translates the Habitats Directive into specific legal obligations in Scotland, namely: the Conservation (Natural Habitats, &c.) Regulations 1994; the Conservation of Habitats and Species Regulations 2017; and the Conservation of Offshore Marine Habitats and Species Regulations 2017 (in each case as amended).
Habitats Regulations Appraisal (HRA)	An assessment carried out under the Habitats Regulations to determine if a plan or project could adversely affect the integrity of a European site.
Impact	A change caused by an action that occurs during a project's lifetime.
Inter-Array Cables (IAC)	Cables which link the Wind Turbines to each other and with the Offshore Substation Platforms (OSPs).
Inter-Related Effects	The potential effects of multiple impacts from the construction, O&M and decommissioning of the Project, affecting one receptor.
Interconnector Cables	Cables which will connect individual OSPs to each other to provide redundancy against cable failure elsewhere.
Intertidal Area	The area between MHWS and Mean Low Water Springs (MLWS).
Intertidal Survey Area	The proposed Landfall area and a surrounding 250 m buffer.
Landfall	The area in which the Offshore Export Cables make landfall and is also the transitional area between the Offshore Transmission Assets and the Onshore Transmission Assets. Located in the Intertidal Area at Benholm.
Likely Significant Effect (LSE)	A significant effect on a designated site that has the potential to occur as a result of the Proposed Development (as determined by the LSE Screening Report). Where a LSE cannot be ruled out, further assessment is needed as part of the AA.
Marine Directorate (MD)	The Marine Directorate of the Scottish Government, formerly known as Marine Scotland. The planning and licensing authority for Scotland's seas and custodian of Scotland's National Marine

Defined Term	Definition
	Plan (NMP). The Marine Directorate - Licensing and Operations Team (MD-LOT) are specifically responsible for managing Section 36 Consent and Marine Licence Applications seaward of MHWS.
Marine Directorate – Science, Evidence, Data and Digital (MD-SEDD)	The scientific division of the MD, which provides expert scientific, economic and technical advice and services on issues relating to marine fisheries, aquaculture, marine renewable energy, and the aquatic environment and its flora and fauna.
Marine Licence	A Marine Licence permits the undertaking of different activities in the marine environment, including construction, the deposition or removal of substances or objects, and dredging. The Marine (Scotland) Act 2010 requires Marine Licences to be obtained for licensable activities taking place within Scottish Territorial Seas. The Marine and Coastal Access Act (MCAA) 2009 requires a Marine Licence to be obtained for licensable marine activities within the Scottish offshore region (12 nm – 200 nm).
Maximum Design Scenario (MDS)	The scenario within the design envelope likely to result in the greatest impact on a particular topic receptor, and therefore the one that should be assessed for that topic receptor.
Mean High Water Springs (MHWS)	The average tidal height throughout the year of two successive high waters during those periods of 24 hours when the range of the tide is at its greatest.
Mean Low Water Springs (MLWS)	The average tidal height throughout the year of two successive low waters during those periods of 24 hours when the range of the tide is at its greatest.
Micro/Meso/Macro Avoidance	Three scales of avoidance that may be shown by birds in response to OWFs and the individual turbines. Microavoidance is avoidance within metres of the Wind Turbine, mesoavoidance is avoidance within the footprint of the wind farm from Wind Turbines and macroavoidance is avoidance of the whole wind farm.
Mitigation	Measures to avoid, prevent, reduce or control effects on the environment. See also definitions for Embedded Mitigation and Additional Mitigation.
Offshore Environmental Impact Assessment (EIA) Report (hereafter, 'Offshore EIA Report')	Document prepared to report the findings of the EIA for the Proposed Development and produced in accordance with the EIA Regulations. The Offshore EIA Report is submitted to support the Offshore Application for the Proposed Development, and to comply with EIA Regulations.
Offshore Export Cables	Subsea cables used to transmit electricity generated offshore by the Wind Turbines from the OSPs to shore. The Transition Joint Bay is the location where the Offshore Export Cables terminate, and the onshore cabling begins.
Offshore Infrastructure	All of the Offshore Infrastructure associated with the Proposed Development that is located seaward of MHWS, comprising the Offshore Generation Assets and the Offshore Transmission Assets.
Offshore Scoping Report	The Report that presents the findings of the EIA scoping process undertaken for the Proposed Development with the purpose of obtaining a Scoping Opinion. The Report defines what is intended to be assessed and reported as part of the EIA.
Operation and Maintenance (O&M)	The phase of the Proposed Development following completion of construction. This phase of development includes routine inspections, repairs and replacement of infrastructure and equipment (including Interconnector Cables and IACs), scour

Defined Term	Definition
	protection replenishment or replacement, major component replacement, painting and/or other coating works, removal of marine growth, and replacement of access ladders.
Pathway	Describes the means or route by which a receptor (such as the seabed) can be affected by an identified impact source (such as Wind Turbine foundations).
Plan Option Area (POA)	A location identified in the SMP as a preferred area for commercial scale offshore wind development.
Population Viability Analysis (PVA)	Numerical modelling of a population which looks at the difference between the baseline (counterfactual) and impacted scenarios. PVA is used to understand how the population growth rate and population size is affected by the predicted impact.
Project (the)	An overarching term for the Bowdun Offshore Wind Farm (Bowdun OWF) comprising the offshore and onshore infrastructure required to generate and transmit electricity from the Array Area to the onshore Grid Connection Point. The Project includes the Offshore Generation Assets, the Offshore Transmission Assets and the Onshore Transmission Assets.
Project Design Envelope (PDE)	A description of the range of possible elements that make up the design options for the Proposed Development under consideration when the exact engineering parameters are not yet known.
Proposed Development	Term used to define the Offshore Infrastructure associated with the Project seaward of MHWS for which consent is being sought. Further details of the parameters are included in Volume 1, Chapter 3: Project Description.
Qualifying Features	The features for which a European site has been officially designated to protect.
Ramsar Site	Wetlands of international importance, designated under the Ramsar Convention on Wetlands of International Importance 1971.
Report to Inform Appropriate Assessment (RIAA)	The RIAA provides detailed information to support the process of Appropriate Assessment (undertaken by the competent authority) as part of the HRA, which evaluates the potential impacts of a project or plan on European sites.
Scoping Opinion	A document produced by MD-LOT which is issued in response to submission and review of the Offshore Scoping Report. The Scoping Opinion is supported with feedback and advice from consultees, which details what is expected to be included in the Offshore EIA Report and what can be scoped out of the EIA process.
Scoping Workshop	A series of sessions preceding the finalisation of the Offshore Scoping Report to provide an opportunity for the Applicant to consult on the draft scope and for stakeholders to request additional information on key issues.
ScotWind	ScotWind is 'plan-led'. There are 20 ScotWind projects with seabed option agreements through the Crown Estate Scotland to develop offshore wind projects. The first 17 successful projects were announced in April 2022. This means that all sites are within the areas of seabed identified in the Scottish Government's Sectoral Marine Plan for Offshore Wind.

Defined Term	Definition
Sectoral Marine Plan (SMP)	A plan developed by the Scottish Government which provides the strategically planned spatial footprint for offshore wind development in Scotland.
Significance	Effect factor that is determined by the magnitude of impact along with the sensitivity of the receptor.
Site Boundary	The boundary within which all elements of the Proposed Development will be located. The Site Boundary comprises the Array Area and Export Cable Corridor which ends at MHWS.
Special Protection Areas (SPAs)	SPAs are sites that are designated to protect rare or vulnerable birds (as listed on Annex I of the Directive 2009/147/EC on the conservation of wild birds), as well as regularly occurring migratory species.
Statutory Nature Conservation Body (SNCB)	A statutory adviser to the UK and Scottish Governments on Scottish, UK and international nature conservation.
Study Area	For each environmental topic, the baseline environment will be characterised, and the potential environmental impacts will be described within a topic-specific study area. Specific study areas are defined for each topic and are based on the maximum spatial extent across which potential impacts of the Project may be experienced by the relevant receptors (i.e. Zone of Influence).
Thistle Wind Partners (TWP)	Company established for the development of the Project.
Wind Turbines	Structures comprising of a tubular tower, rotor blades, and a nacelle which houses the Wind Turbine generator.

Acronyms

Acronym	Definition
AA	Appropriate Assessment
BOWFL	Bowdun Offshore Wind Farm Limited
BDMPS	Biologically Defined Minimum Population Scales
BOCC5	Birds of Conservation Concern 5th review
BTO	British Trust for Ornithology
CEA	Cumulative Effects Assessment
CEF	Cumulative Effects Framework
CEH	Centre for Ecology & Hydrology
CIEEM	Chartered Institute for Ecology and Environmental Management
CMS	Construction Method Statement
CPGR	Counterfactual Population Growth Rate
CPS	Counterfactual Populations Size
CRM	Collision Risk Modelling
DAS	Digital Aerial Surveys
DEFRA	Department for Environment Food and Rural Affairs
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EPS	European Protected Species
EU	European Union
HAT	Highest Astronomical Tide
HDD	Horizontal Directional Drilling
HPAI	Highly Pathogenic Avian Influenza
HRA	Habitats Regulations Appraisal
HSE	Health and Safety Executive
IAC	Inter-Array Cable
INNS	Invasive Non-Native Species
IPR	Iterative Plan Review
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
LAT	Lowest Astronomical Tide
LiDAR	Light Detection and Ranging
LSE	Likely Significant Effect
MAT	Migration Assessment Tool
mCRM	Migratory CRM
MDS	Maximum Design Scenario
MD	Marine Directorate
MD-LOT	Marine Directorate-Licensing Operations Team

Acronym	Definition
MD-SEDD	Marine Directorate – Science Evidence, Data and Digital
MHWS	Mean High Water Spring
MLS	Most Likely Scenario
MLWS	Mean Low Water Spring
MPCP	Marine Pollution Contingency Plan
MPS	Marine Policy Statement
MSS	Marine Scotland Science
NEEOG	North Eastern and Eastern Ornithological Group
NMP	National Marine Plan
NRW	Natural Resource Wales
NSP	Navigation Safety Plan
OWF	Offshore Wind Farm
O&M	Operation and Maintenance
PCH	Proportion at Collision Height
PDE	Project Design Envelope
PMF	Priority Marine Features
POA	Plan Option Area
PVA	Population Viability Analysis
RIAA	Report to Inform Appropriate Assessment
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
ScotMER	Scottish Marine Energy Research
sCRM	Stochastic Collision Risk Model
SD	Standard Deviation
SMP	Sectoral Marine Plan
SNCB	Statutory Nature Conservation Body
SOSSMAT	Strategic Ornithological Support Services Migration Assessment Tool
SPA	Special Protection Area
SSC	Suspended Sediment Concentration
SSSI	Site of Specific Scientific Interest
TWP	Thistle Wind Partners Limited
UK	United Kingdom
UXO	Unexploded Ordnance
VMP	Vessel Management Plan
VOR	Valued Ornithological Receptor
WCS	Worst Case Scenario
ZOI	Zone of Influence

Table of Units

Units	Definition
%	Percent
‘	Minute
kJ	Kilojoule
km	Kilometre
kV	Kilovolt
m	Metre
m^2	Metre squared
MW	MegaWatt

11 Offshore Ornithology

11.1 Introduction

11.1.1 This chapter of the Offshore Environmental Impact Assessment (EIA) Report presents the assessment of the likely significant environmental effects on offshore ornithology that may occur as a result of the Proposed Development during its construction, Operation and Maintenance (O&M) and decommissioning phases.

11.1.2 This chapter should be read in conjunction with the project description which can be found in Volume 1, Chapter 3: Project Description, and the relevant parts of the following chapters and appendices:

- Volume 2, Chapter 7: Physical Processes, due to potential effects on prey availability (such as the abundance and distribution of fish or shellfish);
- Volume 2, Chapter 8: Benthic Ecology, due to habitat interactions in the intertidal and nearshore area; and
- Volume 2, Chapter 9: Fish and Shellfish Ecology, due to the potential indirect effects from potential changes in distribution and abundance of fish species.

11.1.3 This chapter is also informed by the following technical appendices:

- Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report;
- Volume 3, Technical Appendix 11.2: Nearshore, Intertidal and Offshore Ornithology Along the Export Cable Corridor Baseline Report;
- Volume 3, Technical Appendix 11.3: Offshore Ornithology Displacement Technical Report;
- Volume 3, Technical Appendix 11.4: Offshore Ornithology Collision Risk Model Technical Report;
- Volume 3, Technical Appendix 11.5: Offshore Ornithology Migratory Bird Collision Risk Model Technical Report;
- Volume 3, Technical Appendix 11.6: Offshore Ornithology Apportioning Technical Report; and
- Volume 3, Technical Appendix 11.7: Offshore Ornithology Population Viability Analysis Technical Report.

11.2 Offshore Ornithology Study Area

11.2.1 The Offshore Ornithology Study Area is comprised of two component areas (Figure 11.1):

- The Array Area Study Area: consists of the original E3 Plan Option Area (POA) plus a 12 km buffer except westwards, where it extends all the way to the Aberdeenshire coast during summer months; and
- The Export Cable Corridor Study Area: consists of the Export Cable Corridor route plus a 10 km buffer to the Mean High Water Spring (MHWS).

11.2.2 The Array Area Study Area is the area over which Digital Aerial Surveys (DAS) were undertaken. Guidance outlined by NatureScot (2023a) and the Joint Nature Conservation Committee (JNCC, 2022a) requires impacts from displacement to be assessed using a buffer of 2 km from the Array Area for the majority of species. However, more sensitive species may require a larger buffer for assessment (NatureScot, 2023a). To account for this, a 12 km buffer around the E3 POA was flown as part of the DAS during winter months (September to March, inclusive) to provide a more comprehensive and robust context to the Array Area. During the summer months (April to August, inclusive), the Array Area Study Area was extended westwards to give greater coverage towards the Aberdeenshire coast, where breeding colonies are located (e.g. Fowlsheugh Special Protection Area (SPA)), to provide important additional context on bird distribution and abundance. To differentiate between the two areas covered by DAS, the area flown during winter months is referred to as the DAS Area and the area flown during the summer months is referred to as the Extended DAS Area (Figure 11.1). The data collected over a larger spatial extent allows for a more robust understanding of any displacement effects that may occur.

11.2.3 The Export Cable Corridor Study Area spans the area between the Array Area and the Export Cable Corridor up to MHWS plus a 10 km buffer. The DAS Area partially covers the Export Cable Corridor Study Area, whereas the Extended DAS Area covers the majority of the Export Cable Corridor Study Area (see Figure 11.1). In addition to DAS, intertidal surveys which extended up to 250 m seaward from the shore were also conducted. For areas not covered by DAS or intertidal surveys, baseline data was obtained from desk-based literature sources such as the Wetland Bird Survey database. A 10 km buffer was considered along the length of the Export Cable Corridor Study Area due to some species present within this area (e.g. red-throated diver *Gavia stellata*) potentially being highly sensitive to vessel movement and displacement (JNCC, 2022b; Natural England updated).

11.2.4 Further details of the DAS method can be found in Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report and the methodology for the intertidal surveys can be found in Volume 3, Technical Appendix 11.2: Nearshore, Intertidal and Offshore Ornithology Along the Export Cable Corridor Baseline Report.

11.2.5 A further wider regional study area was also identified encompassing species-specific foraging ranges, derived from Woodward *et al.* (2019) (NatureScot, 2023b), during the breeding season and the species-specific Biologically

Defined Minimum Population Scales (BDMPS) from Furness (2015) during the non-breeding season (see Paragraphs 11.6.2 to 11.6.8 for further detail). These regions have been used to determine the relevant regional populations for assessment.

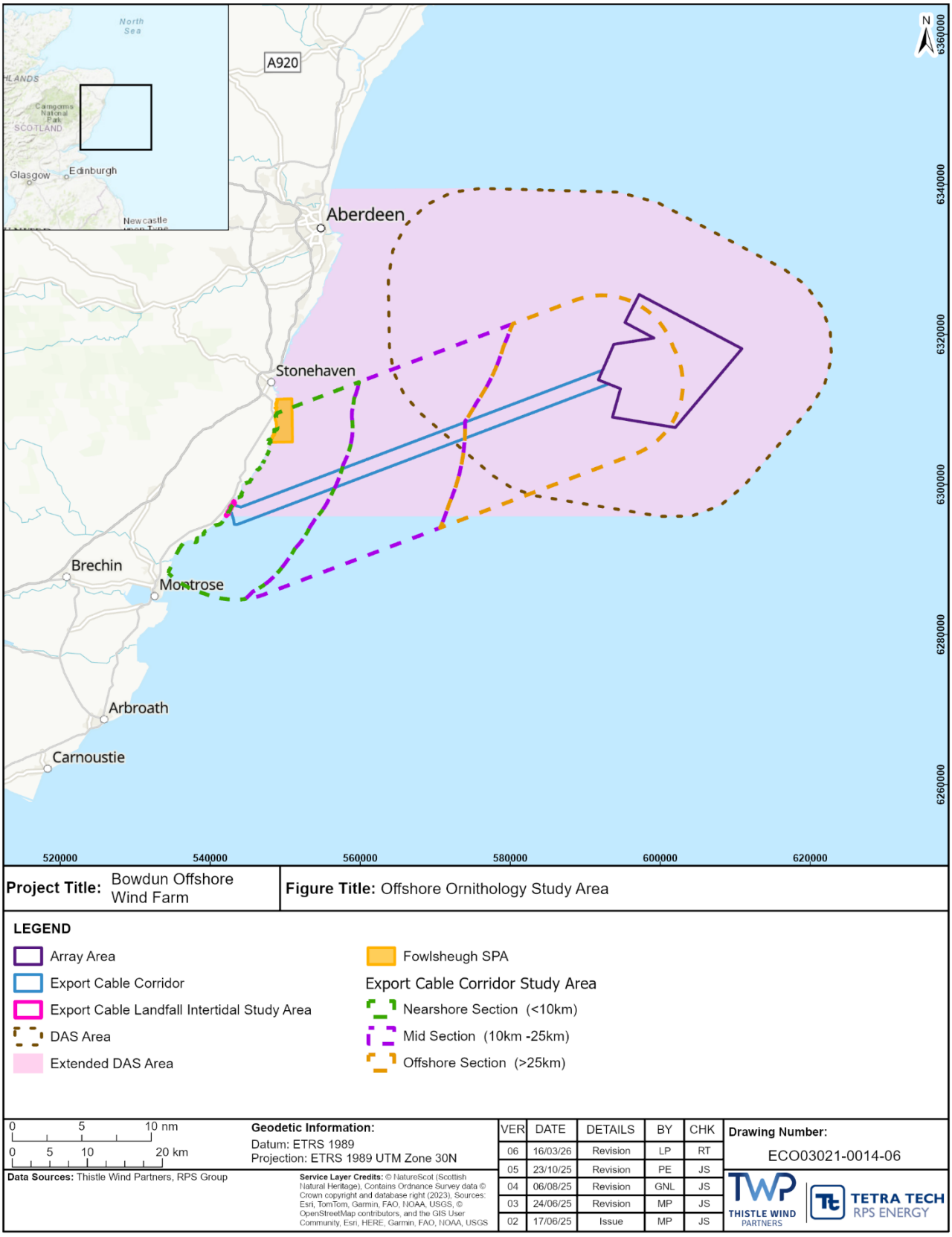

Figure 11.1: Offshore Ornithology Study Areas

11.3 Legislative and Policy Context

11.3.1 The overarching policy and legislation applicable to the Proposed Development is presented in Volume 1, Chapter 2: Policy and Legislation. Policy and legislation specific to offshore ornithology, is contained in the Sectoral Marine Plan (SMP) for Offshore Wind Energy (Scottish Government, 2020), the Scottish National Marine Plan (NMP) (Scottish Government, 2015) and the United Kingdom (UK) Marine Policy Statement (MPS) (HM Government, 2011). A summary of the legislative provisions relevant to offshore ornithology are provided in Table 11.1 below, with other relevant policy provisions set out in Table 11.2. These are summarised here with further detail presented in Volume 3, Technical Appendix 5.1: Consultation Log, and Volume 3, Technical Appendix 5.2: Pre-Application Consultation Report.

Table 11.1: Summary of Legislation Relevant to Offshore Ornithology

Summary of Relevant Legislation	How and Where Considered in the Offshore EIA Report
Biodiversity	
The Habitats Regulations: **The Conservation of Offshore Marine Habitats and Species Regulations 2017** **Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)**	The Habitats Regulations require that where a plan or project that is not directly with, or necessary to the management of a European site, but likely to have a significant effect on a European site (either individually or in combination with other plans or projects), it shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. Likely significant environmental effects on ornithological features of European sites are considered from an EIA perspective (Proposed Development alone and cumulatively) within this Offshore EIA Report.
The Nature Conservation (Scotland) Act 2004 (as amended)	This Act sets out a series of measures which are designed to conserve biodiversity and to protect and enhance the biological and geological natural heritage of Scotland. This Offshore EIA Report demonstrates that the Proposed Development will comply with the Act and provides information to public bodies and office holders to enable them to fulfil their obligations under the Act.
Wildlife and Natural Environment (Scotland) Act 2011	This Act makes amendments to the 1981 Act (below) which concern the management of Sites of Specific Scientific Interest (SSSIs) and the enforcement of wildlife crime. Further detail on how SSSIs have been treated within this report is presented in Paragraph 11.5.3 to 11.5.5.
The Wildlife and Countryside Act 1981 (as amended)	The primary legislation protecting animals, plants and certain habitats in the UK, including all wild birds and their nests, eggs and chicks. This Offshore EIA Report demonstrates that the Proposed Development will comply with the Act and provides information to public bodies and office holders to enable them to fulfil their obligations under the Act.

Summary of Relevant Legislation	How and Where Considered in the Offshore EIA Report
The Convention on Wetlands of International Importance 1971	The mission of this Convention is to support the conservation and wise use of all wetlands through local and national actions and international cooperation. Most Ramsar sites in Scotland are linked to the European site network as a SPA or Special Areas of Conservation (SAC). For the purpose of this Offshore EIA Report, no Ramsar sites were found to have connectivity with the Proposed Development but have been considered within the Habitats Regulations Appraisal (HRA).
EIA Regulations: **The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017** **The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017**	The EIA Regulations set out when EIAs are required and the procedures for carrying out and reporting of EIAs. It is noted that the Proposed Development does meet the criteria for carrying out an EIA, and this Offshore EIA Report is therefore set out to meet the requirements of the EIA Regulations.

Table 11.2: Summary of Policy Provisions Relevant to Offshore Ornithology

Summary of Relevant Policy	How and Where Considered in the EIA Report
Scottish National Marine Plan	
Section 11, Part 1: Objectives and Marine Planning Policies **Sustainable development of offshore wind, wave and tidal renewable energy in the most suitable locations**	The choice of location for the Proposed Development is discussed in Volume 1, Chapter 6: Site Selection and Consideration of Reasonable Alternatives.
Policy GEN 9 Natural Heritage **Development and use of the marine environment must:** **Comply with legal requirements for protected areas and protected species;** **Not result in significant impact on the national status of Priority Marine Features (PMFs); and** **Protect and, where appropriate, enhance the health of the marine area.**	This Offshore EIA Report sets out how the Proposed Development will comply with all relevant legal requirements (refer to Table 11.1). No ornithological features are classified as PMFs except for black guillemot. Black guillemot have been scoped out of the assessment due to low abundance (see Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report). Therefore, they are not discussed further in this chapter.
Living within Environmental Limits **11.32 A strategic approach to mitigating potential impacts and cumulative impacts on the marine environment forms an integral part of marine planning and decision making, whilst issues arising in the coastal interface should align between marine and terrestrial processes.**	A Cumulative Effect Assessment (CEA) has been undertaken and is outlined in Section 11.2 which can be used to inform the Scottish Government's strategic approach to planning and decision making.
Sectoral Marine Plan for Offshore Wind Energy	

Summary of Relevant Policy	How and Where Considered in the EIA Report
The Plan aims to identify sustainable plan options for the future development of commercial scale offshore wind energy in Scotland.	The Proposed Development is located within the E3 Plan POA. The location of the Proposed Development has therefore been informed by the Plan Development Process.
Within the East region a key pathway of concern relates to effects on bird populations, due to potential in - combination impacts resulting from collision risk and displacement for key seabird species.	The potential impact on bird populations from the Proposed Development alone and in-combination with other projects is assessed in this chapter and the accompanying Report to Inform the Appropriate Assessment (RIAA).

11.4 Consultation

11.4.1 The approach to consultation for the Proposed Development is set out in Volume 1, Chapter 5: Consultation and Engagement. A summary of the issues raised during consultation activities undertaken to date specific to offshore ornithology is presented in Table 11.3, together with how these issues have been considered in the production of this assessment. Further detail is presented within Volume 3, Technical Appendix 5.1: Consultation Log, and Volume 3, Technical Appendix 5.2: Pre-Application Consultation Report.

Table 11.3: Summary of Key Consultation Issues Raised During Consultation Activities Undertaken for the Proposed Development Relevant to Offshore Ornithology

Date	Consultee and Type of Consultation	Summary of Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
11/03/2022	Marine Directorate - Licensing Operations Team (MD-LOT), NatureScot: 2022 conference call	Introductory meeting where the Applicant provided an overview of the Proposed Development and proposed site characterisation surveys.	The Applicant to provide regular updates at the MD-LOT quarterly meetings.
18/07/2022	MD-LOT, NatureScot: 2022 Quarterly catch-up conference call	The Applicant provided an update on the Proposed Development. Clarification provided as to timeframe expectations which have been used by the applicant in programme working. DAS to date were summarised. MD-LOT requested early sight of any reports. MD-LOT acknowledged timings of DAS can be difficult due to poor weather. The DAS scope, timings and surveys to date were agreed to be appropriate and sufficient by MD-LOT and NatureScot.	The Applicant provided interim reports to MD-LOT and NatureScot.
03/2022	North-East and Eastern ScotWind Developer Groups: 2022 conference call	Collaboration via the North-East and Eastern Ornithology Group (NEEOG) developing targeted surveys and desk-based research to address the evidence gaps in the Ornithology Roadmap. Active collaboration between North-East Ornithology Group and the Eastern Ornithology. Group to financially contribute to and support scope of works for regional SPA colony counts being undertaken by Royal Society for the Protection of Birds (RSPB) in 2023, 2024 and 2025.	The results of NEEOG surveys have been discussed within the Offshore EIA Report in Section 11.6.
18/11/2022	MD-LOT, NatureScot: 2022 Quarterly catch-up conference call	MD-LOT confirmed that the SMP Iterative Plan Review (IPR) is looking for developer input. MD-LOT also provided an update on the Cumulative Effects Framework (CEF) and strategic compensation measures.	The Applicant provided input to the SMP IPR and confirmed its willingness to assist with the evidence gap filling of ScotMER.

Date	Consultee and Type of Consultation	Summary of Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
		MD-LOT highlighted evidence gaps that Scottish Marine Energy Research (ScotMER) are looking to fill.	
20/01/2023	Marine Directorate – Science Evidence, Data and Digital (MD-SEDD): 2023 Developer Strategic Ornithology Research Meeting	MD-SEDD provided updates to the SMP scope of work and associated ScotMER projects. MD-SEDD will confirm how developers could assist in providing data to review some of the uncertainty for these projects.	Developers, as part of NEEOG, have strategically undertaken census and sample plot surveys of potentially impacted colonies (North Caithness Cliffs SPA in 2023 and both the North and East Caithness Cliffs SPAs in 2024 and 2025). NEEOG has and continues to support kittiwake tracking from Buchan Ness to Collieston Coast SPA, and guillemot and razorbill tracking at Copinsay SPA, Fowlsheugh SPA, Troup, Pennan and Lion's Heads SPA and other colonies, along with targeted seabird counts and productivity monitoring. The baseline data, and developments in survey methods and coverage have been used to help inform the monitoring proposals set out in Section 11.13.
14/02/2023	RSPB: conference call	Introducing the project	N/A
03/03/2023	MD-LOT, NatureScot: 2023 Quarterly catch-up conference call	MD-LOT confirmed CEF workshop will happen in March 2023. NatureScot provided an update on new guidance published in January 2023.	The Applicant attended the CEF workshop. The assessment presented within the Offshore EIA Report uses NatureScot's guidance (NatureScot, 2020, 2023a to h & 2025a to b).
12/06/2023	MD-LOT, NatureScot: 2023 Quarterly catch-up conference call	MD-LOT provided update to the new structure with ScotMER now under the Offshore Wind Directorate. Also, an update on ScotMER projects. The migratory Collision Risk Modelling (CRM) update undertaken by Centre for Ecology & Hydrology (CEH) will be published soon.	The Applicant sent first breeding season DAS bird results and initial Light Detection and Ranging (LiDAR) survey results. MD-LOT to send links mentioned in update. The migratory CRM tool provided by CEH will be used within the Offshore EIA Report (see Volume 3, Technical Appendix 11.5: Offshore

Date	Consultee and Type of Consultation	Summary of Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
			Ornithology Migratory Bird Collision Risk Model Technical Report and Section 11.10).
11/09/2023	MD-LOT, NatureScot: 2023 Quarterly catch-up conference call	MD-LOT provided an update on the cumulative effects framework that testing has started. MD-LOT confirmed the next ScotMER symposium would be in February 2024 with updates on specific projects undertaken. The SMP IPR is due to be adopted in 2024. Plan level derogation required in north-east Scotland.	The Applicant sent the first breeding season DAS bird results and initial LiDAR survey results. The Applicant continued to work with other developers via NEEOG and to provide additional data to aid the Marine Directorate (MD) and NatureScot to understand the HRA risks and potential for adverse projects.
11/12/2023	MD-LOT, NatureScot: 2023 Quarterly catch-up conference call	MD-LOT provided updates on the CEF, the streamlining team, ScotMER, strategic compensation, the Energy Bill, the SMP IPR, and resourcing. The pre-meeting questions were discussed. These included questions on scoping workshops, Wind Turbine layout and ornithology assessment.	The Applicant sent a doodle poll to stakeholders for the scoping workshop and send ornithology questions to NatureScot, who were unable to attend the quarterly catch-up.
11/03/2024	MD-LOT, NatureScot: 2024 Quarterly catch-up conference call	MD-LOT provided an update on the CEF and mentioned that it will be completed in summer 2024. They also provided an update on: • The work of the streamlining team and the marine renewable licensing and consenting guidance; • ScotMER; • The Energy Act and strategic compensation; • The National Marine Plan 2; and • The SMP IPR.	The Applicant gave a general project update and the information provided by MD-LOT was noted by the Applicant.
03/04/2024	NatureScot: Email sent	Update note regarding discrepancy between raw seabird counts in APEM report and RPS 12-month interim survey report.	Data points included in the APEM report from beyond the 12 km buffer were excluded to ensure consistency.
25/04/2024	MD-LOT, NatureScot, and RSPB: Bowdun	Clarification by NatureScot and RSPB on the impact assessment and provided recommendations on the	The Applicant has followed this advice accordingly.

Date	Consultee and Type of Consultation	Summary of Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
	Offshore Scoping Workshop – Offshore Ornithology section	ornithological approach. Multiple studies and updated guidance were provided for clarification. Clarified discrepancy between ornithological data sets. Confirmation of approach to CEA and study area. NatureScot noted that post-construction monitoring has been adopted for recent projects. Post-workshop advice included clarification on: connectivity in the breeding season, using straight-line distance for foraging ranges; guidance on population viability analysis; how avoidance rates and flight heights are interlinked; and available tools for CRM.	The Applicant used the latest available NatureScot guidance for the assessment. The Applicant used the best available displacement analysis but was unable to commit to using SeabORD because of the difficulties acknowledged by NatureScot in running the current version of the software. Demographic rates from Horswill and Robinson (2015) were used as updated rates were not published at the time PVA was carried out (see Volume 3, Technical Appendix 11.7: Offshore Ornithology Population Viability Analysis Technical Report).
26/04/2024	NatureScot: Email response	Email response providing clarifications to the points raised by NatureScot on the DAS methodology and survey results from the first 12 months.	Further information provided to NatureScot on the DAS methodology and survey results. DAS methodology and survey results are presented in Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report and discussed in Section 11.2 and Section 11.5.
10/06/2024	MD-LOT: Quarterly meeting	NatureScot provided the following advice in relation to PVA for ornithology: • PVAs will be required for all sites and species where the combined breeding and non-breeding season threshold of 0.02 percentage point change for adult annual survival rate was met or exceeded for project alone or in-combination impacts. • A PVA of the in-combination effect is not required where the project alone impact is less than 0.2 birds per annum. In this instance a table should be provided that details by site and species what the point change in adult survival rate are and number of birds impacted per annum.	The Applicant followed NatureScot advice accordingly, as set out in Section 11.10, Section 11.11 and Section 11.12. The 0.02 percentage threshold has been used in the PVA carried out in support of this assessment (see Volume 3, Technical Appendix 11.7: Offshore Ornithology Population Viability Analysis Technical Report).

Date	Consultee and Type of Consultation	Summary of Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
11/09/2024	MD-LOT confirming consultation for the Offshore EIA Scoping Report has begun	MD-LOT confirming that the consultation for the Offshore EIA Scoping Report and associated appendices has begun.	See response to Scoping Opinion on 25/11/2024.
24/09/2024	RSPB: Conference call	Project update call. Points raised were the same as in the Scoping Opinion (see below).	See response to Scoping Opinion on 25/11/2024.
20/11/2024	NatureScot: Email	NatureScot provided advice on Year 1 and 2 DAS. It is recommended that SPA populations are derived from the Seabird Counts census (Burnell *et al*., 2023). It is highlighted that foraging ranges have been inconsistently applied and recommended foraging ranges from Woodward *et al*. (2019) should be used during screening.	Colony counts have derived from the Seabird Counts census (Burnell *et al*., 2023) have been used within the assessment (see Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report and Volume 3, Technical Appendix 11.6 Offshore Ornithology Apportioning Technical Report). Recommended foraging ranges have been used to identify sites (Section 11.6)
25/11/2024	MD-LOT, NatureScot, RSPB: Scoping Opinion	**Study Area and Data** • Study areas and data sources are generally acceptable but require clearer descriptions of key resources. • Regional Study Area to be defined using breeding season foraging ranges during the breeding season and BDMPS regions (Furness, 2015) during the non-breeding season. • Breeding season foraging range to be used for guillemot and herring gull during the non-breeding season. • LiDAR can be used for comparison, but generic flight height information from Johnston *et al*. (2014) should be primarily used. • Avoid relying on the West of Orkney 2023 application for ornithology due to ongoing amendments.	**Study Area and Data** • Data sources further clarified in Section 11.5. • Species-specific breeding season foraging ranges and BDMPS regions (Furness, 2015) used to determine regional study areas in the breeding and non-breeding season for all species except guillemot and herring gull (see Section 11.5). • Guillemot and herring gull breeding foraging ranges were used year-round (see Section 11.5). • LiDAR data was used for comparison for kittiwake only as set out in Paragraph 11.10.30, with results for both methods presented in Section 11.10. • West of Orkney has now been consented, updated data submitted as part of the

Date	Consultee and Type of Consultation	Summary of Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
			Additional Information for the project (submitted in 2024) used.
		Impacts and Assessment • Broadly content with scoped in impacts; pleased that disturbance to birds from vessel movements and the extent of the assessment required will depend on ports used. • Direct impacts to birds from Unexploded Ordnance (UXO) detonations should be included alongside indirect underwater noise effects. • Nocturnal species (European storm petrel, Leach's petrel, Manx shearwater) are vulnerable to light attraction and disorientation; qualitative assessments of lighting impacts are expected. • Noted that updated availability bias correction factors for auks and red-throated diver (Dunn *et al.*, 2024) may become available. • CRM guidance is updated; both stochastic and deterministic outputs are required; fulmar is excluded from CRM due to low collision risk. • Migratory CRM tools are under development; strategic assessments are ongoing and may be applied. • Use SeabORD to assess distributional effects during chick rearing for guillemot, razorbill, puffin, and kittiwake. • A 0.02 percentage point decrease in survival should be used to determine whether PVAs are required for the PVA, with three periods (25 year, operational lifespan and 50 year) modelled.	Impacts and Assessment • Vessel disturbance impacts, direct impacts from UXO and attraction to light are presented in Section 11.10. • Impacts to birds from UXO and indirect effects are presented in Section 11.10. • Impacts to European storm petrel and Manx shearwater have been considered in Section 11.10. Leach's petrel has been screened out as only one individual observed within full DAS dataset (see Paragraphs 11.6.16 to 11.6.17). • Review of updated availability bias correction factors (Dunn *et al.*, 2024) had not been completed at the time of data analysis. • CRM impact presented in Section 11.10, fulmar excluded. • Migratory collision risk presented in Section 11.10 • Further consultation on the 30 April 2025, NatureScot advised the use of the matrix approach rather than SeabORD. • PVA threshold of 0.02% reduction in survival implemented (see Sections 11.10 and 11.12). Following further consultation, only the operational lifespan and 50-year period presented (see Quarterly Call on 09 June 2025).

Date	Consultee and Type of Consultation	Summary of Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
		• Effects of Highly Pathogenic Avian Influenza (HPAI) should be qualitatively considered, considering surveys by RSPB (Tremlett *et al.*, 2024).	• Effects of HPAI qualitatively considered throughout.
		Cumulative Effects • The NEEOG methodology for cumulative effects is provisionally supported, pending further detail. • NatureScot is preparing the CEF, which needs to be used if available. • The Berwick Bank application scenario should be modelled both consented and unconsented due to overlapping species impact uncertainties. • The transboundary impacts are supported.	**Cumulative Effects** • The NEEOG interim CEF method was used in Section 11.12. The official CEF was not published at the time of writing this application. • Cumulative Effects considered with and without Berwick Bank where appropriate. • Transboundary impacts are presented in Section 11.14.
		Mitigation and Monitoring • Embedded Mitigation measures are welcomed but should clearly describe specific impact-reducing actions beyond plans. • Additional Embedded Mitigation should address nocturnal lighting impacts and include protocols for monitoring and handling birds attracted or disoriented by lighting during construction and operation	**Mitigation and Monitoring** • Embedded Mitigation proposed in Section 11.9.
10/12/2024	MD-LOT, NatureScot: Conference call	Quarterly catchup to enable updates on project, teams, timelines and requirements.	See response to consultation on 24 February 2025.
24/02/2025	NatureScot: Email	NatureScot responded to the Applicant's request for further advice and clarifications from NatureScot following responses to the Ayre Scoping Report, HRA Screening Report and the APEM Limited DAS annual survey reports. The following points raised are considered to be relevant for Bowdun OWF: • NatureScot will accept Natural England macro-avoidance rates for gannet in the non-breeding	The Applicant has followed this advice accordingly, as set out in Section 11.10 under the relevant impact pathway headings.

Date	Consultee and Type of Consultation	Summary of Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
		season only, as there is insufficient evidence regarding gannet behaviour around wind farms near Scottish SPAs in the breeding season. • Displacement and barrier effects should be considered together in the displacement assessments as there is not enough evidence to separate and apportion them separately. • A quantitative displacement assessment should be undertaken for fulmar given the high abundance of this species in the first year DAS data, both for project alone and in-combination with West of Orkney using a 20% displacement rate and 1% & 3% mortality rates for fulmar as advised by RSPB. • Principles for reducing direct impacts from UXO clearance on marine mammals can also be effective for diving birds, such as visually observing the area prior to a detonation occurring and delaying operations could be applied to rafts of diving birds as well. • NatureScot guidance on foraging ranges should be used in assessments, but additional data can be included to refine foraging ranges for species.	
11/03/2025	MD-LOT: Conference call	Quarterly catchup to enable updates on project, teams, timelines and requirements.	N/A
07/04/2025	NatureScot: email	Consultation regarding the use of SeabORD for displacement assessment and the CEF. NatureScot confirmed (30 April 2025) the use of the matrix approach for the displacement assessment, if the new SeabORD R model is not published in time, and that the interim CEF, development on behalf of NEEOG could be used.	Matrix displacement method used in the assessment, as R-based SeabORD was unavailable, agreed by NatureScot as described in Section 11.10. The interim CEF was used as described in Section 11.12.
09/06/2025	MD-LOT, NatureScot: Conference call	Quarterly catchup to enable updates on project, teams, timelines and requirements. NatureScot advised the	PVAs in EIA and HRA presented for Project lifetime (30 years) and 50 years (see Volume 3,

Date	Consultee and Type of Consultation	Summary of Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
		25-year period was no longer necessary to present for PVAs.	Technical Appendix 11.7: Offshore Ornithology Population Viability Analysis Technical Report).
02/07/2025	NatureScot: email	Consultation regarding the approach to use of curtailment within CRM and CEA. An additional 5% downtime was proposed to allow for the incorporation of curtailment in for the MLS of CRM, which is well below the unweighted average for curtailment figures in Scotland. It was proposed that as-built numbers be used for collision risk within the CEA to provide a more accurate reflection of real-world impacts.	Curtailment incorporated into the MLS, provided the WCS without curtailment is used and presented in the full assessment (see Volume 3, Technical Appendix 11.4: Collision Risk Model Technical Report). As-built numbers to be used where available in the Development Specification and Layout Plan. However, where these are not available, consented numbers are used (see Section 11.12.
29/07/2025	Email correspondence with NatureScot	NatureScot provided additional advice on curtailment and use of as-built details in CEA.Advice given on Light Detection and Ranging (LiDAR) specific flight height CRM. NatureScot advised they are content with curtailment to be included within the MLS, given that the Worst-Case Scenario (WCS) is also presented. Where as-built numbers are available from the Development Specification and Layout Plan, NatureScot are content with these being used. Where as-built numbers are not available, consented numbers should be used.	The Applicant notes the advice from NatureScot.
08/09/2025	MD-LOT, NatureScot: Conference call	Policy updates were provided by MD-LOT. Updates on Bowdun provided by the Applicant.	The Applicant notes the updates.
02/12/2025	NatureScot: Email	• Response to the Applicants Response to the Scoping Opinion.	• Due to the application deadline and as the CEF is unavailable at the time of preparing

Date	Consultee and Type of Consultation	Summary of Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
		• NatureScot stated that it is appropriate for the interim CEF to be used given the CEF is not available, unless the CEF is made available in the short term. • When responding to queries regarding apportioning method, it is NatureScot's opinion that as Bowdun is located in Scottish waters, NatureScot guidance/assessment methods are recommended.	this report, the interim CEF has been used as detailed in Section 11.12. • Apportioning has been carried out follow NatureScot guidance (2018), as detailed in Volume 3, Technical Appendix 11.6: Offshore Ornithology Apportioning Technical Report.
04/12/2025	Consultation Note to request advice, NatureScot: email	NatureScot and MD-LOT offered advice on Ornithology CEF and approach on guillemot and razorbill apportioning.	The advice was noted by the Applicant and has been considered as part of the Offshore EIA Report production process.
08/12/2025	MD-LOT, NatureScot: 2025 Quarterly catch-up conference call	Quarterly catchup to enable updates on project, teams, timelines and requirements.	N/A
13/02/2026	NatureScot: email	Review of the Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report (and associated Annexes A-E) and Volume 3, Technical Appendix 11.2: Nearshore, Intertidal and Offshore Ornithology Along the Export Cable Corridor Baseline Report. The main points raised within NatureScot's response include: • NatureScot now advise a correction factor of 1.49 from Burnell *et al.*, (rather than 1.34) to be applied to guillemot counts measured in individuals. • MRSea should be used to generate abundance estimates when the number of observations is 10 or more. • NatureScot now accept monthly availability correction factors published in Dunn *et al.* (2024). • Where LiDAR has been used within CRM, NatureScot recommend the presentation of CRM	• The Applicant notes that NatureScot have recently (early 2026) updated the recommended correction factor. Due to the timing, the Applicant was unable to adopt this updated correction factor at the time of data analysis and has used the recommended correction factor at the time of analysis. • MRSea has been used for surveys with 10 observations or more where possible. However, it should be noted that as MRSea requires observations to be aggregated into a grid, in some cases this can lead to less than 10 data points, making data unsuitable for modelling. • The acceptance of Dunn *et al.* (2024) availability bias corrections occurred late within the application process. Therefore,

Date	Consultee and Type of Consultation	Summary of Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
		using general flight height distributions (Johnston *et al.*, 2014) are also presented. • Discrepancies in the presented distances of the Proposed Development to SPAs were highlighted including Troup, Pennan and Lion's Heads SPA, North Caithness Cliffs SPA and SPAs found in Shetland. • It is highlighted that Fair Isle SPA is not within foraging range of kittiwake, and Mousa SPA, Seas off Foula SPA, Seas off St Kilda SPA and Outer Firth of Forth and St Andrews Bay Complex SPA are within foraging range of the Proposed Development. • It was noted that tables presenting monthly density estimates of flying birds for CRM and seasonal mean peaks required updating. • It was recommended for guillemot and razorbill that seasonal definitions be adjusted to account for post-breeding season dispersal peak.	the Applicant has used the most up to date guidance at the time of data analysis. • Both Option 1 (LiDAR) and Option 2 (generic flight heights) have been run during CRM for kittiwake (see Section 11.10). • Distances for SPAs were reviewed. However, it should be noted that by-sea distances have been used for Troup, Pennan and Lion's Heads SPA and North Caithness Cliffs SPA within the assessment. Changes were made to some Northern Isle SPA distances (see Table 11.6). • Following a review of distances, Fair Isle SPA is within range of kittiwake and Mousa SPA is within range of fulmar. The remaining SPAs are within foraging range, however it should be noted that marine SPAs have not been included within data analysis e.g. apportioning (see Table 11.6). • Tables within the technical reports have been updated. • The Applicant has followed the recommended seasonal definitions (NatureScot, 2020). It should be noted that following NatureScot's feedback on the baseline, if adjusted seasonal definitions were used, the number of mortalities for the O&M phase in Section 11.10. The low and high displacement scenarios for guillemot and razorbill would be reduced to approximately 343 to 763, and 30 to 69 respectively. Therefore, the Proposed Development alone mortalities presented can be considered precautionary.

Date	Consultee and Type of Consultation	Summary of Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
			• The Applicant will discuss relevant updates required on ornithology post application submission.
19/02/2026	MD-LOT: email	MD-LOT response to the following questions: • How should consented projects be considered within the CEA and in-combination assessments for Bowdun? • Should projects considered to have a mortality of 0 if the project has approved compensation measures? MD-LOT provided a response with the main points summarised: • MD-LOT noted that with and without Berwick Bank scenarios have been provided following advice given before Berwick Bank was granted consent, but this is not required for other consented projects. • Bowdun can exclude the effects from Scottish projects with consents where there is a conclusion of AEOSI (or unable to conclude no AEOSI) which have resulted in derogation and secured compensatory measures. • Projects which have secured compensatory measures include Green Volt, Salamander, West of Orkney and Berwick Bank.	• The Applicant has presented assessments including and excluding Berwick Bank within the CEA. • It should be noted that the data analysis had been undertaken before the Applicant received a response to the question. Therefore, all projects have been included, and in some cases, the CEA may provide an overestimation of impacts given MD-LOT's response.

11.5 Data Sources

Desktop Study

11.5.1 The baseline environment within the Offshore Ornithology Study Area was assessed through detailed desktop review of existing studies and datasets, and informed by consultation with NatureScot, MD-LOT and RSPB (see Table 11.3). The main references and data sources are summarised in Table 11.4. In addition to these sources, insights into seabird ecology, population trends, offshore wind effects on birds and other evidence were gained from a range of additional published research literature and reports. These sources are referenced as appropriate throughout this chapter, with full citations provided in the Reference Section (see References).

Table 11.4: Summary of Key Data Sources

Title	Source	Extent	Year	Author
Seabird Monitoring Programme Database[1]	British Trust for Ornithology (BTO)	UK	2025	BTO
Seabird Population Trends and Causes of Change: 1986-2023 Report, the annual report of the Seabird Monitoring Programme	BTO	UK	2024	Harris *et al.*
Seabird Population Trends and Causes of Change: 1986-2019 Report	Joint Nature Conservation Committee (JNCC)	UK	2021	JNCC
The status of our bird populations	British Birds	UK	2021	Stanbury *et al.*
Data from: Distribution maps of cetacean and seabird populations in the North-East Atlantic	Dryad	North-East Atlantic	2019	Waggitt
Distribution maps of cetacean and seabird populations in the North-East Atlantic	Journal of Applied Ecology	North-East Atlantic	2019	Waggitt *et al.*
Incorporating data uncertainty when estimating potential vulnerability of Scottish seabirds to marine renewable energy developments	Marine Policy	Scotland	2016	Wade *et al.*
Non-breeding season populations of seabirds in UK waters: Population sizes for BDMPS	Natural England Commissioned Reports, Number 164	UK	2015	Furness

Title	Source	Extent	Year	Author
Mapping Seabird Sensitivity to Offshore Wind Farms	PLOS	English territorial waters	2014	Bradbury *et al.*
Seabirds Count: a census of breeding seabirds in Britain and Ireland (2015-2021)	Lynx Nature Books	UK and Ireland	2023	Burnell *et al.*
An atlas of seabird distribution in north-west European waters	JNCC	North-west European waters	1995	Stone *et al.*

1 Available at https://app.bto.org/seabirds/public/data.jsp

11.5.2 In order to characterise the baseline for the relevant species, a literature review and modelling of relevant datasets were used. Full details of the analyses undertaken to develop the ornithology baseline for key species are provided in the offshore ornithology technical reports accompanying this chapter (Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report and Volume 3, Technical Appendix 11.2: Nearshore, Intertidal and Offshore Ornithology Along the Export Cabel Corridor Baseline Report).

Identification of Designated Sites

11.5.3 A three-step process was used to identify all designated sites within the Offshore Ornithology Study Area and Qualifying Features that could be affected by the construction, O&M, and decommissioning phases of the Proposed Development. The term designated sites refers to specific areas that have been recognised for their importance to the conservation and study of their natural features (e.g. bird species), and are often designated under various conservation designations, including SPAs, Ramsar sites, and SSSIs.

11.5.4 Where a designated site such as an SSSI or Ramsar site shares the same Qualifying Features and falls within the boundary of an SPA, the assessment of the designated site is covered by the assessment of the SPAs qualifying ornithological features. This is because it was found that all relevant SSSIs and Ramsar sites shared the same qualifying ornithological features, and entire boundary fell within that of an SPA. Therefore, a separate assessment for these sites has not been undertaken.

11.5.5 The aforementioned three-step process is described below:

- Step 1: All designated sites of international, national, and local importance within the Offshore Ornithology Study Area were identified using GIS outputs from online mapping portals of NatureScot and Natural England/Natural Resource Wales (NRW).
- Step 2: Information was compiled on the relevant ornithological features for each of these sites as follows:
  - breeding seabird colony SPAs (and Ramsar sites) within the breeding season;

- breeding seabird colony SPAs (and Ramsar sites) within the non-breeding season(s);
- marine SPAs; and
- SPAs (and Ramsar sites) with migratory seabirds as qualifying features.

- Step 3: Using the above information and professional judgement, sites were included for further consideration if:
  - the designated site directly overlaps with the Proposed Development and therefore has the potential to be directly affected by the Proposed Development;
  - the designated site with qualifying mobile features/species (e.g. Annex I birds) whose range (e.g. foraging, migratory, overwintering, breeding or natural habitat range) overlaps with the Proposed Development; or
  - the site and associated features were located within the relevant offshore ornithology Zone of Influence (ZoI; see relevant impact section in Section 11.10) for impacts associated with the Proposed Development (e.g. habitat loss/disturbance, noise and collision risk).

Site-Specific Surveys

11.5.6 Site-specific surveys were undertaken to inform this assessment, in accordance with NatureScot (2023b) and as agreed with NatureScot, MD-LOT, MD-SEDD and RSPB (see Table 11.3 for further details).

11.5.7 In addition to surveys carried out to monitor the abundance and distribution of birds, the Applicant also commissioned APEM Limited to perform site-specific LiDAR surveys within the Array Area to provide baseline information on the flight height data of birds likely to be within the vicinity of Offshore Infrastructure. The aim of this work was to utilise species-specific flight height data of birds in the Array Area Study Area for CRM to inform this offshore ornithology component of the EIA.

11.5.8 A summary of the surveys is outlined in Table 11.5. A summary of site DAS coverage is available in Table 3.5 of Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report.

Table 11.5: Summary of Site-Specific Survey Data

Title	Extent of Survey	Overview of Survey	Survey Contractor	Date
DAS	E3 PO Area plus 12km buffer in winter (DAS Area), extending to the shore in summer (Extended DAS Area)	24 months, high resolution DAS transects, with approximately 25% coverage of the Bowdun Array Area with a minimum of 12.5% analysed	APEM Limited	March 2022 to February 2024
LiDAR surveys	Array Area	4 months, site-specific flight height data	APEM Limited	July and September 2022 April and July 2023
Intertidal bird surveys	Landfall within the Export Cable Corridor Study Area in Haugh's Bay, Gourdon plus 250m buffer	Bi-monthly diurnal surveys aiming to count and map wader and other water birds within the Landfall area of Haugh's Bay and a surrounding 250 m buffer	RPS sub-contractors	September 2023 to March 2024
Caithness Cliffs Seabird Surveys	North Caithness Cliffs	Boat and land surveys to census breeding seabirds across 30 subsections of the North Caithness Cliffs	RPS and sub-contractors	June 2023 and June 2024
	East Caithness Cliffs	Boat and land surveys to census breeding seabirds across 50 subsections of the East Caithness Cliffs	RPS and sub-contractors	June 2024 and June 2025

11.6 Baseline Environment

Overview of Baseline Environment

11.6.1 The following sections provide a summary of the offshore ornithology baseline environment. This section should be read in conjunction with Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report and Volume 3, Technical Appendix 11.2: Nearshore, Intertidal and Offshore Ornithology Along the Export cable Corridor Baseline Report, which included full details of the analysis undertaken to develop the offshore ornithology baseline.

Designated Sites

11.6.2 Designated sites and relevant Qualifying Features identified for offshore ornithology are summarised in Table 11.6 and presented in Figure 11.2.

11.6.3 To determine connectivity during the breeding season between the Array Area and designated sites, and to identify the wider regional study area during the breeding season, a marine pathway 'by-sea' foraging distance was measured based on the foraging ranges, provided by Woodward et al. (2019) as recommended by NatureScot (2023b). The 'by-sea' distance represents the shortest route around land masses, following the coast, and is used on the basis that seabirds will avoid flying over large land masses. Due to the location of the Proposed Development, the use of 'by-sea' distances is particularly important when determining connectivity with designated sites on the west coast of the UK, where the 'by-sea' distance significantly differs from straight-line distance.

11.6.4 Designated sites for which the 'by-sea' distance to the Array Area or Export Cable Corridor are less than or equal to recommended foraging range of a species (NatureScot, 2020) are deemed to have connectivity and therefore are presented in Table 11.6.

11.6.5 Seabirds from SPA breeding colonies during the non-breeding seasons are not constrained to a specific colony-centred foraging range by the need to provide for young and will disperse to areas beyond the recommended foraging range from their breeding colonies. As a result, during the non-breeding seasons there is potential for connectivity with the Proposed Development for a greater number of Qualifying Features from SPA breeding colonies than during the breeding season (NatureScot, 2023d).

11.6.6 Furness (2015) defines the regions within which non-breeding seabird populations are distributed within bio-seasons and calculates regional BDMPS for each species. Where the Proposed Development overlaps spatially with a BDMPS region, it is assumed that there is potential for connectivity with that region and with the SPA colonies from which birds contribute to the BDMPS population, and therefore also forms part of the wider regional study area. It should be noted that following NatureScot advice (NatureScot, 2023b; MD-LOT, 2024), the breeding season foraging ranges are used for herring gull and guillemot rather than the BDMPS population, as these species remain relatively close to their breeding colonies during the non-breeding season.

11.6.7 As noted in Paragraph 11.6.4, locally or nationally important sites which fall within and share the same ornithological features as an SPA have not been assessed separately. Due to this, no SSSIs have been included within this EIA. Furthermore, no SSSIs were highlighted within the Scoping Opinion (MD-LOT, 2024).

11.6.8 Four marine SPAs (Outer Firth of Forth and St Andrew's Bay Complex SPA, Northumberland Marine SPA, Seas off Foula SPA and Seas off St Kilda SPA) are within foraging range of the Proposed Development but have not been included within this EIA. As marine SPAs are not designated for the breeding colonies themselves, and instead due to being functionally linked to SPAs with breeding colonies, they have only been included if activities associated with the Proposed Development are expected to occur within the boundary of the relevant SPAs. It is expected that Moray Firth SPA is the only marine SPA which has the potential to be intersected by vessel routes and therefore has been included in Section 11.10. It is also noted that vessel movements associated with the Proposed Development from the Port of Aberdeen are expected to come within 15 km of Ythan Estuary, Sands of Forvie and Meikle Loch SPA and Ramsar Site. Therefore, this site has also been considered within the assessment of vessel movements. However, as neither site has connectivity to the Proposed Development it they have not been included in Table 11.6 or Figure 11.2.

Table 11.6: Designated Sites and Relevant Qualifying Features with Connectivity to the Proposed Development for Offshore Ornithology

Designated Site[1]	Closest Distance to the Array Area (km)[2]	Relevant Qualifying Feature(s)[3]
Fowlsheugh SPA	40.93	• Fulmar • Kittiwake • Herring gull • Guillemot • Razorbill
Buchan Ness to Collieston Coast SPA	43.17	• Fulmar • Kittiwake • Herring gull • Guillemot
Troup, Pennan and Lions Heads SPA	96.95	• Fulmar • Kittiwake • Razorbill
Forth Islands SPA	101.40	• Kittiwake • Gannet • Puffin • Arctic tern[4] • Razorbill
St Abb's Head to Fast Castle SPA	117.18	• Kittiwake • Razorbill
Farne Islands SPA	140.24	• Kittiwake • Arctic tern[4] • Puffin
Coquet Islands SPA	174.24	• Arctic tern[4] • Puffin
East Caithness Cliffs SPA	180.44	• Fulmar • Kittiwake • Great black-backed gull[4] • Razorbill[4]
Pentland Firth Islands SPA	210.86	• Arctic tern[4]
North Caithness Cliffs SPA	211.12	• Fulmar • Kittiwake • Razorbill[4] • Puffin
Copinsay SPA	214.50	• Fulmar • Kittiwake • Great black-backed gull[4]

Designated Site[1]	Closest Distance to the Array Area (km)[2]	Relevant Qualifying Feature(s)[3]
Hoy SPA	223.12	• Fulmar • Kittiwake • Great black-backed gull[4] • Puffin
Auskerry SPA	229.26	• Arctic tern[4] • European storm petrel
Marwick Head SPA	254.87	• Kittiwake
Rousay SPA	256.09	• Fulmar • Kittiwake • Arctic tern[4]
Calf of Eday SPA	265.66	• Fulmar • Kittiwake • Great black-backed gull[4]
West Westray SPA	268.75	• Fulmar • Kittiwake • Arctic tern[4] • Razorbill[4]
Papa Westray SPA	279.17	• Arctic tern[4]
Fair Isle SPA	270.49	• Fulmar • Kittiwake[4] • Gannet • Arctic tern[4] • Razorbill[4] • Puffin[4]
Sule Skerry and Sule Stack SPA	295.55	• Gannet • Puffin[4] • European storm petrel
Flamborough and Filey Coast SPA	300.38	• Fulmar • Kittiwake • Gannet • Razorbill[4]
Sumburgh Head SPA	308.75	• Fulmar • Kittiwake[4] • Arctic tern[4]
Cape Wrath SPA	311.08	• Fulmar • Kittiwake[4] • Razorbill[4] • Puffin[4]

Designated Site[1]	Closest Distance to the Array Area (km)[2]	Relevant Qualifying Feature(s)[3]
Mousa SPA	326.36	• Arctic tern[4] • European storm petrel
Foula SPA	339.25	• Fulmar • Kittiwake[4] • Arctic tern[4] • Razorbill[4] • Puffin[4]
Noss SPA	340.43	• Fulmar • Kittiwake[4] • Gannet • Puffin[4]
Handa SPA	351.31	• Fulmar • Kittiwake[4] • Razorbill[4]
North Rona and Sula Sgeir SPA	372.79	• Fulmar • Gannet • Kittiwake[4] • Great black-backed gull[4] • Razorbill[4] • Puffin[4]
Papa Stour SPA	401.31	• Arctic tern[4]
Shiant Isles SPA	433.58	• Fulmar • Kittiwake[4] • Razorbill[4] • Puffin[4]
Fetlar SPA	441.65	• Fulmar • Arctic tern[4]
Hermaness, Saxa Vord and Valla Field SPA	459.96	• Fulmar • Kittiwake[4] • Gannet • Puffin[4]
Flannan Isles SPA	475.63	• Fulmar • Kittiwake[4] • Razorbill[4] • Puffin[4]
Canna and Sanday SPA	535.19	• Kittiwake[4] • Puffin[4]
Rum SPA	535.81	• Kittiwake[4] • Manx shearwater

Designated Site[1]	Closest Distance to the Array Area (km)[2]	Relevant Qualifying Feature(s)[3]
St Kilda SPA	542.90	• Fulmar • Gannet • Kittiwake[4] • Razorbill[4] • Puffin[4] • Manx shearwater
Mingulay and Berneray SPA	575.60	• Fulmar • Kittiwake[4] • Razorbill[4] • Puffin[4]
North Colonsay and Western Cliffs SPA	643.21	• Kittiwake[4]
Rathlin Island SPA	731.84	• Fulmar • Kittiwake[4] • Razorbill[4] • Puffin[4] • Manx shearwater
Horn Head to Fanad Head SPA	740.19	• Fulmar
Tory Island SPA	750.76	• Fulmar
West Donegal SPA	769.49	• Fulmar
Ailsa Craig SPA	790.06	• Fulmar • Kittiwake[4] • Gannet[4]
Outer Ards SPA	813.75	• Arctic tern[4]
Copeland Islands SPA	817.78	• Manx shearwater
Strangford Lough SPA	824.48	• Arctic tern[4]
Duvillaun Islands SPA	934.00	• Fulmar
Clare Island SPA	965.62	• Fulmar
Lambay Island SPA	969.28	• Fulmar
High Island, Inishshark and Davillaun SPA	984.67	• Fulmar
Cruagh Island SPA	995.21	• Manx shearwater
Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island	1,034.26	• Manx shearwater
Cliffs of Moher SPA	1,065.97	• Fulmar
Kerry Head SPA	1,116.50	• Fulmar
Saltee Islands SPA	1,124,58	• Fulmar

Designated Site[1]	Closest Distance to the Array Area (km)[2]	Relevant Qualifying Feature(s)[3]
Dingle Peninsula SPA	1,132.46	• Fulmar
Blasket Islands SPA	1,150.46	• Fulmar
Skomer, Skokholm and the Seas off Pembrokeshire SPA	1,151.45	• Kittiwake[4] • Puffin[4] • Razorbill[4] • Manx shearwater
Grassholm SPA	1,155.41	• Gannet[4]
Iveragh Peninsula SPA	1,161.11	• Fulmar
Puffin Island SPA	1,182.79	• Fulmar
Skelligs SPA	1,189.68	• Fulmar
Deenish Island and Scariff Island SPA	1,194.02	• Fulmar
Isles of Scilly SPA	1,249.23	• Great black-backed gull[4]

[1] Marine SPAs have not been presented
[2] Distances presented are the 'by-sea' distances measured from the closest point of the SPA to the closest point of the Export Cable Corridor or Array Area.
[3] Only species identified as VORs presented (see Table 11.7)
[4] Species found to have connectivity during the non-breeding season only

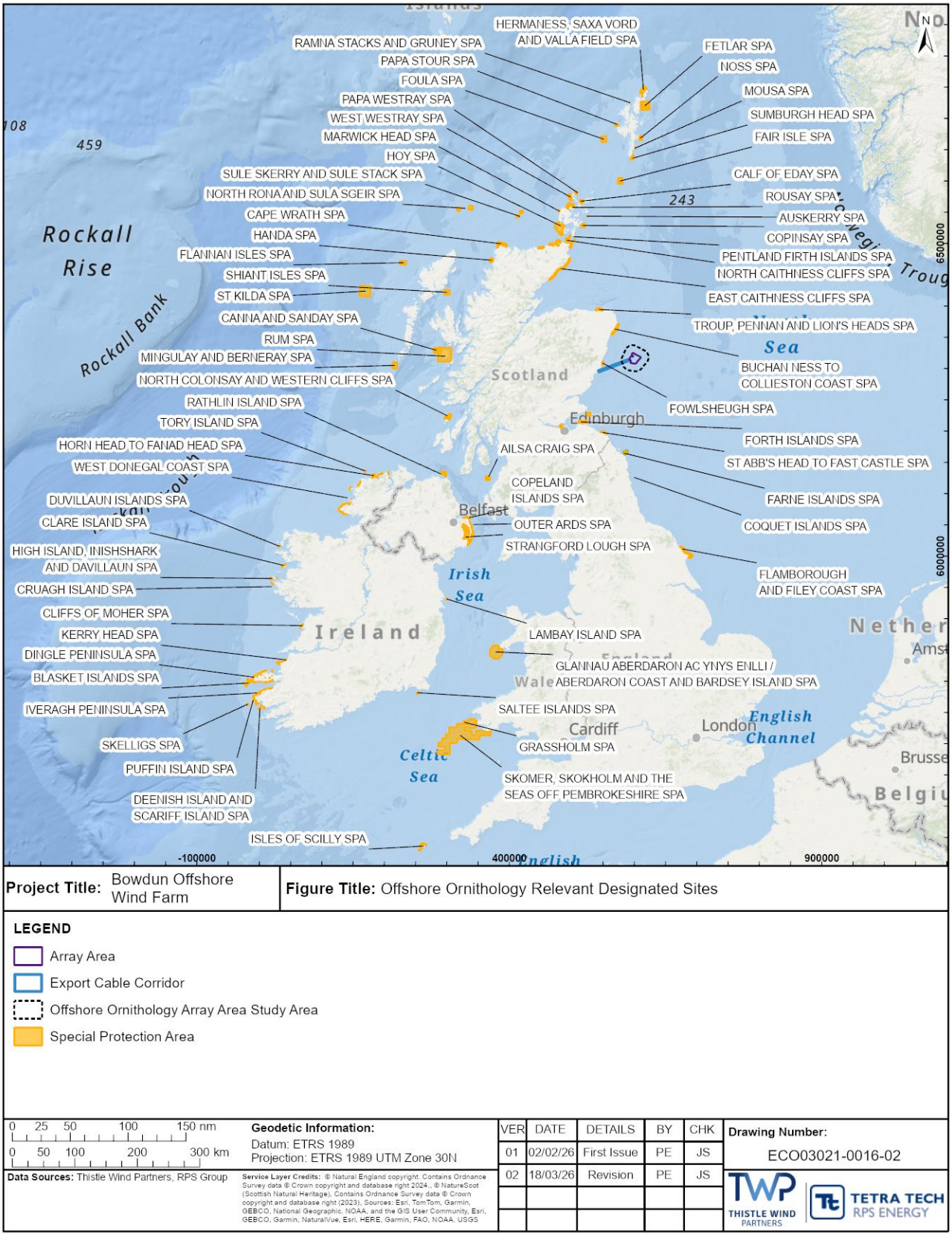

Figure 11.2: Offshore Ornithology Relevant Designated Sites

Valued Ornithological Receptors

11.6.9 Important Ecological Features, referred to as Valued Ornithological Receptor (VOR) for the purposes of offshore ornithology, have been identified using best practice guidelines (Chartered Institute for Ecology and Environmental Management (CIEEM), 2024). The potential impacts of the Proposed Development which have been scoped into the assessment (see Section 11.7) have been assessed to determine whether or not they have a significant effect on the VORs.

An ornithological receptor is considered to be a VOR based on:

- their known abundance within the Offshore Ornithology Study Area, their vulnerability to an impact pathway (for each impact pathway scoped into the assessment),
- their conservation status (e.g. Status listed in the Fifth Birds of Conservation Concern in the UK (Stanbury *et al.,* 2021); listing in Annex I of EU Birds Directive; listing in Schedule 1 of the Wildlife and Countryside Act 1981 (as amended); or listing in Scottish Biodiversity List; and
- their status as a Qualifying Feature of SPAs or Ramsar site with theoretical connectivity to the Proposed Development (Table 11.6).

11.6.10 See Section 4.3 of Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report for additional details.

11.6.11 For quantitively assessed impacts, to inform the identification of VORs, the below criteria were defined for each species, where only those with moderate to high abundances and low to high vulnerabilities were taken forward for assessment of collision risk and/or displacement impact:

The abundance of a species based on the recorded raw count within the Array Area Study Area during monthly DAS:

- <100 birds in all surveys = low;
- 100 to 500 birds in at least one survey = moderate; and
- >500 birds in at least one survey = high.

11.6.12 A secondary screening was then carried out to ensure that all species were recorded in the Array Area plus 2 km buffer, as the ZoI for collision risk and displacement are the Array Area (NatureScot, 2023g) and the Array Area plus 2 km buffer (NatureScot, 2023a) respectively. As all VORs identified in the initial screening were recorded within the Array Area plus 2 km buffer, no changes were made to the list of VORs.

11.6.13 A number of migratory birds were screened in for quantitative assessment of migratory CRM (mCRM) only, however due to the number of species assessed these species have not been listed within this section (see Volume 3, Technical Appendix 11.5: Offshore Ornithology Migratory Bird Collision Risk Model Technical Report for full list of species included within the assessment).

11.6.14 For qualitatively assessed impacts, VORs were identified based on their status as a Qualifying Feature of designated sites with connectivity to the Proposed

Development. Additionally, oystercatcher *Haematopus ostralegus*, lapwing *Vannellus vanellus*, curlew *Numenius arquata*, common gull *Larus canus* and black-headed gull *Larus marinus* were screened in for assessment for impacts within the Export Cable Corridor only due the abundance of individuals observed within the intertidal surveys (Volume 3, Technical Appendix 11.2: Nearshore, Intertidal and Offshore Ornithology Along the Export Cable Corridor Baseline Report).

11.6.15 A number of VORs have been screened in for a qualitative assessment of disturbance and displacement due to vessel movements travelling from ports to the Proposed Development (see Paragraph 11.10.178, including for details of the species assessed on that basis).

11.6.16 We note that MD-LOT (2024) advised that Leach's storm petrel *Oceanodroma leucorhoa* should be included for a qualitative assessment for the impact of attraction to light. However, following a review of the data collected from DAS and intertidal surveys only one individual was recorded during the entire 24-month survey period.

11.6.17 As Leach's storm petrel are nocturnal, it is important to consider the limitation of DAS being conducted in daylight hours, potentially skewing the recording of more nocturnal bird species such as Leach's storm petrel (Bradbury *et al.*, 2014). However, research has shown that storm petrel species remain in the intertidal zone at night (Albores-Barajas *et al.,* 2011; Thomas *et al.,* 2006; d'Elbée and Hémery, 1998) and travel further afield in the daylight (Albores-Barajas *et al.,* 2011). Consequently, Leach's storm petrel has been scoped out of further assessment.

11.6.18 In total, 16 VORs have been identified for assessment based on the factors outlined above and have been presented in Table 11.7.

Table 11.7: VORs Within the Proposed Development Offshore Ornithology Study Area

VOR	Regional Baseline Population[1]	Description[2]	Conservation Status	Recoverability[3]	Importance Within the Offshore Ornithology Study Area[4]
Fulmar	Breeding: 1,128,693 Non-breeding: 568,736 Annual: 1,128,693	• Recorded in high numbers • Very low vulnerability to displacement impacts • Very low vulnerability to collision impacts • Connectivity to 43 SPAs	Amber list	Low	International
Gannet	Breeding: 841,748 Non-breeding: 248,385 Annual: 841,748	• Recorded in high numbers • Very low vulnerability to displacement impacts • High vulnerability to collision impacts • Connectivity to 10 SPAs	Amber list	Low	International
Kittiwake	Breeding: 604,582 Non-breeding: 627,816 Annual: 627,816	• Recorded in high numbers • Very low vulnerability to displacement impacts • High vulnerability to collision impacts • Connectivity to 31 SPAs	Red list	Low	International
Great black-backed gull	Breeding: 364 Non-breeding: 91,399 Annual: 91,399	• Recorded in low numbers • Low vulnerability to displacement impacts • Very high vulnerability to collision impacts • Connectivity to six SPAs	Amber list	Moderate	International
Herring gull	Breeding: 40,076 Non-breeding: 59,816 Annual: 59,816	• Recorded in high numbers • Very low vulnerability to displacement impacts • Very high vulnerability to collision impacts • Connectivity to two SPAs	Red list	Moderate	International

VOR	Regional Baseline Population[1]	Description[2]	Conservation Status	Recoverability[3]	Importance Within the Offshore Ornithology Study Area[4]
Arctic tern	Breeding: 5,050 Non-breeding: 163,930 Annual: 163,930	• Recorded in moderate numbers • Low vulnerability to displacement impacts • Moderate vulnerability to collision impacts • Connectivity to 16 SPAs	Amber list; Annex I; Scottish Biodiversity List	Low	International
Guillemot	Breeding: 250,506 Non-breeding: 250,506 Annual: 250,506	• Recorded in high numbers • Moderate vulnerability to displacement impacts • Very low vulnerability to collision impacts • Connectivity to two SPAs	Amber list	Low	International
Razorbill	Breeding: 90,519 Non-breeding: 218,622 Annual: 218,622	• Recorded in high numbers • Moderate vulnerability to displacement impacts • Very low vulnerability to collision impacts • Connectivity to 19 SPAs	Amber list	Moderate	International
Puffin	Breeding: 507,599 Non-breeding: 231,957 Annual: 507,599	• Recorded in high numbers • Low vulnerability to displacement impacts • Very low vulnerability to collision impacts • Connectivity to 17 SPAs	Red list	Low	International
Manx shearwater	NA	• Recorded in low numbers • Very low vulnerability to displacement impacts • Very low vulnerability to collision impacts • Connectivity to five SPAs	Amber list	Moderate	International
European storm petrel	NA	• Recorded in low numbers	Amber list	Moderate	International

VOR	Regional Baseline Population[1]	Description[2]	Conservation Status	Recoverability[3]	Importance Within the Offshore Ornithology Study Area[4]
		• Very low vulnerability to displacement impacts • Low vulnerability to collision impacts • Connectivity to two SPAs			
Oystercatcher	NA	• Recorded in low numbers, but moderate numbers in the Export Cable Corridor Study Area • Low vulnerability to displacement impacts • Low vulnerability to collision impacts • Migratory route overlaps Array Area Study Area	Amber list	Moderate	International
Lapwing	NA	• Recorded in low numbers, but moderate numbers in the Export Cable Corridor Study Area • High vulnerability to displacement impacts • Low vulnerability to collision impacts • Migratory route overlaps Array Area Study Area	Red list	Low	International
Curlew	NA	• Recorded in low numbers, but moderate numbers in the Export Cable Corridor Study Area • High vulnerability to displacement impacts • Low vulnerability to collision impacts • Migratory route overlaps Array Area Study Area	Red list	Low	International

VOR	Regional Baseline Population[1]	Description[2]	Conservation Status	Recoverability[3]	Importance Within the Offshore Ornithology Study Area[4]
Common gull	NA	• Recorded in low numbers, but moderate numbers in the Export Cable Corridor Study Area • Low vulnerability to displacement impacts • high vulnerability to collision impacts • No connectivity to SPAs	Red list	Low	Local
Black-headed gull	NA	• Recorded in low numbers, but moderate numbers in the Export Cable Corridor Study Area • Low vulnerability to displacement impacts • High vulnerability to collision impacts • No connectivity to SPAs	Amber list	Low	Local

[1] Regional populations have only been provided where relevant to the assessment. Regional population sizes for the breeding season using Burnell *et al.* (2023) and the SMP database. For non-breeding season populations have been defined using the relevant BDMPS in Furness (2015).
[2] Vulnerability defined using Bradbury *et al.* (2014) and Wade *et al.* (2016).
[3] Determined using information in Mitchell *et al.* (2020), Horswill and Robinson (2015), Bolton *et al.* (2017), Souchay and Schaub (2016), Duriez *et al.* (2009) and Viana *et al.* (2023)
[4] Importance determined by connectivity to SPAs using recommended foraging ranges. Although there were no SPAs with oystercatcher, lapwing and curlew as a Qualifying Feature (Table 11.6), both the Firth of Forth and Inner Moray Firth SPA and Ramsar Sites include lapwing and/or curlew as named components of the waterfowl assemblage screened in for the assessment of migratory collision risk (see Table 3.7 in the RIAA Part 3: Special Protection Areas and Ramsar Sites TWP-BOW-RPS-ENV-RPT-00015).

11.6.19 Fulmar is an Amber-listed species of conservation concern by the Birds of Conservation Concern 5th review (BoCC5) (Stanbury *et al.,* 2021) and Least Concern by the International Union for Conservation of Nature's (IUCN) global Red List of Threatened Species (British Trust for Ornithology (BTO), 2025). Fulmar are present year-round in the UK and are found around almost all of the UK's coastlines. A total of 43 SPAs with fulmar as a Qualifying Feature, or as named component of a qualifying assemblage, are within max/mean max foraging range of the Array Area Study Area. This ornithological receptor was recorded during all 24 of the 24 months of Array Area Study Area DAS between March 2022 and February 2024. Fulmar score very low in vulnerability to displacement impacts due to scoring very low in vulnerability to structures, vessels and helicopters and in habitat specialisation (Wade *et al*., 2016). Fulmar also scored very low in vulnerability to collision impacts due to spending approximately 1% of flights at Wind Turbine blade height (Bradbury *et al.*, 2014) and high vulnerability to impacts arising from attraction to light. Fulmar have been selected as a VOR due to being recorded in high numbers in the Array Area Study Area and their connectivity to 43 SPAs in proximity to the Array Area Study Area.

11.6.20 Gannet is an Amber-listed species of conservation concern by the BoCC5 (Stanbury *et al.*, 2021) and Least Concern by the IUCN global Red List of Threatened Species (BTO, 2024). Gannet are recorded across the UK year-round, with most colonies located on remote offshore islands most notably off the north coast of Scotland, however most birds migrate south during the wintering period with only a few remaining in UK waters. A total of ten SPAs with gannet as a Qualifying Feature, or as named component of a qualifying assemblage, are within max/mean max foraging range of the Array Area Study Area. This ornithological receptor was recorded during 23 of the 24 months of Array Area Study Area DAS between March 2022 and February 2024. Gannet score very low in vulnerability to displacement impacts due to scoring very low in vulnerability to vessels and helicopters and in habitat specialization (Wade *et al*., 2016). Although gannet score high in vulnerability to structures within Wade *et al.* (2016), Bradbury (2014) found gannet to have a very low vulnerability. Gannet scored high in vulnerability to collision impacts due to spending approximately 12% of flights at Wind Turbine blade height and for having high nocturnal flight activity (Bradbury *et al.*, 2014) and scored high in vulnerability to impacts arising from attraction to light. Gannet have been selected as a VOR due to being recorded in high numbers in the Array Area Study Area, their connectivity to ten SPAs in proximity to the Array Area Study Area, and high vulnerability to collision risk impacts.

11.6.21 Kittiwake is a Red-listed species of conservation concern by the BoCC5 (Stanbury *et al.*, 2021) and Vulnerable by the IUCN global Red List of Threatened Species (BTO, 2024). Kittiwake are the most numerous gull species in the UK and its waters with the overall highest mean modelled seasonal densities from Waggitt (2019) occurring within the Export Cable Corridor. A total of 31 SPAs with kittiwake as a Qualifying Feature, or as named component of a qualifying assemblage, are within foraging range (mean max +1 Standard Deviation (SD)) of the Array Area Study Area. This ornithological receptor was recorded in each

of the 24 months of Array Area Study Area DAS between March 2022 and February 2024. Kittiwake score very low in vulnerability to displacement impacts, high in vulnerability due to collision impacts due to spending approximately 15% of flights at Wind Turbine blade height and moderate vulnerability to impacts arising from attraction to light. Kittiwake have been selected as a VOR considering that they were recorded in high numbers in the Array Area, their connectivity to 31 SPAs in proximity to the Array Area Study Area, and their high vulnerability to collision impacts.

11.6.22 Great-black backed gull is an Amber-listed species of conservation concern by the BoCC5 (Stanbury *et al.*, 2021) and Least Concern by the IUCN global Red List of Threatened Species (BTO, 2024). Great black-backed gulls are present in greater numbers in the UK during the winter period, though they are present on coastal sites around the UK, aside from the North Sea, during the breeding period. A total of six SPAs with great black-backed gull as a Qualifying Feature, or as a named component of a qualifying assemblage, are within max/mean max foraging range of the Array Area Study Area. This ornithological receptor was recorded during 15 of the 24 months of Array Area Study Area DAS March 2022 and February 2024. Great-black backed gull score low in vulnerability to displacement impacts, very high in vulnerability to collision impacts due to spending approximately 35% of flights at Wind Turbine blade height (Bradbury *et al.*, 2014) and moderate vulnerability to impacts arising from attraction to light. Great black-backed gull have been selected as a VOR considering they have been recorded in high numbers in the Array Area Study Area, their connectivity to six SPAs in proximity to the Array Area Study Area, and their very high vulnerability to collision impacts.

11.6.23 Herring gull is a Red-listed species of conservation concern by the BoCC5 (Stanbury *et al.*, 2021) and Least Concern by the IUCNs global Red List of Threatened Species (BTO, 2024). Herring gull are present in the UK year-round with breeding populations predominantly found at coastal sites around the UK but are increasingly colonising and nesting in urban areas. In winter, the UK population of herring gull increases as birds arrive from Iceland and Scandinavia. There are two SPAs with herring gull as a qualifying feature within foraging range (mean max + 1 SD) of the Array Area Study Area. This ornithological receptor was recorded during 21 of the 24 monthly DAS surveys from March 2022 to February 2024. Herring gull score very low in vulnerability to displacement impacts, very high in vulnerability to collision impacts due to spending approximately 35% of flights at Wind Turbine blade height (Bradbury *et al.*, 2014), and moderate vulnerability to impacts arising from attraction to light. Herring gull have been selected as a VOR considering that they were recorded in high numbers in the Array Area Study Area, their connectivity to two SPAs in proximity to the Array Area Study Area, and their very high vulnerability to collision impacts.

11.6.24 Arctic tern is an Amber-listed species of conservation concern by the BoCC5 (Stanbury *et al.*, 2021) and Least Concern by the IUCN global Red List of Threatened Species (BTO, 2024). Arctic tern are summer visitors to the UK during the breeding season only and are concentrated on the coasts of north and north-western Scotland, including the Northern Isles, Western Isles and

Outer Hebrides. A total of 16 SPAs with Arctic tern as a Qualifying Feature, or as named component of a qualifying assemblage, are within max/mean max foraging range of the Array Area Study Area. This ornithological receptor was recorded in seven of the 24 months of Array Area Study Area DAS between March 2022 and February 2024. Arctic tern score low in vulnerability to displacement impacts. Arctic tern also scored low in vulnerability to collision impacts due to spending approximately 5% of flights at Wind Turbine blade height (Bradbury *et al.*, 2014) and very low vulnerability to impacts arising from attraction to light. Arctic tern have been selected as a VOR due to being recorded in moderate numbers in the Array Area Study Area and their connectivity to 16 SPAs in proximity to the Array Area Study Area.

11.6.25 Guillemot is an Amber-listed species of conservation concern by the BoCC5 (Stanbury *et al.*, 2021) and Least Concern by the IUCN global Red List of Threatened Species (BTO, 2024). Guillemot are present year round in high densities around UK coasts, with a notable absence from the south-east of England and higher densities in the North Sea off south-east Scotland and north-east England over winter (BTO, 2024). A total of two SPAs with guillemot as a Qualifying Feature, or as named component of a qualifying assemblage, are within max/mean max foraging range of the Array Area Study Area. This ornithological receptor was recorded in each of the 24 months of Array Area Study Area DAS between March 2022 and February 2024. Guillemot score moderately in vulnerability to displacement impacts due to scoring high in vulnerability to structures and moderate in vulnerability to vessels and helicopters and in habitat specialisation (Wade *et al.*, 2016). Guillemot also scored very low in vulnerability to collision impacts due to spending approximately 1% of flights at Wind Turbine blade height (Bradbury *et al.*, 2014) and low vulnerability to impacts arising from attraction to light. Guillemot have been selected as a VOR due to being recorded in high numbers in the Array Area Study Area, their connectivity to two SPAs in proximity to the Array Area Study Area, and very low vulnerability to collision impacts.

11.6.26 Razorbill is an Amber-listed species of conservation concern by the BoCC5 (Stanbury *et al.*, 2021) and Near Threatened by the IUCN global Red List of Threatened Species (BTO, 2024). Razorbill are present year-round in the UK, and similarly to the guillemot they are notably absent from the south-east of England with the largest concentrations of breeding razorbill being found on the UK's north-east North Sea coast. A total of 19 SPAs with razorbill as a Qualifying Feature, or as a named component within a qualifying assemblage, are within max/mean max foraging range of the Array Area Study Area. This ornithological receptor was recorded during each of the 24 months of Array Area Study Area DAS between March 2022 and February 2024. Razorbill score moderately in vulnerability to displacement impacts due to scoring high in vulnerability to structures and moderate in vulnerability to vessels and helicopters and in habitat specialisation (Wade *et al.*, 2016). Razorbill also scored very low in vulnerability to collision impacts due to spending approximately 0.5% of flights at Wind Turbine blade height (Bradbury *et al.*, 2014) and very low vulnerability to impacts arising from attraction to light. Razorbill have been selected as a VOR due to being recorded in high numbers in the Array

Area Study Area and their connectivity to 19 SPAs in proximity to the Array Area Study Area.

11.6.27 Puffin is a Red-listed species of conservation concern by the BoCC5 (Stanbury *et al.*, 2021) and Vulnerable by the IUCN global Red List of Threatened Species (BTO, 2024). Puffins are present in Scotland's Northern Isles and along the North Sea coast during the breeding season and winter offshore in the North Sea and widely throughout the Atlantic Ocean from Newfoundland in the west, the Canary Islands to the south and into the Mediterranean Sea. A total of 17 SPAs with puffin as a Qualifying Feature, or as a named component within a qualifying assemblage, are within max/mean max foraging range of the Array Area Study Area. This ornithological receptor was recorded in all of the 24 months of Array Area Study Area DAS between March 2022 and February 2024. Puffin score low in vulnerability to displacement impacts due to scoring moderate in sensitivity to structures and vessels and helicopters (Wade *et al.*, 2016). Puffin also scored very low in vulnerability to collision impacts due to spending approximately 0.5% of flights at Wind Turbine blade height (Bradbury *et al.*, 2014) and very low vulnerability to impacts arising from attraction to light. Puffin have been selected as a VOR due to being recorded in high numbers in the Array Area Study Area and their connectivity to 17 SPAs in proximity to the Array Area Study Area.

11.6.28 Manx shearwater is an Amber-listed species of conservation concern by the BoCC5 (Stanbury *et al.*, 2021) and Least Concern by the IUCNs global Red List of Threatened Species (BTO, 2024). This species are summer visitors to the UK, spending most of the year at sea and only returning to colonies on land to breed in the hours of darkness. There are five UK SPAs with Manx shearwater as a Qualifying Feature or named as part of a qualifying species assemblage within mean max + 1 SD foraging range of the Array Area Study Area. This receptor was recorded in two of the 24 monthly DAS surveys from March 2022 to February 2024. Manx shearwater score very low in vulnerability to displacement impacts, due to scoring very low in sensitivity to structures, vessels and helicopters and very low in habitat specialisation, and score very low in vulnerability to collision impacts due to having 0% of flight at Wind Turbine blade height. However, this receptor scores high in proportion of nocturnal flight activity (Bradbury *et al.*, 2014; Wade *et al.*, 2016), indicating a high vulnerability to impacts arising from attraction to light emitted from Offshore Infrastructure. Manx shearwater have been selected as a VOR for the reasons above and their connectivity to five SPAs.

11.6.29 European storm petrel is an Amber-listed species of conservation concern by the BoCC5 (Stanbury *et al.*, 2021) and Least Concern by the IUCNs global Red List of Threatened Species (BTO, 2024). This receptor is a pelagic seabird species, only returning to land to breed on remote offshore islands on the Atlantic coast during the hours of darkness, with UK breeding populations sparsely located on the north and west coasts from Shetland in the north to the Channel Islands in the south (BTO, 2024). There are two UK SPAs with European storm petrel as a Qualifying Feature or named as part of a qualifying species assemblage within mean max + 1 SD foraging range of the Array Area Study Area. This receptor was recorded in four of the 24 monthly DAS surveys

from March 2022 to February 2024. European storm petrel score very low in vulnerability to displacement impacts, due to scoring very low in sensitivity to structures, vessels and helicopters and very low in habitat specialisation, indicating very limited disturbance behaviour and a very good ability to utilise alternative habitats (high habitat flexibility) (Bradbury *et al.*, 2014; Wade *et al.*, 2016). This species also score low in vulnerability to collision impacts, however European storm petrel score high in proportion of nocturnal flight activity, indicating a high vulnerability to impacts arising from attraction to light emitted from Offshore Infrastructure. European storm petrel have been selected as a VOR for the reasons above and their connectivity to two SPAs.

11.6.30 Oystercatcher is an Amber-listed species of conservation concern by the BoCC5 and Near Threatened by the IUCNs global Red List of Threatened Species (BTO, 2024). This species is widely distributed on rocky shores around the UK in winter, and breed around most of the UK coast, interior of Scotland and have recently spread into the interior of north-eastern England (BTO, 2024). Oystercatcher migratory routes overlap with the Array Area Study Area, and this receptor was recorded in three out of the 24 monthly DAS surveys from March 2022 to February 2024, in addition to all seven monthly intertidal surveys. This species scores low in vulnerability to displacement impacts (Carless, 2005). Though oystercatcher migratory routes and flight heights indicate potential risk, a high avoidance rate means that they score low in vulnerability to collision impacts (Table 11.17). Oystercatcher have been selected as a VOR for the reasons above and their migratory routes overlapping with the Array Area Study Area, and their presence in moderate numbers in the Export Cable Corridor Study Area.

11.6.31 Lapwing is a Red-listed species of conservation concern by the BoCC5 and Near Threatened by the IUCNs global Red List of Threatened Species (BTO, 2024). This species populations are concentrated in the Somerset Levels, Fens, north-west England, the Uists, Caithness and Orkney during winter and currently breed mainly in north-west England, Orkney, Shetland and the Outer Hebrides (BTO, 2024). Lapwing migratory routes overlap with the Array Area Study Area and was recorded in all seven monthly intertidal surveys. This receptor has high vulnerability to disturbance (Collop, 2017). Though lapwing migratory routes and flight heights indicate potential risk, a high avoidance rate means that they score low in vulnerability to collision impacts (Table 11.17). Lapwing have been selected as a VOR for the reasons above and their migratory routes overlapping with the Array Area Study Area, and their presence in moderate numbers in the Export Cable Corridor Study Area.

11.6.32 Curlew is a Red-listed species of conservation concern by the BoCC5 and Near Threatened by the IUCNs global Red List of Threatened Species (BTO, 2024). This receptor's population has significantly reduced throughout Britain, with most breeding birds located in northern and western Britain and wintering birds present along the coastline (BTO, 2024). Curlew migratory routes overlap with the Array Area Study Area. They were recorded in one out of the 24 monthly DAS surveys from March 2022 to February 2024 and were present in all seven monthly intertidal surveys. Curlew score high in vulnerability to displacement impacts (Sexton, 2017). Though curlew migratory routes and flight heights

indicate potential risk, the very high avoidance rate means that they score low in vulnerability to collision impacts (Table 11.17). Curlew have been selected as a VOR for the reasons above and their migratory routes overlapping with the Array Area Study Area, and their presence in moderate numbers in the Export Cable Corridor Study Area.

11.6.33 Common gull is an Red-listed species of conservation concern by the BoCC5 (Stanbury *et al.*, 2021) and Least Concern by the IUCN's global Red List of Threatened Species (BTO, 2024). This species is present in the UK year-round with breeding populations found across the north and west of the UK and an influx of birds wintering throughout the UK in winter from the wider breeding range of continental Europe (Delany *et al.*, 2006). No SPA with common gull as a Qualifying Feature or named as part of a qualifying species assemblage are within the mean max + 1 SD foraging range of the Array Area Study Area. This receptor was recorded in 13 of the 24 monthly DAS from March 2022 to February 2024 in the DAS Area and two of the seven monthly intertidal surveys. Common gull score low in vulnerability to displacement impacts, due to scoring low in sensitivity to structures, vessels and helicopters (Bradbury *et al.*, 2014; Wade *et al.*, 2016) and score high in vulnerability to collision risk overall (Bradbury *et al.*, 2014). Common gull has been selected as a VOR for the reasons above and their presence in moderate numbers in the Export Cable Corridor Study Area.

11.6.34 Black-headed gull is an Amber-listed species of conservation concern by the BoCC5 (Stanbury *et al.*, 2021) and Least Concern by the IUCN's global Red List of Threatened Species (BTO, 2024). This receptor is widely distributed throughout lowland Britain and Ireland during the winter, with the highest densities located in Orkney, northern England, East Anglia, the Thames Estuary, and the Solent (BTO, 2024). No SPA with black-headed gull as a Qualifying Feature or named as part of a qualifying species assemblage is within the mean max + 1 SD foraging range of the Array Area Study Area. This receptor was recorded in seven of the 24 monthly DAS from March 2022 to February 2024 in the DAS Area and four of the seven monthly intertidal surveys. This species scores low in vulnerability to displacement impacts, due to scoring low in sensitivity to structures, vessels and helicopters (Furness *et al.*, 2012) and score high in vulnerability to collision risk overall (Bradbury *et al.*, 2014). Black-headed gull has been selected as a VOR for the reasons above and their presence in moderate numbers in the Export Cable Corridor Study Area.

Seasonality

11.6.35 For the purpose of this assessment, the NatureScot (2020) definition of seasons is used as it specifically defines the species in the Scottish environment (as shown in Table 11.8) as:

- **Breeding season:** birds are strongly associated with nest site, including nesting, egg laying and provisioning of young; and
- **Non-breeding season:** birds are not strongly associated with nest site but present in significant numbers in Scottish marine areas.

11.6.36 NatureScot (2020) define a further period in the phenology of some seabird species, where birds attend breeding sites but are not closely associated with

nest sites, occurring immediately before and/or after the breeding period. For this assessment, the breeding site attendance period is attributed to the non-breeding season as per other Scottish OWF assessments.

11.6.37 For the purpose of CRM, when seasons include half months, e.g. gannet breeding season (Table 11.8), mortalities have been attributed proportionally as advised by NatureScot (2025b).

Table 11.8: Seasonal Definitions of VORs Recorded in the Array Area Study Area, Taken from NatureScot (2020)

Species	Breeding Season	Non-Breeding Season
Fulmar	April to mid-September	Mid-September to March
Gannet	Mid-March to September	October to mid-March
Kittiwake	Mid-April to August	September to mid-April
Great black-backed gull	April to August	September to March
Herring gull	April to August	September to March
Arctic tern	May to August	September to April[1]
Guillemot	April to mid-August	Mid-August to March
Razorbill	April to mid-August	Mid-August to March
Puffin	April to mid-August	Mid-August to March

[1] Due to the low number of Arctic tern in Scottish marine areas, NatureScot (2020) does not provide a non-breeding season definition for Arctic tern. For the purpose of this report any months outside the NatureScot (2020) breeding season have been included within the non-breeding season definition

Future Baseline Scenario

11.6.38 The EIA Regulations 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 implementation of the project 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 Offshore EIA Report.

11.6.39 If the Proposed Development does not come forward, an assessment of the 'without development' future baseline conditions has also been carried out and is described within this section.

11.6.40 UK seabird populations have shown a marked decline over the last two decades (JNCC, 2020; Mitchell *et al.*, 2020), with over a third of species experiencing declines in breeding abundance of up to 30% or more since the early 1990s (Mitchell *et al.*, 2020; Burnell *et al.*, 2023; Harris *et al.*, 2024).

11.6.41 A recent study identifies that the three key threats to seabird populations globally are invasive species (165 species affected, across all the most threatened groups), bycatch in fisheries (100 species affected, but with the greatest average impact) and climate change (96 species affected) (Dias *et al.*, 2019; Mitchell *et al.*, 2020).

11.6.42 In the UK and Ireland, climate change is considered to be the likely primary cause of decline in seabird populations, with anticipated depletion of breeding

conditions for most species either indirectly, through changes in prey abundance, or directly during extreme weather events (Mitchell *et al.*, 2020), including increased storminess over the non-breeding season. Most seabird species in the UK are at the southern limit of their range in the north-east Atlantic and therefore an increase in global temperatures may result in a northward shift in species' range with the potential for overall declines in population size (Frederiksen *et al.*, 2007; 2013; Mitchell *et al.*, 2020).

11.6.43 The impact of commercial fisheries on seabird populations in the UK and Ireland has been largely negative. Substantial historic and contemporary over-fishing has and continues to have an effect on prey availability, although there have been attempts to improve stock management at fisheries. Many British species are impacted as bycatch, triggering spatial restrictions in place at some British colonies (e.g. off the Flamborough and Filey Coast SPA by Byelaw XVIII 2016 of the Northeastern Inshore Fisheries and Conservation Authority). The number of birds reported as bycatch is unquantifiable due to the size of the commercial fishing industry and attempts to quantify impacts within British waters have resulted in huge variation due to the level of observer effort versus fishing effect (Northridge *et al.*, 2020; Kingston *et al.*, 2023; Kober *et al.*, 2024). A conservative estimate is that over 1 million seabird deaths per year globally are directly correlated to fishing operations (Melvin *et al.*, 2023).

11.6.44 For many years, seabird species have benefitted from fisheries discards; for scavenging species such as herring gull, kittiwake, great skua and fulmar, population levels may have risen to above those that naturally occurring food sources could sustain (Votier *et al.*, 2004; Frederiksen *et al.*, 2013). However, the introduction between 2015 and 2019 of the Common Fisheries Policy Landings Obligation ('discard ban') has reduced the discard available and ultimately put more pressure on scavenging species, such as gulls.

11.6.45 After over 30 years of campaigning by conservation bodies, the UK and Scottish Governments recently announced their intention to close the sandeel fisheries in all Scottish waters and the English North Sea (Department for Environment Food and Rural Affairs (DEFRA), 2024; Scottish Government, 2024). This aims to allow recovery of the sandeel population and therefore benefit predators including seabirds such as kittiwake, puffin and guillemot which feed upon sandeels. Whether the positive impact of this measure can prevail over the negative impacts of climate change remains to be seen.

11.6.46 Seabird colonies throughout the British Isles are impacted by invasive species, particularly mammalian predators. Rat eradication programs have been implemented successfully at a number of colonies. The removal or reduction of predation pressure is one clear way to improve bird species breeding success and juvenile survival. Conservation bodies, governments, individual parties (e.g. landowners) and the offshore wind industry are currently working together to identify which colonies are most at risk and where implementation of measures would have the greatest benefit. These measures often stem from compensation measures that are required for offshore wind development (e.g. West of Orkney is proposing to remove rats and cats from Rousay; Marine Directorate, 2025). In the future there is likely to be a net increase of birds due

to removal of predators due to an accepted agreement from relevant stakeholders being broadly accepting of the benefits of predator eradication.

11.6.47 In light of these three main pressures, without the Proposed Development, climate change and the resulting disruption to marine ecosystems is considered to be the most likely primary cause of continued decline in seabird populations into the future. The other two pressures (invasive species and fishing pressure both direct and indirect) are much easier to control 'at source' and therefore likely to improve and reduce the impact on birds. However, due to its global nature, birds would continue to be negatively impacted by climate change despite the reduction in the impact of invasive predators and commercial fisheries.

11.6.48 The absence of the Proposed Development would contribute to the UK's failure to sufficiently rapidly transition away from fossil fuels and therefore further contribute towards climate change impacts and declining seabird populations. To help put this in its context, the Greenhouse Gas Emissions savings from the Proposed Development are estimated to be 11,247 tonnes of carbon dioxide equivalent (tCO2e) a year (based on the projected UK electricity grid marginal generation source), representing a contribution of 0.003 per cent of the UK's 2024 territorial Greenhouse Gas Emissions of 373 megatons of carbon dioxide equivalent (MtCO2e) (DESNZ, 2026). It should be noted however that this is considered a conservative estimate for operational avoided emissions, and the true value would likely be higher depending on the abatement of fossil fuel from the UK electricity grid. It does not however account for any construction, maintenance or decommissioning emissions (see Volume 2, Chapter 22: Climatic Change for further details).

Data Limitations and Assumptions

11.6.49 As described, three site-specific surveys were carried out for the baseline characterisation of the Offshore Ornithology Study Area, namely DAS, intertidal, and LiDAR surveys.

11.6.50 Like all wildlife surveys, the surveys conducted provide a snapshot of the abundance and distribution of birds and it is acknowledged that the number of birds present, and their distribution do vary over time in response to various factors, such as seasons, environmental conditions, and prey availability. However, by following survey guidance and consulting Statutory Nature Conservation Bodies (SNCBs) and agreeing the survey timings and duration the data collected were robust and suitable to support the assessment. In the very few instances where logistical, weather or health and safety considerations necessitated brief deviations from survey guidance, these were the subject of consultations with SNCBs, and sufficient steps taken to ensure the baseline data for the assessment remained suitable and robust. Specific deviations are given below.

11.6.51 The DAS flights took place over 24 months (March 2022 to February 2024 inclusive), with the area covered varying as described in Section 11.2. As notified to and accepted by NatureScot, three surveys were not flown within the target month and were instead flown in the following month. These were the March

2022 survey flown in April 2022, the May 2022 survey flown in June 2022 and April 2023 survey flown in May 2023. The DAS flights were nonetheless regularly spaced and therefore, as confirmed by NatureScot, ensured adequate DAS coverage was achieved (Table 11.3). Additionally, two flights were flown during five months (November 2022, December 2022, July 2023, August 2023, September 2023) and three flights flown during two months (April 2022, April 2023) as the conditions during the first flight became unsuitable for data collection, and the DAS was therefore stopped and resumed at the next available opportunity. Additionally, four flights were flown in May 2023 to avoid imagery being captured during parts of the day where the sea-surface glint/glare is worst. The required number of surveys were still completed, and therefore there were no significant implications for the baseline distribution and abundance data.

11.6.52 Furthermore, as the DAS flights extended well beyond the minimum requirement in guidance (to 12 km rather than 4 km), abundance and distribution data were obtained from a higher proportion of the Array Area Study Area than the minimum requirement. The increased coverage also helped ensure the resulting data are a robust and comprehensive basis from which to determine VOR abundance and distribution for the assessment.

11.6.53 The 12 km DAS coverage also included the outer section of the Export Cable Corridor Study Area (Figure 11.1).

11.6.54 The Landfall end of the Export Cable Corridor Study Area was covered by shore-based intertidal surveys. Characterisation of the intervening section of the Export Cable Corridor Study Area was completed using desk study sources, an approach that is widely accepted by SNCBs for assessment purposes. Moreover, this approach is further supported by a comparison of the survey data to the Wetlands Bird Survey Data, which found that the abundance and diversity of species recorded within intertidal surveys was similar to those recorded in the database (see Section 4.3 of Volume 3, Technical Appendix 11.2: Nearshore, Intertidal and Offshore Ornithology Along the Export Cable Corridor Baseline Report). As a result, and having agreed the sampling regime adopted for the DAS and the coverage of the Export Cable Corridor Study Area with MD-LOT and NatureScot (Table 11.3), there were no limitations on the baseline data available for the assessment of effects on VORs.

11.6.55 In relation to flight heights, LiDAR data collection was commissioned, as noted. The LiDAR sample sizes for the majority of the VORs were relatively small (ranging from one to 83 individuals), with the exception of kittiwake which had a statistically representative site-specific sample of flight heights (707 records). Therefore, in addition to the CRM following NatureScot guidance (2023g), CRM was carried out using model Option 1 to allow for the incorporation of LiDAR data for kittiwake only. The use of site specific flight height data therefore added to the robustness of the assessment of collision risk, reducing the limitations of using generic flight height data.

11.6.56 Table 11.3In relation to the population data used for the assessment, the seabird population figures for the UK, Scotland and SPA colonies used to inform the assessments were taken from recent colony count data. This included from

Seabirds Count (Burnell *et al.*, 2023), which was based on census surveys undertaken between 2015 and 2021, and the Seabird Monitoring Programme database. In addition, through the NEEOG-funded census and sample plot surveys along the North and East Caithness Cliffs SPAs further recent population data have been collected. Although not used within the analysis, these counts provide further context when analysing results. Additionally, the NEEOG-funded work contributed to a wider RSPB project to help assess the impacts of HPAI, reported in Tremlett *et al.* (2024), and NEEOG also funded additional work, such as undertaking tracking studies as SPAs with connectivity to the Proposed Development (e.g. Fowlsheugh SPA and Buchan Ness to Collieston Coast SPA).

11.6.57 Consideration was also given to the implications of the avian influenza outbreak on seabird populations, including in consultation with SNCBs. The H5N1 strain of HPAI was first recorded in the UK in summer 2021 (Falchieri *et al.*, 2022). Although existing systematic reviews indicate that diseases are seldom a key factor leading to the extinction of vertebrates, diseases can cause population crashes (Young and VanderWerf, 2023).

11.6.58 Thousands of seabird mortalities attributed to HPAI were reported across the UK in 2022, with minimum losses of almost 20,000 individuals in Scotland alone (NatureScot, 2023h) and by the end of 2022, 17 of the 25 UK breeding seabird species had tested positive for HPAI (Animal and Plant Health Agency (APHA), 2023).

11.6.59 The baseline DAS data were collected between March 2022 and February 2024 and therefore the survey period overlapped the HPAI outbreak.

11.6.60 HPAI surveys were carried out by the RSPB (Tremlett *et al.*, 2024) in order to investigate the potential impacts of this HPAI outbreak on UK seabirds. Notably seven of the VORs included within this assessment were included within these surveys.

11.6.61 The RSPB HPAI report (Tremlett *et al.*, 2024) showed large declines in gannet of 25% across eight SPAs when compared against the Burnell *et al.* (2023) pre-HPAI baseline, whereas kittiwake increased by 10% across 21 SPAs and guillemot declined by 6% across 21 SPAs.

11.6.62 When considering Scottish SPAs only, gannet were found to decrease by 22%, with all six Scottish SPAs showing declines ranging from 3% (Fair Isle SPA) to 37% (Hermaness, Saxa Vord and Valla Field SPA).

11.6.63 For kittiwake, the majority of Scottish SPAs recorded increases (13 of 19 surveyed), with an overall increase of 21%. However, notable decreases were observed a Sumburgh Head SPA (-89%) and Copinsay SPA (-69%) which both have connectivity with the Proposed Development.

11.6.64 Guillemot were also found to increase when only considering Scottish populations. However, this was a much a smaller increase than kittiwake with populations increasing by 2%. The impacts on guillemot showed a much wider range than other species with impacts at Scottish SPAs ranging from a decrease of 56% (Copinsay SPA) to an increase of 33% (North Caithness Cliffs SPA).

11.6.65 Other VORs included within these surveys include herring gull, great black-backed gull and Arctic tern. All three species were found to show declines across the UK and Scotland.

11.6.66 Herring gull were found to decline by 7% within the UK. However, when considering only Scottish SPAs a decrease of 24% was recorded. The six Scottish SPAs showed varied trends with two SPAs showing increases (Troup, Pennan and Lion's Head SPA and St Abb's Head to Fast Castle SPA) and the remaining four showing decreases ranging from 1% at Buchan Ness to Collieston Coast SPA to 34% at Forth Islands SPA.

11.6.67 Great black-backed gull showed similar trends across the UK (-20%) and Scotland (-19%). However, only three SPAs were surveyed with both Scottish sites recording decreases of over 25%. Notably, both Hoy SPA (-44%) and Copinsay SPA (-27%) were found to have connectivity with the Proposed Development.

11.6.68 Arctic tern remained relatively stable across the UK, with a decrease of just 2% recorded. However, the three Scottish sites surveyed showed a high variability in population trends with Mousa SPA recording a 21% increase in population size, Fair Isle recording a 55% increase and at Papa Westray SPA recording an 80% decrease. The only SPA with connectivity to the Proposed Development, Auskerry SPA, was not included within surveys.

11.6.69 The RSPB HPAI report (Tremlett *et al.*, 2024) concludes that changes in species, such as guillemot, may be partially due to other factors as they were already in decline, whereas the decline in species showing much higher decreases in population size, such as gannet, is almost certainly attributable to HPAI due to the species showing recent population increases.

11.6.70 In addition to the surveys by Tremlett *et al.* (2024), bird count surveys have been carried out by the NEEOG (Zisman, Swann and Burt, 2025; Zisman and Swann, 2025). In 2023, increases in the North Caithness Cliffs SPA compared to the previous SPA count of 2015/2016 were recorded. These consisted of increases of 47% in kittiwake, 29% in great black-backed gull, 27% in herring gull and 27% in common guillemot, with no gannets and only small numbers of Arctic tern present in the North Caithness Cliffs SPA. This would suggest that the North Caithness Cliffs SPA birds had avoided the worst of the HPAI outbreak in 2022. In 2024, there were low seabird numbers at both the North Caithness Cliffs SPA and East Caithness Cliffs SPA across species, but this was likely attributable to a uniquely poor breeding season, with little seabird activity evident across the cliffs. In 2025, the recorded seabird numbers were higher across the East Caithness Cliffs SPA in comparison to those found in 2015/2016, with demonstrated increases in kittiwake (41%), guillemot (35%), razorbill (77%) and puffin (34%). However, decreases were also recorded for a number of species such as great black-backed gull (58%), herring gull (65%) and fulmar (4%). The recorded seabird numbers in 2025 were also higher than those recorded in 2024, potentially confirming 2024 as an atypical year. Higher counts in 2025 could also be attributed to the novel use of drones in sections that were previously difficult to survey by the standard sea count and/or land count methodology.

11.6.71 As shown by both RSPB (Tremlett *et al.*, 2024) and NEEOG surveys, although the majority of seabirds were found to decrease during the HPAI outbreak the medium and long-term effects on demographic rates remains unclear. However, it was found that species showing increases during RSPB surveys, such as kittiwake and guillemot, continued to increase in population size at both East Caithness Cliffs SPA and North Caithness Cliff SPA. Whereas, species showing decreases during the outbreak, such as herring gull and great black-backed gull, showed differing trends at both SPAs surveyed by NEEOG. Despite the mixed trends, the HPAI outbreak has undoubtedly impacted UK and Scottish seabirds, with over 60 species recorded to be impacted (Pearce-Higgins *et al.*, 2023). Notably, species included within this assessment such as gannet have been highlighted as species particularly impacted by HPAI (Pearce-Higgins *et al.*, 2023; Atkinson and Baillie, 2025), which could have global consequences considering the UK supports 55.6% of the global population (JNCC, 2021).

11.6.72 Following consultation with NatureScot (Table 11.3), the impact of HPAI is to be considered qualitatively within the assessment. However, the short, medium and long-term effects of the most recent HPAI outbreak on demographic rates is unclear. Quantitative assessments have been carried out following the advice received in the Proposed Development's Scoping and Screening Opinions (MD-LOT, 2024), which have not included adjustments to account for HPAI. As in other applications (e.g. Ossian OWF (Ossian, 2024)), it assumed that reductions in at-sea abundances and densities will be proportional to the impacts of HPAI and therefore reflected within the magnitude of predicted impacts. Therefore, there are not considered to be significant limitations to the assessment as a result of the HPAI outbreak.

11.7 Key Parameters for Assessment

Maximum Design Scenario

11.7.1 The Maximum Design Scenario (MDS) identified in Table 11.9 are those parameters expected to result in the greatest potential impact on an identified receptor or receptor group. Any other development scenario within the Project Design Envelope (PDE), will result in the same, or less, level of environmental effect. The scenario has been selected from the details provided in Volume 1, Chapter 3: Project Description.

Table 11.9: MDS Considered for Each Potential Impact as Part of the Assessment on Offshore Ornithology

Potential Impact	Phase*			MDS	Justification
	C	O	D		
Collision mortality risk due to collision with rotor blades	×	✓	×	**O&M Phase** Wind Turbines for the 15 MW Wind Turbine layout: • operational lifetime up to 30 years; • up to 67 Wind Turbines on fixed foundations; • maximum rotor diameter 236 m, chord width 6.5 m, hub height 151 m above Lowest Astronomical Tide (LAT), minimum blade clearance 33.12 m above LAT (29.28 m above Highest Astronomical Tide (HAT)), upper blade height 269.12 m above LAT; • Wind Turbine spacing minimum 1,038 m; and • maximum rotor speed of 8.4 rpm, average of 7.1 rpm.	**O&M Phase** The potential for collision risk was derived from a sensitivity analysis using Wind Turbine parameters including rotor diameter, chord width, rotor speed and minimum blade clearance above LAT. The parameters associated with the highest number of Wind Turbines (15 MW) represents the MDS because it will result in the greatest potential for collision risk. This is a combined effect of Wind Turbine number and higher rotation speed.
Distributional responses, displacement and barrier effects from Offshore Infrastructure	✓	✓	✓	**O&M Phase** Wind Turbines for the 15 MW Wind Turbine layout: • operational lifetime up to 30 years; • up to 67 fixed foundation Wind Turbines; • maximum rotor diameter 236 m, chord width 6.5 m, hub height 151 m above LAT, minimum blade clearance 33.12 m above LAT (29.28 above HAT), upper blade height 269.12 m above LAT; • Wind Turbine spacing minimum 1,038 m; and • maximum rotor speed of 8.4 rpm, average 7.1 rpm. OSPs: • 3 OSPs, main structure 60 m above LAT in height (tallest point 70 m above LAT); and • topside 50m long x 40m wide for each OSP.	**All Phases** Represents the maximum number and density of Wind Turbines and structures across the Array Area, which maximises the potential: • barrier to foraging grounds and migration routes for migratory bird species; and • disturbance to and displacement of birds from the Array Area. For seabirds occurring within the Array Area, in line with NatureScot guidance (NatureScot, 2023a), barrier to movement impacts are assessed as part of displacement and therefore not considered separately for these species.

Potential Impact	Phase*			MDS	Justification
	C	O	D		
				Construction and Decommissioning Phases Displacement and barrier effects have the potential to occur across all development phases with construction and decommissioning impacts lesser than during O&M when the number of Offshore Infrastructure is greatest.	
Disturbance to birds from vessel movements	✓	✓	✓	**Construction Phase** • Maximum 41 vessels on site at any one-time (25 and 16 vessels for the Array Area and Export Cable Corridor respectively), totalling 2,120 return vessel trips (1,671 and 449 return trips for the Array Area and Export Cable Corridor respectively) during the total construction period of 5 years. • Maximum of 2 helicopters on site at any one-time, totalling 267 return trips during construction. **O&M Phase** • Maximum 20 vessels on site at any one time (12 and 8 vessels for the Array Area and Export Cable Corridor respectively), totalling 713 return vessel trips per year (588 and 125 return trips for the Array Area and Export Cable Corridor respectively). In addition to this, a further number of vessels will undertake another 260 return trips spread over entire 30 year O&M phase (146 and 114 return trips for the Array Area and Export Cable Corridor respectively). • Maximum of 3 helicopters on site at any one-time, totalling 30 return trips per year. **Decommissioning Phase** A Decommissioning Programme will be submitted to MD-LOT for consultation and approval. The Decommissioning Programme will be updated during the Project's lifespan to take account of changing best practice and new technologies.	**All Phases** Represents the maximum number of vessel and helicopter movements that would cause greatest visual and noise disturbance and displacement to birds from the Proposed Development during construction, and O&M activities. Decommissioning impacts assumed to be similar or less than construction impacts.

Potential Impact	Phase*			MDS	Justification
	C	O	D		
				The approach for decommissioning is yet to be determined, however, for the purposes of this MDS, total removal of all infrastructure including buried cables and cable protection has been assumed, and as such the environmental impact of decommissioning will be the same if not lower than construction.	
Disturbance to prey species and their habitats	✓	✓	✓	**Construction Phase** • Up to **19,414,805 m²** of subtidal temporary habitat loss and/or disturbance due to exit pit excavation, sandwave clearance, sandwave clearance material deposition, cable installation (including boulder clearance) and jack-up events. • An additional **13,987 m²** of temporary habitat loss and/or disturbance could occur due to crater formation from the clearance of UXO. • Up to **2,251,000 m2** (0.77% of the total area of the Site Boundary) of long-term subtidal habitat loss due to infrastructure installed in the construction phase, which will persist into the O&M phase. • Introduction of up to **2,705,020 m²** of hard substrate surface area installed throughout the construction phase which will persist into the O&M phase. • Effects on fish and shellfish receptors due to underwater noise from piling, UXO clearance, site investigation surveys and vessel noise and other noise producing activities. • Effects on fish and shellfish receptors from Suspended Sediment Concentrations (SSC) from drill arising, IAC, Interconnector Cable and Offshore Export Cable installation, sandwave clearance, exit pit excavation, and drilling fluid release (at Landfall). **O&M Phase** • a total of up to **11,688,813 m²** of temporary subtidal habitat loss (up to **4.01%** of the total area of the Site Boundary) and/or disturbance due to jack-up events and disturbance caused by	**Construction (including Site Preparation)** Sets out activities contributing to habitat loss (which in turn affects prey availability), such as clearance of boulders and sandwaves, as well as installation of foundations and cables. Sets out construction activities that would cause disturbance to prey, including clearance of boulders and sandwaves, foundation and cable installation, and vessel movements. **O&M Phase** Disturbance caused by reburial of IACs, Interconnector Cables, and Offshore Export Cables. **Decommissioning Phase** Decommissioning impacts assumed to be similar or lesser than construction impacts.

Potential Impact	Phase*			MDS	Justification
	C	O	D		

				reburial of IAC, Interconnector Cables and Offshore Export Cables;
				• up to **2,705,020 m²** of hard substrate will be installed in the construction phase could be colonised by benthic species;
				• effects on fish and shellfish ecology due to Electromagnetic Field (EMF)s from subsea electrical cabling due to presence of:
				  • up to 151 km of 132 kV IAC;
				  • up to 36 km of 275 kV Interconnector Cables;
				  • up to 210 km of 275 kV Offshore Export Cables; and
				  • effects on fish and shellfish receptors due to operational noise from Wind Turbines, and vessel noise and other noise producing activities.
				
				Decommissioning Phase
				A Decommissioning Programme will be submitted to MD-LOT for consultation and approval. The Decommissioning Programme will be updated during the Proposed Development's lifespan to take account of changing best practice and new technologies.
				
				The approach for decommissioning is yet to be determined, however, for the purposes of this MDS it has been assumed that all Scour Protection, cable protection, and cable crossing protection will be left *in situ*. Therefore, up to **2,232,100 m²** (up to **0.77%** of the total area of the Site Boundary) of long term habitat loss will persist past the decommissioning phase.	

Temporary habitat loss and/or habitat disturbance	✓	×	✓	**Construction phase - Subtidal** Up to **19,414,805 m²** of subtidal temporary habitat loss and/or disturbance, this represents up to **6.66%** of the total area of the Site Boundary, due to:	The MDS for this impact considers the maximum seabed footprint of infrastructure resulting in the greatest level of temporary habitat loss and/or disturbance during the construction, O&M, and decommissioning phases of the Proposed Development. The MDS for this

Potential Impact	Phase*			MDS	Justification
	C	O	D		
				Trenchless Technique Exit Pit Excavation (e.g. Horizontal Directional Drilling (HDD) Up to 17,130 m^2 of habitat disturbance associated with excavation of exit pits comprising: • up to 16,800 m^2 from deposition of 8,400 m^3 of trenchless techniques excavation material; and • up to 330 m^2 of habitat disturbance from the installation of up to three trenchless techniques exit pits. Sandwave clearance Up to 835,872 m^2 of habitat disturbance associated with sandwave clearance comprising: • Wind Turbine foundations: 141,000 m^2 for the installation of up to 50 Wind Turbine foundations (this may also include boulder clearance but sandwave clearance is the greater impact of the 2). • Offshore Substation Platform (OSP) foundations: 24,359 m^2 for the installation of up to 3 OSP foundations. • Inter-Array Cables (IACs): up to 49,552 m^2 (assumes 0.56% requires clearance with a 58.6 m width of disturbance). • Interconnector Cables: up to 11,814 m^2 (assumes 0.56% requires clearance with a 58.6 m width of disturbance). • Offshore Export Cables: up to 609,147 m^2 (assumes 4.95% requires clearance with a 58.6 m width of disturbance). Sandwave clearance material deposition Up to 8,774,332 m^2 of habitat disturbance associated with the deposition of sandwave clearance material comprising: • Wind Turbines foundations: up to 1,188,770 m^2 from deposition of 594,385 m^3 of sandwave clearance material;	impact is represented by the 50 x 20 MW wind turbine layout scenario. **Construction phase – Subtidal** Trenchless techniques Exit Pit Excavation Based on up to: • assuming a mound of uniform thickness of 0.5 m height; and • 110 m^2 per exit pit. Sandwave clearance Based on up to: • 151 km total length of IACs on the seabed; • 36 km total length Interconnector Cables; and • 210 km total length of Offshore Export Cables. Sandwave Clearance material deposition The area of seabed affected by the placement of sandwave clearance material has been calculated based on the maximum volume of sediment to be placed on the seabed, assuming all this sediment is coarse material (i.e. is not dispersed through tidal currents; see "Potential changes to SSCs" impact below). The total footprint of seabed affected has been calculated, for the purposes of the MDS, assuming a mound of uniform thickness of 0.5 m height.

Potential Impact	Phase*			MDS	Justification
	C	O	D		
				• OSP foundations: up to 272,824 m^2 from deposition of 136,412 m^3 of sandwave clearance material; • IACs: up to 395,910 m^2 from deposition of 197,955 m^3 of sandwave clearance material; • Interconnector Cable: up to 94,382 m^2 from deposition of 47,191 m^3 of sandwave clearance material; and • Offshore Export Cables: up to 6,822,446 m^2 from deposition of 3,411,223 m^3 of sandwave clearance material. <u>Cable installation (including boulder clearance)</u> Up to 9,638,945 m^2 of habitat disturbance associated with cable installation comprising: • IACs: up to 3,753,860 m^2 disturbance from installation of up to 151 km of IACs (99.44% of the total length, including the length which requires boulder clearance with a 25 m width of disturbance, separate to sandwave clearance); • Interconnector Cable: up to 894,960 m^2 from installation of up to 36 km of Interconnector Cable (99.44% of the total length, including the length which requires boulder clearance with a 25 m width of disturbance, separate to sandwave clearance); and • Offshore Export Cables: up to 4,990,125 m^2 of disturbance from installation of up to 200 km of Offshore Export Cables (95.05% of the total length, including the length which requires boulder clearance with a 25 m width of disturbance, separate to sandwave clearance). <u>Jack-up events</u> Up to 148,400 m^2 of disturbance due to jack-up vessel use for the installation of up to 3 OSPs and up to 50 Wind Turbine foundations. Up to 126 m^2 of disturbance due to jack-up vessel use for the installation of up to 3 trenchless techniques exit pits.	Temporary loss of benthic habitat is assumed beneath this. <u>Cable installation (including boulder clearance)</u> The MDS assumes that up to 151 km of the IACs cable will be on the seabed, with up to 16 km within the Wind Turbine foundation. Based on the assumption that the width of disturbance for sandwave (58.6 m) clearance also includes subsequent cable installation as repeat disturbance. As such up to 95.02% of the length of Offshore Export Cables, and up to 99.44% of the length of IACs and Interconnector Cables has been assumed for cable installation. Boulder clearance is captured within the disturbance corridor for cable installation. <u>Jack-up event</u> Based on the assumption that there will be up to a maximum of up to two jack-up positions per OSP and Wind Turbine foundation. <u>Additional Subtidal Information</u> UXO clearance MDS calculated from the maximum estimated crater diameter of 21.10 m in Ordtek, 2018.

				Additional Subtidal Information In addition, up to 13,987 m^2 of temporary habitat loss and/or disturbance could occur due to crater formation from the clearance of UXO. This value has not been included in the total disturbance presented above, as the footprint from UXO clearance will likely overlap with area subject to temporary habitat disturbance from other site preparation activities. Additionally, the footprint associated with the UXO clearance has not been derived from Volume 1, Chapter 3: Project Description. Instead, it has been calculated based on appropriate crater sizes estimated in Ordtek (2018) and applied to the 40 UXOs that may require clearance during the construction phase of the Proposed Development (30 in the Array Area and 10 along the Export Cable Corridor). **Construction phase – Intertidal** There is no impact in the intertidal zone as cables will be installed via trenchless techniques with exit pits located below MLWS and above MHWS. **O&M phase** A total of **11,688,813 m^2** of temporary subtidal habitat loss and/or disturbance, this represents up to **4.01%** of the total area of the Site Boundary, over the 30 year life cycle of the Proposed Development due to: Disturbance caused by reburial of IACs, Interconnector Cables, and Offshore Export Cables Up to 4,915 m of cable reburial may be required per year for repair of IACs. The width of the minimum installation corridor is up to 25 m. Up to 2,040 m of cable reburial may be required per year for repair of Interconnector Cables. The width of the minimum installation corridor is up to 25 m. Up to 6,390 m of cable reburial may be required per year for repair of Offshore Export Cables. The width of the minimum installation corridor is up to 25 m.	**O&M phase** Disturbance caused by reburial of IACs, Interconnector Cables, and Offshore Export Cables. **Decommissioning phase** In the decommissioning phase, the MDS accounts for the maximum amount of infrastructure which could be removed from the seabed.

Potential Impact	Phase*			MDS	Justification
	C	O	D		
				Jack-up events Up to 1,680,000 m^2 of disturbance due to jack-up vessel use for the repair of Wind Turbines. Up to 63 m^2 of disturbance due to jack-up vessel use for repair and reburial event at the 3 trenchless techniques exit pits. **Decommissioning phase** A Decommissioning Programme will be submitted to MD-LOT for consultation and approval. The Decommissioning Programme will be updated during the Proposed Development's lifespan to take account of changing best practice and new technologies. The approach for decommissioning is yet to be determined, however, for the purposes of this MDS total removal of all infrastructure including buried cables and cable protection has been assumed, and as such the environmental impact of decommissioning will be the same if not lower than construction.	
Attraction to light	✓	✓	✓	**O&M Phase** Aviation lighting in accordance with MGN 654, Annex 5: • Winching lights as per CAP 437; • Periphery Wind Turbine lights: Red 2,000 candela dimmable to 200 candela when visibility is greater than 5 km. Flashing Morse 'W' in unison; and • All other structures (i.e. internal Wind Turbines and OSPs): Red, 200 candela SAR light with fixed illumination. Lights on servicing and construction vessels will follow International Maritime Organization's (IMO) convention on preventing collisions at sea (COLREGS).	**All Phases** Represents the maximum lighting that would cause the greatest visual disturbance to birds from the Array Area.

Potential Impact	Phase*			MDS	Justification
	C	O	D		
				Construction (including Site Preparation) and Decommissioning Phases For the purpose of the MDS, it is assumed that the environmental impact of construction and decommissioning will be the same if not lower than the O&M phase.	
Direct impacts from UXO clearance	✓	×	×	**Construction Phase** • Maximum realistic charge weight of UXO 254 kg (Net Explosive Quantity (NEQ)). • A maximum of 40 UXOs are anticipated to require clearance (based on most probable case for the Array Area (30 UXOs) and Export Cable Corridor (10 UXOs) combined). • A maximum of 2 detonations during 24 hrs. • A maximum of 40 days of UXO clearance activities (assuming one clearance per day).	**Construction Phase** Maximum number used in the MDS (reflecting the most probable worst case) and the maximum size of UXOs encountered within the Site Boundary is based on the UXO hazard assessment undertaken for the Array (PDE; 6 Alpha Associates, 2020). The actual detail of any possible UXO that may need clearance is not known at this stage. The MDS represents the maximum charge weight likely to require clearance. Noise modelling will estimate impact ranges for low order as the default, with high order impact ranges provided for context
Indirect impacts from construction and decommissioning noise	✓	×	✓	**Construction Phase** Maximum temporal scenario: *Fixed Foundations – 15 MW 4-legged jacket* • Number of piled jacket foundations – 67; • Maximum number of piles – 268; • Maximum pile diameter – 3.8 m; • Maximum pile length – 70 m, with final pile penetration depth of 65 m; • Maximum hammer energy – 4,500 kJ;	**Construction Phase** Construction activities including the installation of Wind Turbine and OSP foundations. Represents the maximum number and duration of piling events that would cause the greatest noise disturbance to birds from the Proposed Development during construction activities.

Potential Impact	Phase*			MDS	Justification
	C	O	D		
				• Maximum duration of piling per pile – 12.4 hours; • Maximum duration of piling per day – 22 hours; and • Maximum duration of piling – 3,323.3 hours (12.4 hours per day over 268 days). <u>Maximum spatial scenario:</u> *Fixed Foundations – 25 MW monopile* • Number of monopile foundations – 40; • Maximum number of piles – 40; • Maximum pile diameter – 15 m; • Maximum pile length – 123 m, with final pile penetration depth of 45 m; • Maximum hammer energy – 6,250 kJ; • Maximum duration of piling per pile – 8.6 hours; • Maximum duration of piling per day (based on 2 piles installed over 24 hours) – 17.1 hours; and • Maximum total hours of piling – 344 hours (8.6 hours per day over 40 days). <u>Realistic spatial scenario:</u> *Fixed Foundations – 25 MW monopile* • Number of monopile foundations – 40; • Maximum number of piles – 40; • Maximum pile diameter – 15 m; • Maximum pile length – 123 m, with final pile penetration depth of 45 m; • Average maximum hammer energy – 6,000 kJ; • Average maximum duration of piling per pile – 4.3 hours; and • Maximum total hours of piling – 172 hours (4.3 hours per day over 40 days).	**Decommissioning Phase** Decommissioning activities are assumed to be the same if not of a lower impact than construction.

Potential Impact	Phase*			MDS	Justification
	C	O	D		
				Concurrent piling – all three scenarios • up to 2 vessels piling concurrently; and • minimum 1 km and maximum 20 km distance between concurrent piling events **Decommissioning Phase** A Decommissioning Programme will be submitted to MD-LOT for consultation and approval. The Decommissioning Programme will be updated during the Proposed Development's lifespan to take account of changing best practice and new technologies. The approach for decommissioning is yet to be determined, however, for the purposes of this MDS total removal of all infrastructure including buried cables and cable protection has been assumed, and as such the environmental impact of decommissioning will be the same if not lower than construction	

*Proposed Development Phase refers to construction (C), operation and maintenance (O) and decommissioning (D).

Impacts Scoped Out of the Assessment

11.7.2 The Scoping Workshop (see Table 11.3) was used to facilitate stakeholder engagement on topics to be scoped out of the assessment.

11.7.3 Based on the baseline environment and the Project Description outlined in Volume 1, Chapter 3: Project Description, certain potential impacts have been scoped out of the assessment for offshore ornithology (BOWFL, 2024).

11.7.4 These impacts are outlined in Table 11.10, together with the justification for scoping them out.

Table 11.10: Impact Scoped Out of the Assessment for Offshore Ornithology (Tick Confirms the Impacts is Scoped Out)

Potential Impact	Phase*			Justification
	C	O	D	
Collision risk with substructure and underwater Offshore Infrastructure	✓	✓	✓	The risk of birds colliding with the stationary substructure or underwater infrastructure is markedly low (Furness *et al.*, 2012'; Isaksson *et al*, 2020). The substructures and underwater infrastructure are stationary and therefore do not present a risk of collision to seabirds. The risk of collision is primarily due to birds not being able to see the rotating blade due to its speed (Johnston *et al.*, 2014). Stationary structures present a vastly reduced impact and this pathway is therefore scoped out.
Accidental release of contaminants	✓	✓	✓	The potential impacts caused by the accidental release of pollutants is covered by non-EIA legislation which mitigates against potential impacts to benthic, subtidal and intertidal receptors, thus significant impacts will not be generated for offshore or bird species. A Marine Pollution Contingency Plan (MPCP) will be provided (Volume 4, Appendix 25: Marine Pollution Contingency Plan). The MPCP will contain measures to reduce impact to the environment.
Long-term habitat loss	✓	✓	✓	The impacts resulting from the footprint of the permanent (over 25 years) Offshore Infrastructure including Wind Turbine foundations or cable/scour protection, are considered a permanent loss. However, this habitat loss would be highly localised and negligible for ornithological receptors due to the spatial scale over which these species occur. Scoping out of this impact was agreed at the Scoping Workshop in April 2024.
Entanglement	×	✓	×	As the floating design for the Proposed Development has not been pursued, there is no risk of entanglement to diving seabirds with Offshore Infrastructure or debris which has become caught within offshore infrastructure. It is also advised by NatureScot (MD-LOT, 2024), that the assessment of entanglement is only required for the floating design. Therefore, this impact has been scoped out.

*Proposed Development Phase refers to construction (C), operation and maintenance (O) and decommissioning (D).

11.8 Methodology for Assessment of Effects

Overview

11.8.1 The offshore ornithology assessment of effects has followed the methodology set out in Volume 1, Chapter 4: Environmental Impact Assessment Methodology. Specific to the offshore ornithology assessment, the following guidance documents have also been considered:

- NatureScot Marine Ornithology Guidance Notes 1 to 11 to support Offshore Wind Applications (NatureScot, 2023a to h & 2025a to b);
- Incorporating data uncertainty when estimating potential vulnerability of Scottish seabirds to marine renewable energy developments (Wade *et al.*, 2016);
- Assessing vulnerability of marine bird populations to offshore wind farms (Furness *et al.*, 2013);
- Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index (Garthe and Hüppop, 2004);
- Joint SNCB Interim Displacement Advice Note: Advice on how to present assessment information on the extent and potential consequences of seabird displacement from Offshore Wind Farm developments (JNCC, 2022b);
- Modelling flight heights of marine birds to more accurately assess collision risk with offshore Wind Turbines (Johnston *et al.*, 2014);
- Using a Collision Risk Model to Assess Bird Collision Risks for Offshore Wind Farms (Band, 2012);
- A Stochastic Collision Risk Model for Seabirds in Flight (McGregor *et al.*, 2018);
- Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM, 2024); and
- Developing Guidance on Ornithological Cumulative Impact Assessment for Offshore Wind Farm Developers (King *et al.*, 2009).

Criteria for Assessment

11.8.2 To determine the significance of an effect on a given receptor, a matrix approach has been used. The matrix approach involves defining the magnitude of the potential impact and the sensitivity of the receptor type/VOR, then combining the two outcomes to give the predicted significance of the effect on the respective VOR. This section describes the criteria applied in this chapter to assign values to the magnitude of potential impacts and the sensitivity of the receptors. The terms used to define magnitude and sensitivity are based on those which are described in further detail in Volume 1, Chapter 4: Environmental Impact Assessment Methodology.

11.8.3 It was stated within the Bowdun OWF Scoping Report (BOWFL, 2024) that a matrix approach would not be used, in line with CIEEM guidance (CIEEM, 2024).

However, following a review of other ScotWind applications (e.g. Berwick Bank OWF, Salamander OWF, Cenos OWF) and the relevant representations it was determined that a matrix approach would provide an appropriate basis for comparison with other projects. Concerns associated with the underestimation of sensitivities and magnitude by NatureScot within the representations for Caledonia OWF (MD-LOT, 2025a) and Cenos OWF (MD-LOT, 2025b) have been acknowledged and it has been ensured that up to date and relevant sources have been used when implementing the approach in this chapter.

11.8.4 The criteria for defining magnitude in this chapter are outlined in Table 11.11. Each assessment considered the spatial extent, duration, frequency and reversibility when determining magnitude of impact on each VOR, with the justification given in each case. For impacts assessed quantitatively, a PVA has been carried out if the decrease in survival rate was estimated to be greater than the 0.02 percentage point threshold, as recommended by NatureScot (2023g). The results of these PVAs have then been used to determine the magnitude of impact as shown in Table 11.11. If the decrease in survival is not predicted to meet the 0.02 percentage point threshold, then a PVA was not required, and the magnitude of impact is therefore deemed to be negligible.

11.8.5 Where a PVA is required, both the counterfactual population growth rate (CPGR) and counterfactual populations size (CPS) have been presented. Counterfactuals, such as the CPGR and CPS, are metrics which compare the difference between baseline or unimpacted scenarios against impacted scenarios. A counterfactual of 1.000 would indicate that the growth rate or population size for both scenarios are the same, whereas a counterfactual of 0.900 would indicate the growth rate or population size for the impacted scenario is 0.100 or 10.0% smaller than the baseline scenario.

11.8.6 As recommended by Cook and Robinson (2016), the CPGR has been used to determine the consequence of impacts to populations as it was considered more robust for density independent modelling. As density dependence is not included within the PVA models, population sizes have the possibility of passing carrying capacity. Therefore, the difference between unimpacted and impacted populations may be exaggerated for models run over a long time period (further discussion of this is presented in Volume 3, Technical Appendix 11.7: Offshore Ornithology Population Viability Analysis Technical Report) The CPS has also been presented in accordance with NatureScot guidance (2023g) to provide a complementary metric.

Table 11.11: Definition of Terms Relating to an Adverse Magnitude of Impact

Magnitude of Impact	Definition
High	• A total change or major alteration to key elements/features of baseline conditions; • An effect occurs over a large scale or spatial geographical consent and/or is long-term (i.e. over five years) or permanent in nature; and/or • High frequency (occurring repeatedly or continuously for a long period of time) and/or high intensity.

Magnitude of Impact	Definition
	• For quantitative assessments: the decrease in survival is predicted to meet the 0.02 percentage point threshold and the growth rate is expected to decrease by greater than or equal to 5%.
Medium	• A partial change or alteration to one or more key elements/features of baseline conditions; • An effect occurs over a medium scale/spatial extent and/or has a medium term (i.e. no more than five years) duration; and/or • Medium to high frequency (occurring repeatedly or continuously for a moderate length of time) and/or at moderate intensity or occurring occasionally/intermittently for short periods of time, but at a moderate to high intensity. • For quantitative assessments: the decrease in survival is predicted to meet the 0.02 percentage point threshold and the growth rate is expected to decrease by 1.0% to 4.9%.
Low	• A minor shift away from baseline conditions; • An effect occurs over a local to medium scale/spatial extent and/or has a short (i.e. no more than one year) to medium-term (i.e. no more than five years) duration; and/or • The effect is unlikely to occur or will occur as a low frequency (occurring occasionally/intermittently for short periods of time at a low intensity). • For quantitative assessments: the decrease in survival is predicted to meet the 0.02 percentage point threshold and the growth rate is expected to decrease by 0.2% to 0.9%.
Negligible	• A very slight change from baseline conditions; • An effect is highly localised and short term with full rapid recovery (i.e. in six months) expected to result in very slight or imperceptible changes to baseline conditions or receptor populations; and/or • The effect is very unlikely to occur and, if it does occur, at a very low frequency or intensity. • For quantitative assessments: the decrease in survival is not predicted to meet the 0.02 percentage point threshold. • For quantitative assessments: the growth rate is expected to decrease by 0.1% or less.

11.8.7 The sensitivity of the ornithology receptors considers the ability of the receptor to tolerate, adapt to and recover from a change within the marine environment, and the vulnerability of the receptor (i.e. the conservation value and protected status). The sensitivity criteria are presented in Table 11.12).

Table 11.12: Definition of Terms Relating to the Sensitivity of the Receptor

Sensitivity of Receptor	Definition
Very High	Receptor has a high to very high vulnerability and no ability, or very little ability, to adapt and/or tolerate potential effects, resulting in no potential or very limited potential for recovery.
High	Receptor has a medium to high vulnerability and little ability to adapt and/or tolerate potential effects, resulting in limited potential for recovery.

Sensitivity of Receptor	Definition
Medium	Receptor has a low to high vulnerability and limited ability to adapt and/or tolerate potential effects, so that reproductive rates may be affected but without a significant effect on survival rate. Receptor is able to recover within a short time frame.
Low	Receptor has a low to medium vulnerability is able to adapt and/or tolerate the effects, so there is no effect on survival or reproductive rates. Receptor has high potential for recovery.
Very Low	No perceptible effect on receptor with no need to recover or adapt to effects. Receptor is generally tolerant to all effects.

11.8.8 It should be noted that, in addition to the ability to adapt and/or tolerate potential effects, the conservation status and importance of individuals within the Offshore Ornithology Study Area (Table 11.7) have been considered where appropriate when determining sensitivity. However, these factors are not included within the definitions presented within Table 11.12 as the conservation status and importance of a VOR is not necessarily linked to the ecological sensitivity of an effect. For example, the regional population of fulmar is deemed to be internationally important (Table 11.7) but shows little vulnerability to distributional responses based on current literature (Bradbury *et al.*, 2014; Wade *et al.*, 2016).

11.8.9 The magnitude of the impact and the sensitivity of the receptor are considered together to determine the significance of the effect upon offshore ornithology receptors. The method employed for this assessment is presented in Table 11.13 and Table 11.14.

11.8.10 Where a range is suggested for the level of significance of the effect, for example, “minor to moderate”, it is possible that the range spans the threshold for an effect to be considered “significant”. The technical specialist’s professional judgement will be applied to determine which outcome defines the most likely effect, which takes in to account the sensitivity of the receptor and the magnitude of impact. Where professional judgement is applied to quantify final significance from a range, the assessment will set out the factors that result in the final assessment of significance. These factors may include the likelihood that an effect will occur, data certainty and relevant information about the wider environmental context and species-specific population trends.

11.8.11 The EIA Regulations require the identification and reporting of likely significant environmental effects. For the purposes of this assessment:

1) a level of moderate or more will be considered a ‘significant’ effect, and in turn a likely significant effect in terms of the EIA Regulations; and
2) a level of minor or less will be considered ‘not significant’, and in turn not a likely significant effect in terms of the EIA Regulations.

Table 11.13: Matrix Used for the Assessment of the Significance of the Effect

Sensitivity of Receptor	Magnitude of Impact			
	Negligible	Low	Medium	High
Very Low	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	Negligible or Minor	Minor	Moderate	Moderate or Major
High	Minor	Minor or Moderate	Moderate or Major	Major
Very High	Minor	Moderate or Major	Major	Major

Table 11.14: Definition of Effect Significance

Impact	Justification	Significance
Major	These adverse effects are very important and are likely to cause a long-term change to the baseline conditions. These effects are generally, but not exclusively, associated with VORs with high or very high sensitivity to a given impact and are expected to impact a VOR frequently.	Significant
Moderate	These adverse effects have the potential to be important and are expected to result in a partial change to baseline conditions. These effects are generally, but not exclusively, associated with VORs with a medium or high sensitivity to a given impact. The effect is expected to occur frequently or continuously for a moderate length of time.	Significant
Minor	These adverse effects are expected to result in a small or partial change to baseline conditions. Generally, but not exclusively, these effects are associated with VORs with a low or medium sensitivity to a given impact with effects occurring infrequently.	Not Significant
Negligible	No effects or those that are beneath levels of perception. These effects are associated with VORs with very low to low sensitivities.	Not Significant

Designated Sites

11.8.12 This offshore ornithology chapter assesses the likely significant environmental effects in EIA terms on designated sites, as presented in Table 11.6.

11.8.13 Where locally designated sites and national designations (other than European sites) fall within the boundaries of a European site and where Qualifying Features are the same, only the European site has been taken forward for assessment. Potential impacts on the integrity and conservation status of the locally or nationally designated site are already covered by the assessment of the European site so a separate assessment for the local or national site is not necessary.

11.9 Embedded Mitigation

11.9.1 As part of the Proposed Development design process, a number of Embedded Mitigation measures have been proposed to reduce the potential for impacts on offshore ornithology (see Table 11.15). They are considered at every stage of the Proposed Development through design and best practice and, as there is a commitment to implementing these measures, these have been considered in the assessment presented in Section 11.10 (i.e. the determination of magnitude and therefore significance assumes implementation of these measures). These Embedded Mitigation measures are considered standard industry practice for this type of development.

11.9.2 Details on the implementation of Embedded Mitigation can be found in Volume 3, Technical Appendix 4.6: Schedule of Mitigation and Commitments.

Table 11.15: Embedded Mitigation Adopted as Part of the Proposed Development

ID*	Embedded Mitigation Adopted as Part of the Proposed Development	Justification
5	Development of, and adherence to, an Environmental Management Plan (EMP), including a Marine Pollution Contingency Plan (MPCP) and a Biosecurity Plan with commitments to monitoring and actions to minimise Invasive Non-Native Species (INNS).	To reduce the risk of accidental release of contaminants from vessels during construction, O&M and decommissioning as far as reasonably practicable, thus providing protection for marine life across all phases of the Proposed Development. Measures will be adopted to ensure that the potential for release of pollutants from construction, operation and maintenance and decommissioning plant is reduced so far as reasonably practicable. These will likely 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, double skinning of pipes containing hazardous substances, and storage of these substances in impenetrable bunds. All vessels associated with the Array Area will be required to comply with the standards set out by International Convention for the Prevention of Pollution from Ships (MARPOL).
7	Development of, and adherence to, a Construction Method Statement (CMS) along with a Code of Construction Practice (CoCP).	The CMS will specify the Proposed Development's construction methods, setting out good practice construction measures and how agreed mitigation measures from the Offshore EIA Report, will be implemented during construction.
8	All relevant Health and Safety Executive (HSE) procedures will be followed	Implementing HSE protocols minimizes risks when working in marine environments and mitigates associated impacts to offshore ornithology.
9	Development of, and adherence to, a combined Navigational Safety and Vessel Management Plan (NSVMP), describing Project vessels' requirements, passages, monitoring and controls.	The NSVMP will include measures to reduce disturbance to bird receptors from transiting vessels, requiring them to stick to established shipping lanes and follow guidance in relation to bird species sensitive to shipping. The NSVMP will be implemented as far as practicable and where it does not compromise the safety of vessels.
21	Wind Turbine design to have a minimum lower blade tip height of 33.12 m above Lowest Astronomical Tide (LAT).	As most seabirds tend to fly low, close to the sea surface, an increased minimum blade tip height above LAT leads to a reduction in predicted collision mortality.

ID*	Embedded Mitigation Adopted as Part of the Proposed Development	Justification
24	Development of, and adherence to, a Development Specification and Layout Plan (DSLP). The development of the DSLP includes consultation with the relevant authorities for approval, including the MCA and Northern Lighthouse Board (NLB).	Appropriate design and layout of Wind Turbines will reduce collision risk, displacement effects and other relevant impacts relevant to offshore ornithology.
36	Where practicable, the use of low order disposal of UXOs will be implemented (i.e. deflagration).	The use of low order UXO will reduce the risk of injury and disturbance of construction/decommissioning noise on ornithological receptors.
43	Use of a trenchless technique (e.g. Horizontal Directional Drilling (HDD) or pipe jack tunnelling) as the Landfall installation option.	Use of a trenchless technique will reduce potential disturbance to birds in the Intertidal area.
53	Low order clearance techniques are the default method for UXO clearance (Mitigation measure 36) and would not require Additional Mitigation over and above the Embedded Mitigation measures within the outline MMMP (Volume 4, Appendix 27: Outline Marine Mammal Mitigation Protocol). However, should high order clearance be unavoidable Additional Mitigation may be required dependant on the results of the UXO Risk Assessment. Appropriate mitigation measures will be discussed and agreed with MD-LOT and NatureScot with the detail to be agreed for the finalised MMMP.	Mitigation measure 36 details that low order clearance is the default method for the Proposed Development, consistent with the guidance set out in the SNCB joint position statement on UXO clearance (UK Government, 2025). Low noise alternatives to high order detonation are commercially available and cause less environmental harm. In line with this guidance high order clearance methods as a contingency will be considered once the results of the UXO geophysical survey are available. Should high order clearance be considered necessary, mitigation measures proportionate to the identified risk will be implemented for the Proposed Development in order to mitigate the impacts.
54	Development of, and adherence to, a Project Environmental Monitoring Plan (PEMP) to include details of any agreed surveys or monitoring requirements. The PEMP will provide the mechanism to validate the impact assessment, assess the effectiveness of mitigation measures, and inform adaptation of mitigation measures throughout the construction and O&M phases of the Proposed Development.	The PEMP will detail the methodology that will be used to validate the impact assessment predictions made within the EIA. The PEMP will also provide for the mechanism for any adaptation of mitigation measures if required to reduce impacts from the Proposed Development.

*see Volume 3, Technical Appendix 4.6: Schedule of Mitigation and Commitments'

11.10 Assessment of Significance

11.10.1 Table 11.9 summarises the potential effects arising from the construction, O&M and decommissioning phases of the Proposed Development, as well as the MDS against which each impact has been assessed.

11.10.2 An assessment of the likely significant environmental effects of the Proposed Development on the offshore ornithology receptors caused by each identified impact is given below.

11.10.3 In cases where the effect of the impact on a VOR has been deemed to not be significant, in EIA terms, no Additional Mitigation is required and therefore has not been presented within the relevant sections.

11.10.4 Moreover, it should be noted that within the CEA that the numbers presented within this section are rounded, with the unrounded values used within calculations.

IMPACT 1 – COLLISION RISK MORTALITY DUE TO COLLISION WITH ROTOR BLADES

11.10.5 Some marine bird species are at risk of colliding with the turning rotor blades of offshore Wind Turbines given their flight characteristics (Furness *et al.,* 2013). Collisions could occur when birds fly through an OWF whilst foraging, commuting between breeding colonies and foraging areas, or during migration. When a collision occurs between the rotor blade and the bird, it would most likely result in direct mortality, and which is the outcome assumed here for the purpose of undertaking an assessment on the basis of a realistic worst-case scenario. If such collisions occurred at high enough frequency, there could potentially be population level-impacts from the OWF.

11.10.6 CRM has therefore been undertaken for the Proposed Development (Figure 11.1), with detailed methods and results presented in Volume 3, Technical Appendix 11.4: Offshore Ornithology Collision Risk Model Technical Report. CRM incorporates species-specific life history information, site-specific Wind Turbine parameters and site-specific DAS of the Array Area. As Wind Turbines will only be present within the Array Area of the Proposed Development, only estimates for flying birds within the Array Area have been used in CRM.

11.10.7 Species differ in their susceptibility to collision risk, depending on their flight behaviour and avoidance responses, and the vulnerability of their populations (Bradbury *et al.,* 2014; Wade *et al.,* 2016; JNCC *et al.,* 2024). As sensitivity to collision differs considerably between VORs, species were screened in for assessment of significance based on the abundance within the Array Area Study Area and consideration of their perceived risk from collision (Furness *et al.,* 2013; Bradbury *et al.,* 2014; Wade *et al.,* 2016). These publications have been informed by previous research into seabird flight behaviour and collision studies, and it is worth noting that there are a number of on-going investigations in Scotland, the UK and Europe that will help further refine knowledge of collision risk for key species, such as the recent Vattenfall/SPOOR study showing the lack of collisions recorded at the Aberdeen Offshore Wind Farm (Brighton *et al*., 2025).

11.10.8 Five regularly occurring VORs were identified as potentially at risk of collision due to their recorded abundance in the Array Area (as described in Paragraph 11.6.11 to 11.6.12) and their sensitivity to collision (Table 11.16):

- gannet;
- kittiwake;
- great black-backed gull;
- herring gull; and
- Arctic tern.

11.10.9 Fulmar were not considered to be at a low risk of collision, as their flight height is close to the sea surface, and below rotor blade height (Johnston *et al.*, 2014; Bradbury *et al.*, 2014). Although Wade *et al.*, (2016) highlight that there is a large amount of uncertainty around fulmar vulnerability and a high abundance of fulmar was recorded within the Array Area, it was advised not to include fulmar within CRM after consultation with NatureScot (Table 11.3).

Table 11.16: Abundance and Sensitivity of Receptors to Collision Risk

Species	Abundance in the Array Area Study Area[1]	Factors Contributing to Final Sensitivity Rating			Final Sensitivity
		Vulnerability to Collision[2]	Uncertainty of time spent at altitudes overlapping with Wind Turbine blades[3]	Recoverability[4]	
Gannet	High	High/High	Very Low	Low	High
Kittiwake	High	High/Very High	Very Low	Low	High
Great black-backed gull	Low	Very high/Very High	Low	Moderate	Very high
Herring gull	High	Very high/Very High	Very Low	Moderate	Very high
Arctic tern	Moderate	Low/Moderate	Moderate	Low	Low

[1] Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report
2 Values from Bradbury et al. (2014)/Wade et al., (2016)
3 Wade et al. (2016)
4 Mitchell et al. (2020); Horswill and Robinson (2015)

11.10.10 It is acknowledged that migratory birds may not be effectively represented by the site-specific DAS conducted at the Array Area Study Area. These birds often fly at night, when no DAS surveys take place, or move in pulses that could easily be missed since DAS are carried out monthly. Consequently, the collision risk to migratory birds cannot be evaluated using the same methods applied to regularly occurring seabirds (as described above). Instead, the potential impact on migratory birds has been assessed qualitatively, drawing primarily on existing literature (notably Woodward *et al.*, 2023), as well as quantitatively, through the use of the Strategic Ornithological Support Services Migration Assessment Tool

(SOSSMAT) (Wright *et al.*, 2012) and the mCRM Shiny application (HiDef Aerial Surveying Limited, 2025).

11.10.11 Woodward *et al.* (2023) present a comprehensive review of existing data on migratory birds in Scottish waters, focusing on their potential collision risks. The key information gathered includes migratory routes, timing of migration, population estimates, flight speeds, flight heights, and avoidance rates and behaviours during migration. These data are compiled for 73 species or subspecies, which are non-seabird features of SPAs, encompassing swans, geese, ducks, waders, raptors, and other non-passerine birds. A summary of the key information for each species studied is provided in Table 11.17 in which the area of interest is confined to the footprint of the Array Area only, as collisions with Wind Turbines can only occur within this area.

11.10.12 Further details on the assessment for migratory birds are presented in Paragraphs 11.10.62 and 11.10.67.

Table 11.17: Assessment of Collision Risk to Migratory Species based on Woodward *et al.* (2023). PCH = Proportion at Collision Height

Species	Migratory Route	PCH	Avoidance rate (±SD)	Summary and Conclusion
Bewick's Swan *Cygnus columbianus bewickii*	No connectivity to the Array Area.	0.50	0.9885 ± 0.00091.	No connectivity and therefore **no impact.**
Whooper Swan *Cygnus cygnus*	Main route has connectivity to the Array Area.	0.50	0.9874 ± 0.00138.	Migratory route and flight heights indicate potential risk, but high avoidance rate. Therefore, magnitude of impact considered to be **low.**
Bean Goose *Anser fabalis*	Main route has connectivity to the Array Area.	1.00	0.9998 ± 0.00001.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Pink-footed Goose *Anser brachyrhynchus*	Main route has connectivity to the Array Area.	0.50	0.9999 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
European White-fronted Goose *Anser albifrons albifrons*	No connectivity to the Array Area.	1.00	0.9998 ± 0.00001.	No connectivity and therefore **no impact.**
Greenland White-fronted Goose *A. a. flavirostris*	No connectivity to the Array Area.	1.00	0.9998 ± 0.00001.	No connectivity and therefore **no impact.**
Icelandic Greylag Goose *Anser anser*	Main route has connectivity to the Array Area.	0.50	0.9996 ± 0.00001.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Greenland Barnacle Goose *Branta leucopsis*	No connectivity to the Array Area.	1.00	0.9998 ± 0.00001.	No connectivity and therefore **no impact.**
Svalbard Barnacle Goose *Branta leucopsis*	Main route has connectivity to the Array Area.	1.00	0.9998 ± 0.00001.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Dark-bellied Brent Goose *Branta bernicla bernicla*	No connectivity to the Array Area.	0.50	0.9998 ± 0.00001.	No connectivity and therefore **no impact.**

Species	Migratory Route	PCH	Avoidance rate (±SD)	Summary and Conclusion
Canadian Light-bellied Brent Goose *B. b. hrota*	No connectivity to the Array Area.	0.50	0.9998 ± 0.00001.	No connectivity and therefore **no impact.**
Svalbard Light-bellied Brent Goose *B. b. hrota*	Main route has connectivity to the Array Area.	0.50	0.9998 ± 0.00001.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Shelduck *Tadorna tadorna*	Main route has connectivity to the Array Area.	0.50	0.9851 ± 0.00088.	Migratory route and flight heights indicate potential risk, but high avoidance rate. Therefore, magnitude of impact considered to be **low.**
Wigeon *Mareca penelope*	Main route has connectivity to the Array Area.	1.00	0.9851 ± 0.00088.	Migratory route and flight heights indicate potential risk, but high avoidance rate. Therefore, magnitude of impact considered to be **low.**
Gadwall *Anas strepera*	No connectivity to the Array Area.	1.00	0.9851 ± 0.00088.	No connectivity and therefore **no impact.**
Teal *Anas crecca*	Main route has connectivity to the Array Area.	1.00	0.9851 ± 0.00088.	Migratory route and flight heights indicate potential risk, but high avoidance rate. Therefore, magnitude of impact considered to be **low.**
Mallard *Anas platyrhynchos*	Main route has connectivity to the Array Area.	1.00	0.9851 ± 0.00088.	Migratory route and flight heights indicate potential risk, but high avoidance rate. Therefore, magnitude of impact considered to be **low.**
Pintail *Anas acuta*	Main route has connectivity to the Array Area.	1.00	0.9851 ± 0.00088.	Migratory route and flight heights indicate potential risk, but high avoidance rate. Therefore, magnitude of impact considered to be **low.**
Shoveler *Anas clypeata*	Main route has connectivity to the Array Area.	1.00	0.9851 ± 0.00088	Migratory route and flight heights indicate potential risk, but high avoidance rate. Therefore, magnitude of impact considered to be **low.**
Pochard *Aythya ferina*	Main route has connectivity to the Array Area.	1.00	0.9851 ± 0.00088.	Migratory route and flight heights indicate potential risk, but high avoidance rate. Therefore, magnitude of impact considered to be **low.**

Species	Migratory Route	PCH	Avoidance rate (±SD)	Summary and Conclusion
Tufted Duck *Aythya fuligula*	Main route has connectivity to the Array Area.	1.00	0.9851 ± 0.00088.	Migratory route and flight heights indicate potential risk, but high avoidance rate. Therefore, magnitude of impact considered to be **low.**
Scaup *Aythya marila*	Main route has connectivity to the Array Area.	1.00	0.9851 ± 0.00088.	Migratory route and flight heights indicate potential risk, but high avoidance rate. Therefore, magnitude of impact considered to be **low.**
Eider *Somateria mollissima*	Main route has connectivity to the Array Area.	0.25	0.9851 ± 0.00088.	Migratory route and flight heights indicate potential risk, but high avoidance rate. Therefore, magnitude of impact considered to be **low.**
Long-tailed Duck *Clangula hyemalis*	Main route has connectivity to the Array Area.	1.00	0.9851 ± 0.00088.	Migratory route and flight heights indicate potential risk, but high avoidance rate. Therefore, magnitude of impact considered to be **low.**
Common Scoter *Melanitta nigra*	Main route has connectivity to the Array Area.	1.00	0.9851 ± 0.00088.	Migratory route and flight heights indicate potential risk, but high avoidance rate. Therefore, magnitude of impact considered to be **low.**
Velvet Scoter *Melanitta fusca*	Main route has connectivity to the Array Area.	1.00	0.9851 ± 0.00088.	Migratory route and flight heights indicate potential risk, but high avoidance rate. Therefore, magnitude of impact considered to be **low.**
Goldeneye *Bucephala clangula*	Main route has connectivity to the Array Area.	1.00	0.9851 ± 0.00088.	Migratory route and flight heights indicate potential risk, but high avoidance rate. Therefore, magnitude of impact considered to be **low.**
Red-breasted Merganser *Mergus serrator*	Main route has connectivity to the Array Area.	1.00	0.9851 ± 0.00088.	Migratory route and flight heights indicate potential risk, but high avoidance rate. Therefore, magnitude of impact considered to be **low.**
Goosander *Mergus merganser*	Main route has connectivity to the Array Area.	1.00	0.9851 ± 0.00088.	Migratory route and flight heights indicate potential risk, but high avoidance rate. Therefore, magnitude of impact considered to be **low.**
Red-throated Diver Gavia *stellata*	Main route has connectivity to the Array Area.	0.25	0.9954 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**

Species	Migratory Route	PCH	Avoidance rate (±SD)	Summary and Conclusion
Manx Shearwater *Puffinus puffinus*	Main route has connectivity to the Array Area.	1.00[1]	0.990[2]	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
European Storm Petrel *Hydrobates pelagicus*	Main route has connectivity to the Array Area.	1.00[1]	0.990[2]	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Leach's Storm Petrel *Oceanodroma leucorhoa*	Main route has connectivity to the Array Area.	1.00[1]	0.990[2]	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Cormorant *Phalacrocorax carbo*	Main route has connectivity to the Array Area.	1.00[1]	0.990[2]	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Shag *Phalacrocorax aristotelis*	Main route has connectivity to the Array Area.	1.00[1]	0.990[2]	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Bittern *Botaurus stellaris*	Main route has connectivity to the Array Area.	1.00	0.9928 ± 0.00092.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Great Crested Grebe *Podiceps cristatus*	Main route has connectivity to the Array Area.	1.00	0.9954 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Slavonian Grebe *Podiceps auritus*	Main route has connectivity to the Array Area.	1.00	0.9954 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Honey-buzzard *Pernis apivorus*	No connectivity to the Array Area.	0.50	0.9957 ± 0.00006.	No connectivity and therefore **no impact.**
Marsh Harrier *Circus aeruginosus*	Main route has connectivity to the Array Area.	0.50	0.9957 ± 0.00006.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**

Species	Migratory Route	PCH	Avoidance rate (±SD)	Summary and Conclusion
Hen Harrier *Circus cyaneus*	Main route has connectivity to the Array Area.	1.00	0.9957 ± 0.00006.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Montagu's Harrier *Circus pygargus*	No connectivity to the Array Area.	1.00	0.9957 ± 0.00006.	No connectivity and therefore **no impact.**
Osprey *Pandion haliaetus*	Main route has connectivity to the Array Area.	0.50	0.9957 ± 0.00006.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Merlin *Falco columbarius*	Main route has connectivity to the Array Area.	1.00	0.9891 ± 0.00033.	Migratory route and flight heights indicate potential risk, but high avoidance rate. Therefore, magnitude of impact considered to be **low.**
Corncrake *Crex crex*	Main route has connectivity to the Array Area.	1.00	0.9875 ± 0.00174.	Migratory route and flight heights indicate potential risk, but high avoidance rate. Therefore, magnitude of impact considered to be **low.**
Oystercatcher *Haematopus ostralegus*	Main route has connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Avocet *Recurvirostra avosetta*	No connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	No connectivity and therefore **no impact.**
Stone-curlew *Burhinus oedicnemus*	No connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	No connectivity and therefore **no impact.**
Ringed Plover *Charadrius hiaticula*	Main route has connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Dotterel *Charadrius morinellus*	Main route has connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Golden Plover *Pluvialis apricaria*	Main route has connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**

Species	Migratory Route	PCH	Avoidance rate (±SD)	Summary and Conclusion
Grey Plover *Pluvialis squatarola*	Main route has connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Lapwing *Vanellus Vanellus*	Main route has connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Knot *Calidris canutus*	Main route has connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Sanderling *Calidris alba*	Main route has connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Purple Sandpiper *Calidris maritima*	Main route has connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Dunlin *Calidris alpina schinzii* and *C. a. arctica*	Main route has connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Ruff *Philomachus pugnax*	Main route has connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Snipe *Gallinago gallinago*	Main route has connectivity to the Array Area.	1.00	0.999 ± 0.00003.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Black-tailed Godwit *Limosa limosa limosa*	No connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	No connectivity and therefore **no impact.**
Black-tailed Godwit *L. l. islandica*	Main route has connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**

Species	Migratory Route	PCH	Avoidance rate (±SD)	Summary and Conclusion
Bar-tailed Godwit *Limosa lapponica*	Main route has connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Whimbrel *Numenius phaeopus*	Main route has connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Curlew *Numenius arquata*	Main route has connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Greenshank *Tringa nebularia*	Main route has connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Wood Sandpiper *Tringa glareola*	No connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	No connectivity and therefore **no impact.**
Redshank *Tringa totanus britannica*	Main route has connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Turnstone *Arenaria interpres*	Main route has connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Red-necked Phalarope *Phalaropus lobatus*	No connectivity to the Array Area.	1.00	0.9996 ± 0.00002.	No connectivity and therefore **no impact.**
Arctic Skua *Stercorarius parasiticus*	Main route has connectivity to the Array Area.	1.00	0.995[3]	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Great Skua *Stercorarius skua*	Main route has connectivity to the Array Area.	1.00	0.995[3]	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**

Species	Migratory Route	PCH	Avoidance rate (±SD)	Summary and Conclusion
Short-eared Owl *Asio flammeus*	Main route has connectivity to the Array Area.	1.00	0.9957 ± 0.00006.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**
Nightjar *Caprimulgus europaeus*	Main route has connectivity to the Array Area.	1.00	0.9954 ± 0.00002.	Migratory route and flight heights indicate potential risk, but very high avoidance rate. Therefore, magnitude of impact considered to be **negligible.**

[1] Precautionary value of 100% chosen, because it was unavailable
[2] Value taken from NatureScot (2025b)
[3] Value taken from Furness (2015)

O&M Phase

11.10.13 CRM was undertaken using two approaches, in accordance with NatureScot guidance and consultation (Table 11.3). These were:

- **Deterministic offshore Band CRM** (Band, 2012), hereafter 'Band CRM'; and
- **Stochastic CRM** (sCRM; Masden, 2015; McGregor *et al.,* 2018; Caneco, 2024).

11.10.14 The Band CRM provides point estimates for the assessment of collision risk and the sCRM approach extends this by incorporating the variability around input parameters, which allows for the estimation of uncertainty around predicted values.

11.10.15 sCRM and Band CRM were conducted in line with one of four model frameworks (Masden, 2015); Option 2, as advised during consultation with NatureScot. Option 2 calculates the proportion of birds at collision risk height based on generic flight height distributions from Johnston *et al.* (2014) assuming a uniform distribution of risk over the rotor swept area (NatureScot, 2023g).

11.10.16 For kittiwake, Option 1 of the model was also run using data collected from site-specific LiDAR surveys covering the Array Area. In order to incorporate LiDAR data into the model, the proportion of kittiwake flying within the rotor swept area, and therefore at potential collision risk height was calculated to be 0.008 (for more information see Volume 3, Technical Appendix 11.4: Offshore Ornithology Collision Risk Model Technical Report).

11.10.17 Two Wind Turbine scenarios have been modelled for the Array Area (NatureScot, 2023g):

- **Worst Case Scenario (WCS):** use of maximum rotation speeds, no curtailment and 67 Wind Turbines; and
- **Most Likely Scenario (MLS):** use of maximum rotation speeds, 5% predicted curtailment and 50 Wind Turbines.

11.10.18 Overall downtime due to maintenance activities was predicted at 3%, which was applied to both scenarios. Curtailment, estimated at 5% downtime, was only included in the MLS scenario, resulting in an overall downtime of 8% for the MLS and 3% for the WCS. This was following consultation with NatureScot (Table 11.3) and is a conservative figure below the unweighted average for curtailment figures in Scotland (Inorite Limited, 2024) and results in a load factor much higher than those reported. The aim of including curtailment within the MLS is to increase the realism of the assessment for the benefit of decision makers, whilst maintaining the precautionary approaches in the collision risk modelling required by NatureScot in its guidance.

11.10.19 CRM was undertaken of collision impacts predicted for the Array Area for Band CRM and sCRM (the latter using the sCRM shiny app (version 0.1.1; Caneco *et al.*, 2022)), using the recommended seabird parameters (JNCC *et al.,* 2024).

11.10.20 The magnitude of the impact in terms of collision risk was determined by calculating the estimated number of collisions from the Wind Turbines and the resulting percentage decrease in survival of the relevant receptor's regional

population. Regional population sizes are derived from Burnell *et al.* (2023) and Furness (2015) (see Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report for more information). The survival decrease of regional populations is used to identify the magnitude of effect from collision mortality and dictate whether a species-specific PVA needs to be undertaken.

11.10.21 Results for both the MLS and WCS have been presented for both the Band and sCRM for context. However, where the 0.02 percentage point threshold set by NatureScot (2023g) has been met, only the mean sCRM estimate for the WCS has been taken forward for PVA.

Gannet

11.10.22 Additional CRM has been undertaken for gannet to replicate the macro-avoidance demonstrated by this species (NatureScot, 2023g; Furness *et al.*, 2013; Ozsanlav-Harris *et al.*, 2023), as displaced birds will not be at risk of collision. For a precautionary approach, CRM for gannet in the non-breeding season has been calculated with a 70% reduction in monthly densities to demonstrate this (NatureScot, 2023g; Pavat *et al.*, 2023) (see Volume 3, Technical Appendix 11.4: Offshore Ornithology Collision Risk Model Technical Report). The lack of evidence of avoidance during the breeding season or from studies in proximity to breeding colonies, and following NatureScot advice, removes the necessity for macro-avoidance to be applied to the breeding season (Table 11.3).

Sensitivity of Gannet to Collision Risk

11.10.23 Gannet are considered to have a high vulnerability to collision as the species was found to score moderately in most factors associated with collision risk. This included having 12% of flight at Wind Turbine blade height (Bradbury *et al.*, 2014; Wade *et al.*, 2016).

11.10.24 As mentioned in Mitchell *et al.* (2020), seabird species are long-lived species with relatively low reproductive rates. This is further supported by published demographic rates which estimate that gannet have a productivity rate of 0.700 per year with breeding pairs producing one egg (Horswill and Robinson, 2015). Moreover, when comparing recent surveys carried out by the RSPB, gannet populations across surveyed SPAs were found to have decreased by 22% across Scotland and 25% across the UK when compared to the most recent seabird census (Tremlett *et al.*, 2024).

11.10.25 Gannet is deemed to be of high vulnerability and low recoverability, indicating little ability to adapt or tolerate potential impacts. The sensitivity of the receptor is therefore considered to be high.

Magnitude of the Effect

11.10.26 The results of CRM for both the WCS and MLS scenarios, using the sCRM and the Band CRM are given in Table 11.18, which also included results applying a 70% reduction in densities in the non-breeding season. Only the mean sCRM value for the WCS has been taken forward for assessment with the other results presented for context.

Table 11.18: Collision Risk Estimates for Gannet on a Seasonal and Annual Basis Against a Resulting Decrease in Survival of Relevant Populations

Season	Regional Baseline Population	Wind Turbine Scenario	Predicted Collision Mortality Per Year		Decrease in Survival (percentage point change)	
			sCRM	Band CRM	sCRM	Band CRM
Breeding	841,748	WCS	23.64 (5.32 to 55.34)	22.45	0.003	0.003
		MLS	18.29 (4.16 to 42.74)	12.42	0.002	0.001
Non-breeding	248,385	WCS	1.41 (0.16 to 3.90)	1.30	0.001	0.001
		MLS	1.09 (0.14 to 3.01)	1.03	0.000	0.000
Non-breeding (70% reduction)	248,385	WCS	0.42 (0.05 to 1.17)	0.39	0.000	0.000
		MLS	0.33 (0.04 to 0.90)	0.31	0.000	0.000
Annual	841,748	WCS	25.05 (5.45 to 59.23)	23.75	0.003	0.003
		MLS	19.38 (4.27 to 45.74)	18.44	0.002	0.002
Annual (70% reduction)	841,748	WCS	24.06 (5.35 to 56.51)	22.84	0.003	0.003
		MLS	18.62 (4.18 to 43.64)	17.73	0.002	0.002

11.10.27 As no scenario and neither CRM approach resulted in survival decreasing more than the 0.02 percentage point threshold set by NatureScot (2023g), no PVAs were needed to help determine the magnitude of the collision effect on gannet. Therefore, the magnitude is considered to be negligible.

Significance of the Effect

11.10.28 The magnitude of collision risk is considered to be negligible, and the sensitivity of the VOR is considered to be high. Following the matrix approach (Table 11.13), the impact of collision risk on gannet is therefore considered to be **Minor** adverse, which is not significant in EIA terms.

11.10.29 However, it should be noted that as gannet have been assessed for both collision risk and distributional responses, further assessment has been carried out, as presented in Section 11.11.

Kittiwake

11.10.30 As detailed in Section 11.5, LiDAR surveys were conducted to characterise the flight height of key seabirds. In order to incorporate this dataset, additional CRM has been undertaken for kittiwake. From LiDAR data, the proportion of kittiwake flying within the rotor swept area, and therefore at potential collision risk height, was calculated to be 0.008. Further information on LiDAR surveys can

be found in Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report, Annex E: Flight Height Data Report.

Sensitivity of Kittiwake to Collision Risk

11.10.31 Kittiwake are considered to have a high (Bradbury *et al.,* 2014) to very high (Wade *et al*., 2016) vulnerability to collision, notably due to spending 15% of flight at Wind Turbine height (Bradbury *et al.*, 2014, and Wade *et al.*, 2016).

11.10.32 As mentioned in Mitchell *et al.* (2020), seabird species are long-lived species with relatively low reproductive rates. This is further supported by published demographic rates which estimate that kittiwake have a 0.690 productivity rate with breeding pairs producing two eggs (Horswill and Robinson, 2015). Population trends have varied across Scotland (Tremlett *et al.*, 2024). Although colonies at SPAs with connectivity to the Proposed Development, such as North Caithness Cliffs SPA (41%), Marwick Head SPA (59%), St Abb's Head to Fast Castle SPA (9%) and Troup, Pennan and Lion's Heads SPA (2%), were found to increase in population size, some colonies with connectivity have shown notable decrease in population size. For example, Copinsay SPA was found to decline by 69% following HPAI (Tremlett *et al.,* 2024). Declines were also recorded during NEEOG-funded surveys of East Caithness Cliffs SPA, which recorded a decrease of 15% in population size (Zisman *et al.,* 2025). As a precautionary measure the recoverability of kittiwake has assumed to be low within this EIA, although it should be noted that RSPB surveys found that Scottish populations have increased by 10% (Tremlett *et al.,* 2024).

11.10.33 Kittiwake is deemed to be of high vulnerability and low recoverability. However, it should be noted that kittiwake populations' ability to tolerate potential impacts may vary. Therefore, the sensitivity of the receptor is considered to be high.

Characterisation of the Effect

11.10.34 The results of CRM for both the WCS and MLS scenarios, using the sCRM and the Band CRM are given in Table 11.19. Model Option 1 was used to carry out CRM incorporating LiDAR data, whereas Model Option 2 was used to carry out CRM using generic flight height data (Johnston *et al.*, 2014). Where PVAs have been conducted, the mean WCS value has been taken forward for CRM using generic flight height data (Model Option 2) as this is the highest impact scenario. Whereas the mean value for the MLS has been taken forward for CRM incorporating site-specific LiDAR data (Model Option 1) to provide a more realistic comparison.

Table 11.19: Collision Risk Estimates for Kittiwake on a Seasonal and Annual Basis Against a Resulting Decrease in Survival of Relevant Populations

Season	Model Option	Regional Baseline Population	Wind Turbine Scenario	Predicted Collision Mortality Per Year		Decrease in Survival (percentage point change)	
				sCRM	Band CRM	sCRM	Band CRM
Breeding	1	604,582	WCS	5.99 (2.94 to 9.26)	6.47	0.001	0.001

Season	Model Option	Regional Baseline Population	Wind Turbine Scenario	Predicted Collision Mortality Per Year		Decrease in Survival (percentage point change)	
				sCRM	Band CRM	sCRM	Band CRM
			MLS	4.69 (2.30 to 7.25)	5.06	0.001	0.001
Non-breeding		627,816	WCS	1.59 (0.54 to 2.74)	1.72	0.000	0.000
			MLS	1.24 (0.41 to 2.14)	1.35	0.000	0.000
Annual		627,816	WCS	7.58 (3.47 to 11.99)	8.18	0.001	0.001
			MLS	5.92 (2.71 to 9.38)	6.40	0.001	0.001
Breeding	2	604,582	WCS	37.59 (16.31 to 62.80)	40.71	0.006	0.007
			MLS	29.67 (12.90 to 49.57)	32.15	0.005	0.005
Non-breeding		627,816	WCS	9.98 (3.18 to 18.53)	10.75	0.002	0.002
			MLS	7.89 (2.51 to 14.64)	8.51	0.001	0.001
Annual		627,816	WCS	47.57 (19.48 to 81.32)	51.46	0.008	0.008
			MLS	37.55 (15.40 to 64.20)	40.65	0.006	0.006

Magnitude of the Effect

11.10.35 As the decrease in survival did not exceed the 0.02 percentage point threshold for PVA set by NatureScot (2023g), no PVAs were required, and the magnitude of impact on the VOR is assessed as negligible.

Significance of the Effect

11.10.36 The magnitude of collision risk is considered to be negligible, and the sensitivity of the VOR is considered to be high. Following the matrix approach, as presented in Table 11.13, the impact of collision risk on kittiwake is therefore considered to be **Minor** adverse, which is not significant in EIA terms.

11.10.37 However, it should be noted that as kittiwake have been assessed for both collision risk and distributional responses, further assessment has been carried out as presented in Section 11.11.

Great black-backed gull

Sensitivity of Great Black-backed Gull to Collision Risk

11.10.38 Great black-backed gull have been considered to have a very high sensitivity to collision risk. This is due to the high proportion of flights (35%) spent at

potential collision risk height (Bradbury *et al.*, 2014) and the low uncertainty around these estimates (Wade *et al.*, 2016).

11.10.39 As mentioned in Horswill and Robinson (2015) great black-backed gull are expected to require less time to recover to impacts compared to other seabirds (e.g. a productivity rate of 1.139 per year and estimated three eggs per breeding pair). Despite showing high productivity, recent HPAI surveys have shown populations within Scotland have shown declines (Tremlett *et al.*, 2024), including severe declines at several SPAs. Therefore the recoverability of great black-backed gull is considered to be moderate.

11.10.40 Great black-backed gull is deemed to be of very high vulnerability, moderate recoverability, indicating limited ability to recover from potential impacts. The sensitivity of the receptor is therefore considered to be very high.

Characterisation of the Effect

11.10.41 The results of CRM for both the WCS and MLS scenarios, using the sCRM and the Band CRM are given in Table 11.20. Only the sCRM WCS has been taken forward for assessment with the other results presented for context.

Table 11.20: Collision Risk Estimates for Great Black-backed Gull for the Non-breeding Season Against a Resulting Decrease in Survival of Relevant Populations

Season[1]	Regional Baseline Population	Wind Turbine Scenario	Predicted Collision Mortality Per Year		Decrease in Survival (percentage point change)	
			sCRM	Band CRM	sCRM	Band CRM
Non-breeding	91,399	WCS	2.30 (0.34 to 5.21)	1.64 to 2.25	0.003	0.002 to 0.002
		MLS	1.78 (0.27 to 4.02)	1.27 to 1.74	0.002	0.001 to 0.002

Magnitude of the Effect

11.10.42 As the decrease in survival did not exceed the 0.02 percentage point threshold for PVA set by NatureScot (2023g), no PVAs were required, and the magnitude of impact on the VOR is assessed as negligible.

Significance of the Effect

11.10.43 The magnitude of collision risk is considered to be negligible, and the sensitivity of the VOR is considered to be very high. Following the matrix approach (Table 11.13), the impact of collision risk on great black-backed gull is therefore considered to be **Minor** adverse, which is not significant in EIA terms.

Herring gull

Sensitivity of Herring gull to Collision Risk

11.10.44 Herring gull scored very high in vulnerability to collision risk due to the large proportion of flights at Wind Turbine height (35%) (Bradbury *et al.*, 2014). Moreover, the uncertainty around these estimates is considered to be low (Wade *et al.*, 2016), further supporting a very high vulnerability score.

11.10.45 Herring gull have been found to have a relatively high productivity rate (0.920) and large clutch size (three eggs per year) compared to other seabirds (Horswill and Robinson, 2015). However, despite these high productivity rates, during RSPB surveys herring gull were found to have decreased by 24% across surveyed SPAs across Scotland (Tremlett *et al.,* 2024). Therefore, the recoverability is determined to be moderate.

11.10.46 Although herring gull are considered to have a moderate recoverability, as herring gull have a very high vulnerability to collision risk, the sensitivity of the species is considered to be very high.

Characterisation of the Effect

11.10.47 The results of CRM for both the WCS and MLS scenarios, using the sCRM and the Band CRM are given in Table 11.21. Only the mean sCRM value for the WCS has been taken forward for assessment with the other results presented for context.

Table 11.21: Collision Risk Estimates for Herring Gull on a Seasonal and Annual Basis Against a Resulting Decrease in Survival of Relevant Populations

Season	Regional Baseline Population	Wind Turbine Scenario	Predicted Collision Mortality Per Year		Decrease in Survival (percentage point change)	
			sCRM	Band CRM	sCRM	Band CRM
Breeding	40,076	WCS	32.15 (9.72 to 68.53)	25.30 to 27.44	**0.080**	0.063 to 0.068
		MLS	24.89 (7.53 to 53.11)	19.60 to 21.27	0.062	0.049 to 0.053
Non-breeding	59,815	WCS	1.46 (0.21 to 3.28)	1.21 to 1.63	0.002	0.002 to 0.003
		MLS	1.14 (0.16 to 2.54)	0.94 to 1.27	0.002	0.002 to 0.002
Annual	59,815	WCS	33.61 (9.93 to 71.81)	26.51 to 29.07	**0.056**	0.044 to 0.049
		MLS	26.03 (7.69 to 55.65)	20.54 to 22.54	0.044	0.034 to 0.038

11.10.48 As shown in Table 11.21, as the 0.02 percentage point threshold was met for the breeding season and annual scenarios, two PVAs were required to further determine the magnitude of the effect (see Volume 3, Technical Appendix 11.7: Offshore Ornithology Population Viability Analysis Technical Report for more information).

Proposed Development Alone PVA Assessment

Breeding Season

11.10.49 When considering the Proposed Development alone impact during the breeding season on the regional population, the PVA predicted that CPGR was 0.999 (Table 11.22) which is equivalent to a decrease of 0.1% in population growth after 30 years compared to the unimpacted population. The CPS was 0.971 (Table

11.22), which is equivalent to a 2.9% decrease in population size. The results of the PVA suggest that the magnitude of effect would be negligible.

Annual

11.10.50 When considering the annual Proposed Development alone impact on the regional population, the PVA predicted that CPGR was 0.999 (Table 11.22) which is equivalent to a decrease of 0.1% in population growth after 30 years compared to the unimpacted population. The CPS was 0.979 (Table 11.22), which is equivalent to a 2.1% decrease in population size. The results of the PVA suggest that the magnitude of effect would be negligible.

Table 11.22: Output of PVA for Proposed Development Alone of Collision Risk Impacts for Herring Gull for the Operational Life of the Proposed Development (up to 30 years). CI = Confidence Intervals Around Counterfactual Ration Metrics Given in Parentheses

Season	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
Breeding	Baseline	47,451	1.004 (0.976 to 1.031)	-	-
	Impacted	45,909	1.003 (0.975 to 1.030)	0.999 (0.998 to 1.000)	0.971 (0.929 to 1.014)
Annual	Baseline	70,648	1.004 (0.976 to 1.031)	-	-
	Impacted	69,195	1.003 (0.976 to 1.030)	0.999 (0.998 to 1.000)	0.979 (0.944 to 1.015)

Magnitude of the Effect

11.10.51 From the results of the PVA, it is estimated that the impact to the growth rate will be just 0.1% during the breeding season (equivalent to a 2.9% decrease in population size) or annually (equivalent to a 2.1% decrease in population size). Therefore, it can be determined that the magnitude of the effect during all bio-seasons is negligible.

Significance of the Effect

11.10.52 The magnitude of collision risk considered to be negligible, and the sensitivity of the VOR is considered to be very high. Following the matrix approach, as presented in Table 11.13, the impact of collision risk on herring gull is therefore considered to be **Minor** adverse, which is not significant in EIA terms.

Arctic tern

Sensitivity of Arctic Tern to Collision Risk

11.10.53 Arctic tern are highly manoeuvrable while in flight and also show a low percentage (5%) of flights at potential collision height (Bradbury *et al.* 2014), with the vulnerability of Arctic tern considered to be low in Bradbury *et al.* (2014). However, within a Scottish-specific study of seabird vulnerability, it is considered that the vulnerability of Arctic tern to collision risk is moderate (Wade *et al,* 2016).

11.10.54 As mentioned in Mitchell *et al.* (2020), seabird species are long-lived species with relatively low reproductive rates. For Arctic tern this is further supported by published demographic rates which estimate that Arctic tern has a relatively low productivity rate of 0.380 per year, with breeding pairs producing two eggs per year (Horswill and Robinson, 2015). Arctic tern has shown varying trends in recent years, with notable increases (e.g. 55% at Fair Isle SPA) and decreases (80% at Papa Westray), therefore as a precautionary measure the recoverability has been considered low.

11.10.55 Arctic tern is deemed to be of low to moderate vulnerability and low recoverability, indicating a limited ability to recover from potential impacts. The sensitivity of the receptor is therefore considered to be low.

Characterisation of the Effect

11.10.56 The results of CRM for both the WCS and MLS scenarios, using the sCRM and the Band CRM are given in Table 11.23. Only the mean sCRM value for the WCS has been taken forward for assessment with the other results presented for context.

Table 11.23: Collision Risk Estimates for Arctic Tern on a Seasonal and Annual Basis Against a Resulting Decrease in Survival of Relevant Populations

Season	Regional Baseline Population	Wind Turbine Scenario	Predicted Collision Mortality Per Year		Decrease in Survival (percentage point change)	
			sCRM	Band CRM	sCRM	Band CRM
Breeding	5,050	WCS	2.24 (0.05 to 11.25)	1.54	**0.044**	0.030
		MLS	1.77 (0.04 to 8.94)	1.23	0.035	0.024
Non-breeding	163,930	WCS	0.19 (0.00 to 0.95)	0.12	0.000	0.000
		MLS	0.15 (0.00 to 0.76)	0.10	0.000	0.000
Annual	163,930	WCS	2.43 (0.05 to 12.20)	1.66	0.001	0.001
		MLS	1.92 (0.04 to 9.70)	1.33	0.001	0.001

11.10.57 As shown in Table 11.23, as the 0.02 percentage point threshold was met for the breeding season, a PVA was required to further determine the magnitude of the effect (see Volume 3, Technical Appendix 11.7: Offshore Ornithology Population Viability Analysis Technical Report for more information).

Proposed Development Alone PVA Assessment

Breeding Season

11.10.58 When considering the Proposed Development alone impact during the breeding season on the regional population, the PVA predicted that the CPGR was 0.999 (Table 11.24) which is equivalent to a 0.1% reduction in population growth after

30 years compared to the unimpacted population. The CPS was 0.985 (Table 11.24), which is equivalent to a 1.5% decrease in population size. The results of the PVA suggest that the magnitude of effect is negligible.

Table 11.24: Output of PVA for Proposed Development Alone of Collision Risk Impacts for Arctic Tern for the Operational Life of the Proposed Development (up to 30 years). CI = Confidence Intervals Around Counterfactual Ration Metrics Given in Parentheses

Season	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
Breeding	Baseline	357	0.944 (0.918 to 0.970)	-	-
	Impacted	353	0.944 (0.918 to 0.969)	0.999 (0.990 to 1.009)	0.985 (0.716 to 1.336)

Magnitude of the Effect

11.10.59 From the results of the PVA, it is estimated that the impact to the growth rate will be just 0.1% during the breeding season (equivalent to a 1.5% decrease in population size). Therefore, it can be determined that the magnitude of the effect during all bio-seasons is negligible.

Significance of the Effect

11.10.60 The magnitude of collision risk is considered to be negligible, and the sensitivity of the VOR is considered to be low. Following the matrix approach, as presented in Table 11.13, the impact of collision risk on Arctic tern is therefore considered to be negligible to minor. Given a predicted impact of 0.1% on the growth rate, expert judgement suggests the significance of the effect is **Negligible** adverse, which is not significant in EIA terms.

Migratory Birds

Sensitivity of Migratory Birds to Collision Risk

11.10.61 It is expected that the vulnerability for most migratory birds will be low, with species expected to travel above rotor height during migration. However, the recoverability of migratory birds is expected to vary considerably amongst the species included for assessment. Therefore, as a precautionary approach, the sensitivity of all migratory birds is assumed to be high.

Characterisation of the Effect

11.10.62 For all species, the impact is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. According to the information from Woodward *et al.* (2023) summarised in Table 11.17, 59 species are connected to the Array Area during migration and are therefore potentially at risk of collision. Among these, 40 species have a very high avoidance rate (greater than 0.99), resulting in an expected negligible impact. For the other 19 species, the recommended avoidance rate is high but slightly lower (between 0.98 and 0.99). Consequently, using a highly precautionary approach, the expected magnitude of impact for these species is considered to be low based on this qualitative assessment.

11.10.63 Additionally, a quantitative assessment of collision risk to all birds whose migratory routes overlap the Array Area has been conducted using SOSSMAT, hereafter referred to as the Migration Assessment Tool (MAT) (Wright *et al.*, 2012). The MAT tool is specifically designed to assess the fraction of migratory bird populations that are features of UK SPAs that may pass through the Array Area during migration periods. Population numbers that were expected to cross the Array Area were compared to the newly developed mCRM Shiny application (HiDef Aerial Surveying Limited, 2025). It is important to note that at the time of writing this report, the mCRM Shiny application is still undergoing beta testing, however the results it generated provide an opportunity to sense check results from the MAT tool. Moreover, in instances where it generated a higher predicted population, this could be used, if relevant, to add an additional degree of precaution.

11.10.64 A comparison of the percentages of the population crossing the Array Area using the MAT tool and the mCRM Shiny application is presented in Table 11.25. As a precautionary measure, the highest number of birds passing through the Array Area is taken forward to the mCRM, with the outputs provided in Volume 3, Technical Appendix 11.5: Offshore Ornithology Migratory Bird Collision Risk Model Technical Report and presented in Table 11.25. A summary of the assessment on all species with a two-passage estimate of 0.2 birds or higher is presented in Table 11.26.

11.10.65 The impact is predicted to be of local spatial extent, long-term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. Under this approach, the magnitude for all species is therefore considered to be negligible.

Table 11.25: Comparison of the Number of Individuals Crossing the Array Area Using the SOSSMAT Tool and the mCRM Shiny Application, and Outputs from the Migratory Collison Risk Model using the Boldface Value. Bold are Species with a Two-Passage Collision Risk Estimate of 0.2 Birds or Higher Taken Forward for Assessment

Species	Number crossing Array Area SOSSMAT	Number crossing Array Area mCRM Shiny Application	Collisions (no avoidance)	Avoidance rate	Collisions (single passage)	Collisions (two passages)
Whooper Swan	405	**531**	12.4	98.74%	0.16	0.31
Bean Goose	19	**43**	1.5	99.98%	0.00	0.00
Pink-footed Goose	**5,250**	172	87.4	99.99%	0.01	0.02
Icelandic Greylag Goose	**12**	0	0.3	99.98%	0.00	0.00
Barnacle Goose (Svalbard)	1,540	**3,366**	108.3	99.96%	0.04	0.09
Light-bellied Brent Goose (Svalbard)	0	**337**	5.5	98.51%	0.08	0.16
Shelduck	**932**	748	14.7	98.51%	0.22	0.44
Wigeon	**2,119**	2,032	60.9	98.51%	0.91	1.81
Teal	**1,688**	899	45.8	98.51%	0.68	1.36
Mallard	**3,963**	3,238	124.6	98.51%	1.86	3.71
Pintail	**41**	39	1.2	98.51%	0.02	0.03
Shoveler	**122**	72	3.4	98.51%	0.05	0.10
Pochard	**151**	0	4.1	98.51%	0.06	0.12
Tufted Duck	568	**608**	16.6	98.51%	0.25	0.49
Scaup	**13**	9	0.4	98.51%	0.01	0.01
Eider	**4,748**	2,421	37.0	98.51%	0.55	1.10
Long-tailed Duck	**154**	127	4.3	98.51%	0.06	0.13
Common Scoter	**853**	755	23.6	98.51%	0.35	0.70
Velvet Scoter	**85**	80	2.5	98.51%	0.04	0.07
Goldeneye	**144**	119	4.0	98.51%	0.06	0.12
Red-breasted Merganser	**40**	-	1.1	98.51%	0.02	0.03
Goosander (non-breeding)	136	**192**	5.7	99.54%	0.03	0.05

Species	Number crossing Array Area SOSSMAT	Number crossing Array Area mCRM Shiny Application	Collisions (no avoidance)	Avoidance rate	Collisions (single passage)	Collisions (two passages)
Goosander (Breeding male moult)	**171**	-	5.1	99.54%	0.02	0.05
Red-throated Diver (breeding)	**17**	-	0.1	99.96%	0.00	0.00
Red-throated Diver (non-breeding)	202	**209**	1.6	99.96%	0.00	0.00
Manx Shearwater	**2,179**	-	6.5	99.00%	0.07	0.13
European Storm Petrel	**463**	-	2.3	99.00%	0.02	0.05
Leach's Storm Petrel	**436**	-	2.3	99.00%	0.02	0.05
Cormorant	**153**	0	1.5	99.00%	0.01	0.03
Shag	**617**	-	5.3	99.00%	0.05	0.11
Bittern	0	**9**	0.4	99.28%	0.00	0.01
Great Crested Grebe	**2**	1	0.0	99.54%	0.00	0.00
Slavonian Grebe	**6**	5	0.2	99.54%	0.00	0.00
Marsh Harrier	0	**53**	0.9	99.57%	0.00	0.01
Hen Harrier (breeding)	**14**	-	0.5	99.98%	0.00	0.00
Hen Harrier (non-breeding)	**3**	2	0.1	99.98%	0.00	0.00
Osprey	0	**15**	0.3	99.57%	0.00	0.00
Merlin	**26**	20	0.8	98.91%	0.01	0.02
Corncrake	155	**336**	9.0	98.75%	0.11	0.22
Oystercatcher (breeding)	**1,607**	-	49.3	99.99%	0.00	0.01
Oystercatcher (non-breeding)	**1,182**	1,037	36.3	99.99%	0.00	0.01
Ringed Plover (breeding)	**62**	-	1.5	99.96%	0.00	0.00
Ringed Plover (non-breeding)	**186**	118	4.6	99.96%	0.00	0.00
Dotterel (breeding and passage)	**2**	-	0.3	99.96%	0.00	0.00
Dotterel (within breeding season)	8	**11**	0.0	99.96%	0.00	0.00
Golden Plover (breeding)	**570**	-	15.0	98.51%	0.22	0.45

Species	Number crossing Array Area SOSSMAT	Number crossing Array Area mCRM Shiny Application	Collisions (no avoidance)	Avoidance rate	Collisions (single passage)	Collisions (two passages)
Golden Plover (non-breeding)	**2,013**	1,457	53.1	98.51%	0.79	1.58
Grey Plover	**597**	429	15.7	99.96%	0.01	0.01
Lapwing	**18,975**	12,364	538.1	99.96%	0.22	0.43
Knot	**1,400**	1,235	34.5	99.96%	0.01	0.03
Sanderling	**778**	700	18.6	99.96%	0.01	0.01
Purple Sandpiper	84	**99**	2.5	99.96%	0.00	0.00
Dunlin *C. a. schinzii* and *C. a. arctica* (passage)	**3,528**	2,688	86.6	98.51%	1.29	2.58
Dunlin *C. a. alpina* (passage and winter)	**1,723**	-	42.3	98.51%	0.63	1.26
Ruff	**111**	105	2.8	99.96%	0.00	0.00
Snipe	**23,794**	22,638	609.2	99.96%	0.24	0.49
Black-tailed Godwit *L. l. islandica*	**460**	0	13.2	98.51%	0.20	0.39
Bar-tailed Godwit	**3,577**	2,862	97.7	99.96%	0.04	0.08
Whimbrel	**44**	33	1.3	99.96%	0.00	0.00
Curlew (breeding)	**654**	-	20.5	99.96%	0.01	0.02
Curlew (non-breeding)	**727**	582	22.8	99.96%	0.01	0.02
Greenshank	**32**	30	0.9	99.96%	0.00	0.00
Redshank *T. t. britannica* (breeding)	**409**	-	10.9	99.54%	0.05	0.10
Redshank *T. t. robusta* (non-breeding)	**2,693**	-	71.9	99.54%	0.33	0.66
Redshank *T. t. totanus* (non-breeding)	**2,458**	1,290	65.6	99.54%	0.30	0.60
Turnstone	**1,344**	1,245	38.7	99.96%	0.02	0.03
Arctic Skua	**9**	-	0.4	99.50%	0.00	0.00
Great Skua	**109**	-	3.8	99.50%	0.02	0.04
Short-eared Owl	**68**	57	2.2	99.57%	0.01	0.02
Nightjar	0	**198**	6.1	99.54%	0.03	0.06

Table 11.26: Quantitative Assessment of Collision Risk to Migratory Species Using SOSSMAT (Wright *et al.*, 2012) and the mCRM Shiny Application

Species	UK population size[1]	Number crossing Array Area[2]	Estimated Collision Mortality per Annum (two-passage estimate)	Decrease in Survival Rate (Percentage Points)
Wigeon	544,000	2,119	1.81	0.000
Teal	435,500	1,688	1.36	0.000
Mallard	823,600	3,963	3.71	0.000
Eider	133,400	4,748	1.10	0.001
Common Scoter	146,700	853	0.70	0.000
Golden Plover (combined)	410,000	2,583	2.03	0.000
Dunlin (combined)	908,000	5,251	3.84	0.000
Redshank (combined)	450,000	5,560	1.36	0.000

[1]Taken from Woodward *et al.*, 2019, 2023;
[2] Highest estimate between the SOSSMAT and mCRM Shiny application (see Table 11.25)

Magnitude of the Effect

11.10.66 As it was found that the decrease in survival did not exceed the 0.02 percentage point threshold for PVA, as recommended by NatureScot (2023g), no PVAs were required, and the magnitude of the effect on the VORs is considered to be negligible.

Significance of the Effect

11.10.67 For all migratory birds, the magnitude of collision risk for all migratory birds is considered to be negligible, and the sensitivity is considered to be high. Following the matrix approach (Table 11.13) the impact of collision risk on migratory birds is therefore considered to be **Minor** adverse, which is not significant in EIA terms.

Summary of the Significance of Collision Risk

11.10.68 The assessment of collision risk for gannet, kittiwake, great black-backed gull, herring gull, Arctic tern and migratory birds during the O&M phase showed that the impact does not result in a significant effect in EIA terms on any of these species. This was demonstrated either, (1) by a decrease in survival rate of below 0.02 percentage point change, or (2) by a Proposed Development alone PVA assessment for a survival rate decrease of 0.02 percentage points or higher. A summary of the likely significant effects arising out of collision risk during the O&M phase is provided in Table 11.27.

Table 11.27: Summary of Likely Significant Effects of Collision Risk During the O&M Phase

Species	Significance of Effect
Gannet	No significant effect on gannet arising from collision risk alone during the O&M phase.
Kittiwake	No significant effect on kittiwake arising from collision risk alone during the O&M phase.
Great black-backed gull	No significant effect on great black-backed gull arising from collision risk alone during the O&M phase.
Herring gull	No significant effect on herring gull arising from collision risk alone during the O&M phase.
Arctic tern	No significant effect on Arctic tern arising from collision risk alone during the O&M phase.
Migratory birds	No significant effect on migratory birds arising from collision risk alone during the O&M phase.

IMPACT 2 - DISTRIBUTIONAL RESPONSES, DISPLACEMENT AND BARRIER EFFECTS FROM OFFSHORE INFRASTRUCTURE

11.10.69 During the construction, O&M and decommissioning phases, the presence of operational Wind Turbines has the potential to directly disturb seabirds, leading to displacement from the Proposed Development, including an area of variable size (buffer) around it.

11.10.70 Disturbance as the result of the presence of Wind Turbines and operational activities during the O&M phase of an OWF has the potential to displace seabirds from the area of sea in which Wind Turbines are located, or the activity

is occurring. In relation to OWF development, displacement is defined as a reduction in the number of seabirds occurring within or immediately adjacent to an OWF (Furness *et al.,* 2012).

11.10.71 Displacement can be considered indirect habitat loss, as the result is that birds are unable to utilise the habitat in the area from which they have been displaced. The loss of habitat means birds may move to areas already occupied by other birds and thus face higher intra- or inter-specific competition due to a higher density of individuals competing for the same resource. Alternatively, displaced birds may be forced to move into areas of lower quality (e.g. areas of lower prey availability) or travel longer distances to reach habitat of a suitable quality. This could therefore affect their demographic fitness (i.e. survival rates and breeding productivity), as well as potentially impacting on other birds in areas that displaced birds move to (for example, by increasing competition for resources).

11.10.72 VORs were screened in for assessment based on their abundance within the Array Area Study Area (as described in Paragraph 11.6.11 to 11.6.12) and sensitivity to displacement as shown in Table 11.28 and further described in Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report. In total six VORs were identified:

- fulmar;
- gannet;
- kittiwake;
- guillemot;
- razorbill; and
- puffin.

11.10.73 For each of the receptors considered for assessment, displacement impacts were quantified for the population derived within the Array Area plus 2 km buffer as recommended by NatureScot (NatureScot, 2023a). The displacement and mortality rates used within the assessment for each species are presented in Table 11.29, with the high displacement rate representing the maximum mortality rate expected to occur during each phase. Further information can be found in Volume 3, Technical Appendix 11.3: Offshore Ornithology Displacement Technical Report.

11.10.74 In addition to those species screened in for assessment of displacement within the Array Area, five species were screened in for qualitative assessment within the Export Cable Corridor only. These species were assessed due to the number of individuals observed within intertidal surveys and/or the proximity to relevant SPAs (see Section 11.6) and include:

- oystercatcher;
- curlew;
- common gull;
- black-headed gull; and

- lapwing.

Table 11.28: Abundance and Sensitivity of Receptors to Displacement Within the Array Area

Species	Abundance in the Array Study Area[1]	Factors Considered for Determining Sensitivity			Sensitivity
		Vulnerability to Displacement[2]	Uncertainty to Displacement Caused by Structures[3]	Recoverability[4]	
Fulmar	High	Very Low/Very Low	High	Low	Low
Gannet	High	Very Low/High	Very Low	Low	Low
Kittiwake	High	Very Low/Low	Very Low	Low	Low
Guillemot	High	Moderate/High	Very Low	Low	Medium
Razorbill	High	Moderate/High	Very Low	Low	Medium
Puffin	High	Low/Moderate	Moderate	Low	Medium

[1] As determined in Volume 2, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report
[2] Scores taken from Bradbury *et al.* (2014)/Wade *et al.* (2016), rated from very low to very high.
[3] Taken from Wade *et al.* (2016)
[4] Derived from information within Mitchell *et al.* (2020) and Horswill and Robinson (2015)

Table 11.29: Species Displacement and Mortality Rates Used During Assessment

Species	Displacement Rate		Mortality Rate	
	C and D[1]	O&M[1]	Breeding Season	Non-Breeding (Winter) Season
Fulmar	10%	20%	1% and 3%	1% and 3%
Gannet	35%	70%	1% and 3%	1% and 3%
Kittiwake	15%	30%	1% and 3%	1% and 3%
Guillemot	30%	60%	3% and 5%	1% and 3%
Razorbill	30%	60%	3% and 5%	1% and 3%
Puffin	30%	60%	3% and 5%	1% and 3%

[1] Refers to construction (C), operation and maintenance (O) and decommissioning (D) phases of the Proposed Development

Construction Phase

Fulmar

Sensitivity of Fulmar to Displacement

11.10.75 Fulmar are considered to have a very low vulnerability to displacement. This is due to the species scoring low in various aspects such as sensitivity to structures and habitat specialisation (Wade *et al.*, 2016). Thus, fulmar is not

expected to be able to utilise alternative habitats well, limiting the impacts of displacement.

11.10.76 As described in Mitchell *et al.* (2020), seabird species are long-lived species with relatively low reproductive rates. This is further supported by published demographic rates which estimate that fulmar have a 0.419 productivity rate with breeding pairs producing one egg (Horswill and Robinson, 2015). Fulmar were not surveyed by RSPB (Tremlett *et al.*, 2024), however NEEOG surveys recorded decreases at both East Caithness Cliffs and at North Caithness Cliffs SPA (Zisman, Swann and Burt, 2025; Zisman and Swann, 2025). Therefore, it is assumed that the recoverability of fulmar is low.

11.10.77 Fulmar is deemed to be of low vulnerability and low recoverability, indicating a limited ability to tolerate impacts. The sensitivity of the receptor is therefore considered to be low.

Characterisation of the Effect

11.10.78 The mortality (using the displacement rate of 10% and a mortality rate of 1% to 3% during the breeding and non-breeding season as per NatureScot guidance (NatureScot, 2023a)) resulting from displacement during construction was calculated for each bio-season and for the combined bio-seasons (Table 11.30) as detailed in Volume 3, Technical Appendix 11.3: Offshore Ornithology Displacement Technical Report.

11.10.79 The displacement estimates are presented in Table 11.30.

Table 11.30: Fulmar Bio-Season and Annual Displacement Estimates for the Proposed Development During Construction

Bio-season	Seasonal Abundance (Array Area + 2 km Buffer)	Regional Baseline Population	Number of Individuals Subject to Mortality Per Year	Decrease in Survival (percentage point change)
Breeding	903	1,128,693	1 to 3	0.000 to 0.000
Non-breeding	270	568,736	0 to 1	0.000 to 0.000
Annual	-	1,128,693	1 to 4	0.000 to 0.000

Magnitude of the Effect

11.10.80 As it was found that the decrease in survival did not exceed the 0.02 percentage point threshold for PVA, as recommended by NatureScot (2023g), no PVAs were required, and the magnitude of the effect on the VOR is considered to be negligible.

Significance of the Effect

11.10.81 The magnitude of distributional responses is considered to be negligible, and the sensitivity of the VOR is considered to be low. Following the matrix approach (Table 11.13) the impact of distributional responses on fulmar is therefore considered to be negligible to minor. Given the the annual decrease in survival rates is expected to be 0.000 for both low and high displacement scenarios, it

has been determined that the significance of the effect is **Negligible** adverse, which is not significant in EIA terms.

Gannet

Sensitivity of Gannet to Displacement

11.10.82 Gannet are considered to have a very low vulnerability to displacement. This is due to the species scoring low in various aspects such as vessels and helicopters and habitat specialisation, but high in vulnerability to displacement to structures (Wade *et al*., 2016). Thus, gannet is expected to be able to utilise alternative habitats, limiting the impacts of displacement (Bradbury *et al.*, 2014). However, it is also noted that the vulnerability of gannet to structures is considered to be low in Bradbury *et al*. (2014), suggesting there is a level of uncertainty in estimates.

11.10.83 The recoverability of gannet is considered to be low (see Paragraph 11.10.24).

11.10.84 Gannet is deemed to be of low vulnerability and low recoverability, indicating a limited ability to tolerate impacts. The sensitivity of the receptor is therefore considered to be low.

Characterisation of the Effect

11.10.85 The mortality (using the displacement rate of 35% and a mortality rate of 1% to 3% during the breeding and non-breeding season as per NatureScot guidance (NatureScot, 2023a)) resulting from displacement during construction was calculated for each bio-season and for the combined bio-seasons (Table 11.31) as detailed in Volume 3, Technical Appendix 11.3: Offshore Ornithology Displacement Technical Report.

11.10.86 The displacement estimates are presented in Table 11.31.

Table 11.31: Gannet Bio-Season and Annual Displacement Estimates for the Proposed Development During Construction

Bio-season	Seasonal Abundance (Array Area + 2 km Buffer)	Regional Baseline Population	Number of Individuals Subject to Mortality Per Year	Decrease in Survival (percentage point change)
Breeding	613	841,748	2 to 6	0.000 to 0.001
Non-breeding	104	248,385	0 to 1	0.000 to 0.000
Annual	-	841,748	2 to 7	0.000 to 0.001

Magnitude of the Effect

11.10.87 As it was found that the decrease in survival did not exceed the 0.02 percentage point threshold for PVA, as recommended by NatureScot (2023g), no PVAs were required, and the magnitude of the effect on the VOR is considered to be negligible.

Significance of the Effect

11.10.88 The magnitude of distributional responses is considered to be negligible, and the sensitivity of the VOR is considered to be low. Following the matrix approach, as presented in Table 11.13, the impact of distributional responses on gannet is therefore considered to be negligible to minor. Given the the annual decrease in survival rates is not predicted to exceed 0.001, the significance has been determined to be **Negligible** adverse, which is not significant in EIA terms.

11.10.89 However, it should be noted that as gannet have been assessed for both collision risk and distributional responses, further assessment has been carried out as presented in Section 11.11.

Kittiwake

Sensitivity of Kittiwake to Displacement

11.10.90 Kittiwake are considered to have a low vulnerability (Wade *et al.,* 2016). This is due to the species scoring low in various aspects such as sensitivity to structures, vessels and helicopters and habitat specialisation. Thus, kittiwake is expected to be able to utilise alternative habitats, limiting the impacts of displacement (Bradbury *et al.*, 2014).

11.10.91 The recoverability of kittiwake is considered to be low (see Paragraph 11.10.32).

11.10.92 Kittiwake is deemed to be of low vulnerability, and low recoverability, indicating a limited ability to tolerate impacts. The sensitivity of the receptor is therefore considered to be low.

Characterisation of the Effect

11.10.93 The mortality (using the displacement rate of 15% and a mortality rate of 1% to 3% during the breeding and non-breeding season as per NatureScot guidance (NatureScot, 2023a)) resulting from displacement during construction was calculated for each bio-season and for the combined bio-seasons (Table 11.32) as detailed in Volume 3, Technical Appendix 11.3: Offshore Ornithology Displacement Technical Report.

11.10.94 The displacement estimates are presented in Table 11.32.

Table 11.32: Kittiwake Bio-Season and Annual Displacement Estimates for the Proposed Development During Construction

Bio-season	Seasonal Abundance (Array Area + 2 km Buffer)	Regional Baseline Population	Number of Individuals Subject to Mortality Per Year	Decrease in Survival (percentage point change)
Breeding	1,749	604,582	3 to 8	0.000 to 0.001
Non-breeding	410	627,816	1 to 2	0.000 to 0.000
Annual	-	627,816	4 to 10	0.001 to 0.002

Magnitude of the Effect

11.10.95 As it was found that the decrease in survival did not exceed the 0.02 percentage point threshold for PVA, as recommended by NatureScot (2023g), no PVAs were required, and the magnitude of the effect on the VOR is considered to be negligible.

Significance of the Effect

11.10.96 The magnitude of distributional responses is considered to be negligible, and the sensitivity of the VOR is considered to be low. Following the matrix approach (Table 11.13) the impact of distributional responses on kittiwake is therefore considered to be negligible to minor. Given the highest decrease in survival is 0.001 percentage points, well below the 0.02 percentage point threshold, the impact has been determined to be **Negligible** adverse, which is not significant in EIA terms.

11.10.97 However, it should be noted that as kittiwake have been assessed for both collision risk and distributional responses, further assessment has been carried out as presented in Section 11.11.

Guillemot

Sensitivity of Guillemot to Displacement

11.10.98 Guillemot are considered to have an overall moderate vulnerability to displacement. This is due to the species scoring moderate in various aspects such as vulnerability to vessels and helicopters and habitat specialisation and high in vulnerability to structures (Wade *et al*., 2016).

11.10.99 As mentioned in Mitchell *et al.* (2020), seabird species are long-lived species with relatively low reproductive rates. This is further supported by published demographic rates which estimate that guillemot have a 0.672 productivity rate with breeding pairs producing one egg (Horswill and Robinson, 2015). Both SPAs with connectivity to the Proposed Development, Buchan Ness to Collieston Coast SPA (3%) and Fowlsheugh SPA (32%), were found to increase (Tremlett *et al.,* 2024). However, guillemot populations across Scotland have been found to remain relatively stable following the most recent HPAI outbreak across Scotland (2% increase) and decreased across the UK by 6% (Tremlett *et al.*, 2024). Therefore, the recoverability is considered to be low for guillemot.

11.10.100 Guillemot is deemed to be of medium vulnerability and low recoverability, indicating a limited ability to tolerate impacts. The sensitivity of the receptor is therefore considered to be medium.

Characterisation of the Effect

11.10.101 The mortality (using the displacement rate of 30% during both seasons and a mortality rate of 3% to 5% during the breeding and 1% to 3% during the non-breeding season as per NatureScot guidance (NatureScot, 2023a)) resulting from displacement during construction was calculated for each bio-season and for the combined bio-seasons (Table 11.33) as detailed in Volume 3, Technical Appendix 11.3: Offshore Ornithology Displacement Technical Report.

11.10.102 Non-breeding season impacts are apportioned based on breeding season regional populations for guillemot (Buckingham *et al.*, 2022). The displacement estimates are presented in Table 11.33.

Table 11.33: Guillemot Bio-Season and Annual Displacement Estimates for the Proposed Development During Construction

Bio-season	Seasonal Abundance (Array Area + 2 km Buffer)	Regional Baseline Population	Number of Individuals Subject to Mortality Per Year	Decrease in Survival (percentage point change)
Breeding	15,960	250,506	144 to 239	**0.057 to 0.095**
Non-breeding	18,212	250,506	55 to 164	**0.022 to 0.065**
Annual	-	250,506	199 to 403	**0.079 to 0.161**

Magnitude of the Effect

11.10.103 As the impact of displacement is expected to be highest during the O&M phase (Table 11.9), despite the impacts during construction meeting the 0.02 percentage point threshold a PVA has not been conducted. Therefore, the magnitude of the effect during construction has not been determined.

Significance of the Effect

11.10.104 As detailed in the MDS (Table 11.9), impacts from displacement are expected to be highest during O&M. As the results of PVAs for the O&M phase (Table 11.41) show that the magnitude is low, and therefore it can be said the impact is not significant, it can also be said that the significance of the effect during construction is not significant.

Razorbill

Sensitivity of Razorbill to Displacement

11.10.105 Razorbill are considered to have a moderate vulnerability to displacement. This is due to the species scoring moderate to high in various aspects such as sensitivity to structures, vessels and helicopters and habitat specialisation (Bradbury *et al.*, 2014) and low recoverability (Mitchell *et al.*, 2020; Horswill and Robinson, 2015).

11.10.106 As mentioned in Mitchell *et al.* (2020), seabird species are long-lived species with relatively low reproductive rates. This is further supported by published demographic rates which estimate that razorbill have a 0.570 productivity rate with breeding pairs producing one egg (Horswill and Robinson, 2015). Although razorbill were not surveyed by RSPB following HPAI, recent NEEOG surveys, have shown that populations have increased by over 50% at both East Caithness Cliffs SPA and North Caithness Cliffs SPA when compared to historical counts. Therefore, the recoverability of razorbill is considered to be moderate.

11.10.107 Razorbill is deemed to be of medium vulnerability, moderate recoverability, indicating an ability to tolerate impacts. The sensitivity of the receptor is therefore considered to be medium.

Characterisation of the Effect

11.10.108 The mortality (using the displacement rate of 30% during both seasons and a mortality rate of 3% to 5% during the breeding and 1% to 3% during the non-breeding season as per NatureScot guidance (NatureScot, 2023a)) resulting from displacement during construction was calculated for each bio-season and for the combined bio-seasons (Table 11.34) as detailed in Volume 3, Technical Appendix 11.3: Offshore Ornithology Displacement Technical Report.

11.10.109 The displacement estimates are presented in Table 11.34.

Table 11.34: Razorbill Bio-Season and Annual Displacement Estimates for the Proposed Development During Construction

Bio-season	Seasonal Abundance (Array Area + 2 km Buffer)	Regional Baseline Population	Number of Individuals Subject to Mortality Per Year	Decrease in Survival (percentage point change)
Breeding	2,675	90,519	24 to 40	**0.027 to 0.044**
Non-breeding	728	218,622	2 to 7	0.001 to 0.003
Annual	-	218,622	26 to 47	0.012 to **0.021**

Magnitude of the Effect

11.10.110 As the impact of displacement is expected to be highest during the O&M phase (Table 11.9), despite the impacts during construction meeting the 0.02 percentage point threshold a PVA has not been conducted. Therefore, the magnitude of the effect during construction has not been determined.

Significance of the Effect

11.10.111 As detailed in the MDS (Table 11.9), impacts from displacement are expected to be highest during O&M. As the results of PVAs for the O&M phase (Table 11.43) show that the magnitude is negligible, and therefore it can be said the impact is not significant, it can also be said that the significance of the effect during construction is not significant

Puffin

Sensitivity of Puffin to Displacement

11.10.112 Puffin are considered to have a low vulnerability to displacement. This is due to the species scoring low in sensitivity to structures, vessels and helicopters, but scoring moderate in habitat specialisation (Bradbury *et al.*, 2014), suggesting that displaced puffins may struggle to adapt to new habitats.

11.10.113 As mentioned in Mitchell *et al.* (2020), seabird species are long-lived species with relatively low reproductive rates. This is further supported by published demographic rates which estimate that puffin have a 0.617 productivity rate with breeding pairs producing one egg (Horswill and Robinson, 2015). Therefore, the recoverability of puffin is considered to be low.

11.10.114 Puffin is deemed to be of medium vulnerability and low recoverability, indicating a limited ability to tolerate impacts. The sensitivity of the receptor is therefore considered to be medium.

Characterisation of the Effect

11.10.115 The mortality (using the displacement rate of 30% during both seasons and a mortality rate of 3% to 5% during the breeding and 1% to 3% during the non-breeding season as per NatureScot guidance (NatureScot, 2023a)) resulting from displacement during construction was calculated for each bio-season and for the combined bio-seasons (Table 11.35) as detailed in Volume 3, Technical Appendix 11.3: Offshore Ornithology Displacement Technical Report.

11.10.116 The displacement estimates are presented in Table 11.35.

Table 11.35: Puffin Bio-Season and Annual Displacement Estimates for the Proposed Development During Construction

Bio-season	Seasonal Abundance (Array Area + 2 km Buffer)	Regional Baseline Population	Number of Individuals Subject to Mortality Per Year	Decrease in Survival (percentage point change)
Breeding	377	507,599	3 to 6	0.001 to 0.001
Non-breeding	705	231,957	2 to 6	0.001 to 0.003
Annual	-	507,599	5 to 12	0.001 to 0.002

Magnitude of the Effect

11.10.117 As it was found that the decrease in survival did not exceed the 0.02 percentage point threshold for PVA, as recommended by NatureScot (2023g), no PVAs were required. Therefore, the magnitude of the effect on the VOR is considered to be negligible.

Significance of the Effect

11.10.118 The magnitude of distributional responses is considered to be negligible, and the sensitivity of the VOR is considered to be medium. Following the matrix approach (Table 11.13) the impact of distributional responses on puffin is therefore considered to be negligible or minor. Given the highest decrease in survival is 0.003 percentage points, well below the 0.02 percentage point threshold, the impact has been determined to be **Negligible** adverse, which is not significant in EIA terms.

Oystercatcher, Lapwing, Curlew, Common Gull and Black-headed Gull

Sensitivity of the VORs

11.10.119 Both oystercatcher and black-headed gull are considered to have a low sensitivity to displacement, and common gull have medium to sensitivity to displacement. However, lapwing and curlew are considered to have high sensitivity to displacement (Table 11.7).

Characterisation of the Effect

11.10.120 VORs within the Export Cable Corridor are expected to experience barrier effects altering their flight paths to foraging locations and displacement. Unlike VORs assessed for displacement within the Array Area, displacement will not occur due to the presence of Wind Turbines and will instead occur due to construction activities associated with the laying of the Offshore Export Cables. Therefore, it is expected that impacts due to activities associated with the Export Cable Corridor will be temporary, with a limited spatial extent. The impact to VORs is also expected to be similar to those described in impacts such as vessel disturbance.

Magnitude of Impact

11.10.121 As the effect of displacement is only expected to occur infrequently over a small spatial extent within the Export Cable Corridor for a limited time during the construction phase of the Proposed Development, the magnitude of impact is considered to be negligible.

Significance of the Effect

11.10.122 For both oystercatcher and black-headed gull, the magnitude of distributional responses is considered to be negligible and the sensitivity of the VOR is considered to be low. Following the matrix approach (Table 11.13), the impact of distributional responses is therefore considered to be negligible or minor. Given the small number of individuals expected to be affected and the short period of time the effect is likely to occur, the significance is deemed to be **Negligible** adverse which is not significant in EIA terms.

11.10.123 For common gull, the magnitude of distributional responses is considered to be negligible and the sensitivity of the VOR is considered to be medium. Following the matrix approach (Table 11.13), the impact of distributional responses is therefore considered to be negligible or minor. For the same reasons as given for oystercatcher and black-headed gull, the significance is deemed to be **Negligible** adverse, which is not significant in EIA terms.

11.10.124 For both lapwing and curlew, the magnitude of distributional responses is considered to be negligible and the sensitivity of the VOR is considered to be high. Following the matrix approach (Table 11.13), the impact of distributional responses is therefore considered to be **Minor** adverse, which is not significant in EIA terms.

Summary of Displacement Impacts During Construction

11.10.125 A summary of the likely significant effects as a result of distributional responses, displacement and barrier impacts during the construction phase of the Array Area is provided in Table 11.36.

Table 11.36: Summary of the Effects of Distributional Responses During Construction

Species	Significance of Effect of Impacts
Fulmar	No significant effect on fulmar arising from displacement during the construction phase.
Gannet	No significant effect on gannet arising from displacement during the construction phase.
Kittiwake	No significant effect on kittiwake arising from displacement during the construction phase.
Guillemot	Although the potential for a significant effect was demonstrated, the Proposed Development alone PVA for the O&M phase demonstrated that the effect was not significant in EIA terms. As the impact of displacement is larger in the O&M phase compared to the construction phase, it can be concluded that the impact during the construction phase is not a likely significant effect in EIA terms.
Razorbill	Although the potential for a significant effect was demonstrated, the Proposed Development alone PVA for the O&M phase demonstrated that the effect was not significant in EIA terms. As the impact of displacement is larger in the O&M phase compared to the construction phase, it can be concluded that the impact during the construction phase is not a likely significant effect in EIA terms.
Puffin	No significant effect on puffin arising from displacement during the construction phase.
Oystercatcher	No significant effect on oystercatcher arising from displacement during the construction phase.
Lapwing	No significant effect on lapwing arising from displacement during the construction phase.
Curlew	No significant effect on curlew arising from displacement during the construction phase.
Common gull	No significant effect on common gull arising from displacement during the construction phase.
Black-headed gull	No significant effect on black-headed gull arising from displacement during the construction phase.

O&M Phase

Fulmar

Sensitivity of Fulmar to Displacement

11.10.126 As previously discussed in Paragraphs 11.10.75 to 11.10.77, the sensitivity of fulmar to displacement is low.

Characterisation of the Effect

11.10.127 The mortality (using the displacement rate of 20% and a mortality rate of 1% to 3% during the breeding and non-breeding season as per NatureScot guidance (NatureScot, 2023a)) resulting from displacement during O&M was calculated for each bio-season and for the combined bio-seasons (Table 11.37) as detailed in Volume 3, Technical Appendix 11.3: Offshore Ornithology Displacement Technical Report.

11.10.128 The displacement estimates are presented in Table 11.37.

Table 11.37: Fulmar Bio-Season and Annual Displacement Estimates for the Proposed Development During O&M

Bio-season	Seasonal Abundance (Array Area + 2 km Buffer)	Regional Baseline Population	Number of Individuals Subject to Mortality	Decrease in Survival (percentage point change)
Breeding	903	1,128,693	2 to 5	0.000 to 0.000
Non-breeding	270	568,736	1 to 2	0.000 to 0.000
Annual	-	1,128,693	3 to 7	0.000 to 0.001

Magnitude of the Effect

11.10.129 As it was found that the decrease in survival did not exceed the 0.02 percentage point threshold for PVA, as recommended by NatureScot (2023g), no PVAs were required and the magnitude of the effect on the VOR is considered to be negligible.

Significance of the Effect

11.10.130 The magnitude of distributional responses is considered to be negligible, and the sensitivity of the VOR is considered to be low. Following the matrix approach (Table 11.13) the impact of distributional responses on fulmar is therefore considered to be negligible to minor. As the decrease in survival is not predicted to exceed 0.001 percentage points it has been determined that the significance of the effect is **Negligible** adverse, which is not significant in EIA terms.

Gannet

Sensitivity of Gannet to Displacement

11.10.131 As previously discussed in Paragraphs 11.10.82 to 11.10.84, the sensitivity of gannet to displacement is low.

Characterisation of the Effect

11.10.132 The mortality (using the displacement rate of 70% and a mortality rate of 1% to 3% as per NatureScot guidance (NatureScot, 2023a)) resulting from displacement during O&M was calculated for each bio-season and for the combined bio-seasons (Table 11.38) as detailed in Volume 3, Technical Appendix 11.3: Offshore Ornithology Displacement Technical Report.

11.10.133 The displacement estimates are presented in Table 11.38.

Table 11.38: Gannet Bio-Season and Annual Displacement Estimates for the Proposed Development During Construction

Bio-season	Seasonal Abundance (Array Area + 2 km Buffer)	Regional Baseline Population	Number of Individuals Subject to Mortality	Decrease in Survival (percentage point change)
Breeding	613	841,748	4 to 13	0.000 to 0.002
Non-breeding	104	248,385	1 to 2	0.000 to 0.001
Annual	-	841,748	5 to 15	0.001 to 0.002

Magnitude of the Effect

11.10.134 As it was found that the decrease in survival did not exceed the 0.02 percentage point threshold for PVA, as recommended by NatureScot (2023g), no PVAs were required and the magnitude of the effect on the VOR is considered to be negligible**.**

Significance of the Effect

11.10.135 The magnitude of distributional responses is considered to be negligible, and the sensitivity of the VOR is considered to be low. Following the matrix approach (Table 11.13), the impact of distributional responses on gannet is therefore considered to be negligible to minor. Given the maximum decrease in survival rate is 0.002 percentage points, well below the 0.02 percentage point threshold, the significance of displacement on gannet is considered to be **Negligible** adverse, which is not significant in EIA terms.

11.10.136 However, it should be noted that as gannet have been assessed for both collision risk and distributional responses, further assessment has been carried out as presented in Section 11.11.

Kittiwake

Sensitivity of Kittiwake to Displacement

11.10.137 As previously discussed in paragraphs 11.10.90 to 11.10.92, the sensitivity of kittiwake to displacement is low.

Characterisation of the Effect

11.10.138 The mortality (using the displacement rate of 30% and a mortality rate of 1% to 3% during the breeding and non-breeding season as per NatureScot guidance (NatureScot, 2023a)) resulting from displacement during the O&M phase was calculated for each bio-season and for the combined bio-seasons (Table 11.39) as detailed in Volume 3, Technical Appendix 11.3: Offshore Ornithology Displacement Technical Report.

11.10.139 The displacement estimates are presented in Table 11.39.

Table 11.39: Kittiwake Bio-Season and Annual Displacement Estimates for the Proposed Development During Construction

Bio-season	Seasonal Abundance (Array Area + 2 km Buffer)	Regional Baseline Population	Number of Individuals Subject to Mortality	Decrease in Survival (percentage point change)
Breeding	1,749	604,582	5 to 16	0.001 to 0.003
Non-breeding	410	627,816	1 to 4	0.000 to 0.001
Annual	-	627,816	6 to 20	0.001 to 0.003

Magnitude of the Effect

11.10.140 As it was found that the decrease in survival did not exceed the 0.02 percentage point threshold for PVA, as recommended by NatureScot (2023g), no PVAs were required, and the magnitude of the effect on the VOR is considered to be negligible.

Significance of the Effect

11.10.141 The magnitude of distributional responses is considered to be negligible, and the sensitivity of the VOR is considered to be low. Following the matrix approach, as presented in Table 11.13, the impact of distributional responses on kittiwake is therefore considered to be negligible to minor. Given the maximum decrease in survival is 0.003, well below the 0.02 percentage point threshold, it is considered that the significance of the effect of displacement on kittiwake is **Negligible** adverse, which is not significant in EIA terms.

11.10.142 However, it should be noted that as kittiwake have been assessed for both collision risk and distributional responses, further assessment has been carried out as presented in Section 11.11.

Guillemot

Sensitivity of Guillemot to Displacement

11.10.143 As shown in in Paragraphs 11.10.98 to 11.10.100 and Table 11.28, the sensitivity of guillemot to displacement is medium.

Characterisation of the Effect

11.10.144 The mortality (using the displacement rate of 60% during both seasons and a mortality rate of 3% to 5% during the breeding and 1% to 3% during the non-breeding season as per NatureScot guidance (NatureScot, 2023a)) resulting from displacement during O&M was calculated for each bio-season and for the combined bio-seasons (Table 11.40) as detailed in Volume 3, Technical Appendix 11.3: Offshore Ornithology Displacement Technical Report.

11.10.145 Non-breeding season impacts are apportioned based on breeding season regional populations for guillemot (Buckingham *et al.*, 2022).

11.10.146 The displacement estimates are presented in Table 11.40.

Table 11.40: Guillemot Bio-Season and Annual Displacement Estimates for the Proposed Development During O&M

Bio-season	Seasonal Abundance (Array Area + 2 km Buffer)	Regional Baseline Population	Number of Individuals Subject to Mortality	Decrease in Survival (percentage point change)
Breeding	15,960	250,506	287 to 479	**0.115 to 0.191**
Non-breeding	18,212	250,506	109 to 328	**0.044 to 0.131**
Annual	-	250,506	396 to 807	**0.158 to 0.322**

11.10.147 As shown in Table 11.40, as the 0.02 percentage point threshold was met for all scenarios three PVAs were required to further determine the magnitude of the effect (see Volume 3, Technical Appendix 11.7: Offshore Ornithology Population Viability Analysis Technical Report for more information).

Proposed Development Alone PVA Assessment

Breeding Season

11.10.148 When considering the Proposed Development alone impact during the breeding season on the regional population, the PVA predicted that the CPGR was 0.999 and 0.998 (Table 11.41) for the high and low impact scenarios which translates to a 0.1% to 0.2% reduction in population growth after 30 years compared to the unimpacted population. The CPS was 0.961 and 0.936 (Table 11.41) for the low and high impact scenarios respectively, which is equivalent to a 3.9% to 6.4% decrease in population size. The results of the PVA suggest that the magnitude is low.

Non-breeding Season

11.10.149 When considering the Proposed Development alone impact during the non-breeding season on the regional population, the PVA predicted that the CPGR was 1.000 and 0.999 (Table 11.41) for the high and low impact scenarios respectively, which translates to a 0.0% to 0.1% reduction in population growth rate after 30 years compared to the unimpacted population. The CPS was 0.985 and 0.956 (Table 11.41) for the low and high impact scenarios respectively, which is equivalent to a 1.5% to 4.4% decrease in population size. The results of the PVA suggest that the magnitude is negligible.

Annual

11.10.150 When considering the Proposed Development alone impact annually on the regional population, the PVA predicted that the CPGR was 0.998 and 0.996 (Table 11.41) for the low and high impact scenarios which translates to a 0.2% to 0.4% reduction in population growth after 30 years compared to the unimpacted population. The CPS was 0.946 and 0.894 (Table 11.41) for the low and high impact scenarios respectively, which is equivalent to a 5.4% to 10.6% decrease in population size. The results of the PVA suggest that the magnitude is low.

Table 11.41: Output of PVA for Proposed Development alone of Displacement Impacts for Guillemot for the Operational Life of the Proposed Development (up to 30 years). CI = Confidence Intervals Around Counterfactual Ration Metrics Given in Parentheses

Season	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
Breeding	Baseline	957,118	1.034 (1.024 to 1.044)	-	-
	Impacted: Low	919,304	1.033 (1.022 to 1.043)	0.999 (0.998 to 0.999)	0.961 (0.953 to 0.969)
	Impacted: High	895,618	1.032 (1.021 to 1.042)	0.998 (0.998 to 0.998)	0.936 (0.927 to 0.944)
Non-breeding	Baseline	957,118	1.034 (1.024 to 1.044)	-	-
	Impacted: Low	942,377	1.034 (1.023 to 1.044)	1.000 (0.999 to 1.000)	0.985 (0.977 to 0.993)
	Impacted: High	914,607	1.033 (1.022 to 1.043)	0.999 (0.998 to 0.999)	0.956 (0.947 to 0.964)
Annual	Baseline	957,118	1.034 (1.024 to 1.044)	-	-
	Impacted: Low	905,666	1.032 (1.022 to 1.042)	0.998 (0.998 to 0.998)	0.946 (0.938 to 0.954)
	Impacted: High	854,427	1.031 (1.020 to 1.040)	0.996 (0.996 to 0.997)	0.894 (0.885 to 0.901)

Magnitude of the Effect

11.10.151 From the results of the PVA, it is predicted that the maximum impact on growth rate is 0.3%, equivalent to a 9.1% decrease in population size. Therefore, it can be determined that the magnitude of the effect during all bio-seasons is low.

Significance of the Effect

11.10.152 The magnitude of distributional responses is considered to be low, and the sensitivity of the VOR is considered to be medium. Following the matrix approach (Table 11.13), the impact of distributional responses on guillemot is therefore considered to be **Minor** adverse, which is not significant in EIA terms.

Razorbill

Sensitivity of Razorbill to Displacement

11.10.153 As shown in in paragraphs 11.10.105 to 11.10.107, the sensitivity of razorbill to displacement is medium.

Characterisation of the Effect

11.10.154 The mortality (using the displacement rate of 60% during both seasons and a mortality rate of 3% to 5% during the breeding and 1% to 3% during the non-breeding season as per NatureScot guidance (NatureScot, 2023a)) resulting from displacement during O&M was calculated for each bio-season and for the

combined bio-seasons (Table 11.42) as detailed in Volume 3, Technical Appendix 11.3: Offshore Ornithology Displacement Technical Report.

11.10.155 The displacement estimates are presented in Table 11.42.

Table 11.42: Razorbill Bio-Season and Annual Displacement Estimates for the Proposed Development During O&M

Bio-season	Seasonal Abundance (Array Area + 2 km Buffer)	Regional Baseline Population	Number of Individuals Subject to Mortality	Decrease in Survival (percentage point change)
Breeding	2,675	90,519	48 to 80	**0.053 to 0.088**
Non-breeding	728	218,622	4 to 13	0.002 to 0.006
Annual	-	218,622	53 to 93	**0.024 to 0.043**

11.10.156 As shown in Table 11.42, as the 0.02 percentage point threshold was met for the breeding season and annual scenarios, two PVAs were required to further determine the magnitude of the effect (see Volume 3, Technical Appendix 11.7: Offshore Ornithology Population Viability Analysis Technical Report for more information).

Proposed Development PVA Assessment

Breeding Season

11.10.157 When considering the Proposed Development alone impact during the breeding season on the regional population, the PVA predicted that the CPGR was 0.999 (Table 11.43) for both impact scenarios which translates to 0.1% reduction in the population growth rate after 30 years compared to the unimpacted population. The CPS was 0.981 and 0.969 (Table 11.43) for the low and high impact scenarios respectively, which is equivalent to a 1.9% to 3.1% decrease in population size. The results of the PVA suggest that the magnitude of effect is negligible.

Annual

11.10.158 When considering the annual Proposed Development alone impact on the regional population, the PVA predicted that the CPGR was 1.000 (Table 11.43) for both impact scenarios which translates to no identifiable reduction in population growth after 30 years compared to the unimpacted population. The CPS was 0.992 and 0.985 (Table 11.43) for the low and high impact scenarios respectively, which is equivalent to a 0.8% to 1.5% decrease in population size. The results of the PVA suggest that the magnitude of effect is negligible.

Table 11.43: Output of PVA for Proposed Development Alone of Displacement Impacts for Razorbill for the Operational Life of the Proposed Development (up to 30 years). CI = Confidence Intervals Around Counterfactual Ration Metrics Given in Parentheses

Year (Years of operational impact)	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
Breeding	Baseline	156,072	1.014 (0.988 to 1.038)	-	-

Year (Years of operational impact)	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
	Impacted: Low	152,972	1.013 (0.988 to 1.037)	0.999 (0.999 to 1.000)	0.981 (0.961 to 1.001)
	Impacted: High	150,882	1.013 (0.988 to 1.037)	0.999 (0.998 to 1.000)	0.969 (0.949 to 0.989)
Annual	Baseline	421,881	1.013 (0.988 to 1.038)	-	-
	Impacted: Low	418,019	1.013 (0.988 to 1.038)	1.000 (0.999 to 1.000)	0.992 (0.977 to 1.006)
	Impacted: High	415,912	1.013 (0.988 to 1.038)	1.000 (0.999 to 1.000)	0.985 (0.971 to 0.999)

Magnitude of the Effect

11.10.159 From the results of the PVA, it is predicted that the maximum impact on growth rate is 0.1% (rounded to one decimal place), equivalent to a 3.1% decrease in population size for the breeding season scenario. Therefore, it can be determined that the magnitude of the effect during all bio-seasons is negligible.

Significance of the Effect

11.10.160 The magnitude of distributional responses is considered to be negligible, and the sensitivity of the VOR is considered to be medium. Following the matrix approach (Table 11.13), the impact of distributional responses on razorbill is therefore considered to be negligible to minor. From the results of the PVA, given the maximum impact on growth rate is 0.1%, equivalent to a 3.1% decrease in population size, it is considered that the significance of the impact is **Negligible** adverse, which is not significant in EIA terms.

Puffin

Sensitivity of Puffin to Displacement

11.10.161 As shown in in paragraphs 11.10.112 to 11.10.114, the sensitivity of puffin to displacement is medium**.**

Characterisation of the Effect

11.10.162 The mortality (using the displacement rate of 60% during both seasons and a mortality rate of 3% to 5% during the breeding and 1% to 3% during the non-breeding season as per NatureScot guidance (NatureScot, 2023a)) resulting from displacement during O&M was calculated for each bio-season and for the combined bio-seasons (Table 11.44) as detailed in Volume 3, Technical Appendix 11.3: Offshore Ornithology Displacement Technical Report.

11.10.163 The displacement estimates are presented in Table 11.44.

Table 11.44: Puffin Bio-Season and Annual Displacement Estimates for the Proposed Development During O&M

Bio-season	Seasonal Abundance (Array Area + 2 km Buffer)	Regional Baseline Population	Number of Individuals Subject to Mortality	Decrease in Survival (percentage point change)
Breeding	377	507,599	7 to 11	0.001 to 0.002
Non-breeding	705	231,957	4 to 13	0.002 to 0.006
Annual	-	507,599	11 to 24	0.002 to 0.005

Magnitude of the Effect

11.10.164 As it was found that the decrease in survival did not exceed the 0.02 percentage point threshold for PVA, as recommended by NatureScot (2023g), no PVAs were required and the magnitude of the effect on the VOR is considered to be negligible.

Significance of the Effect

11.10.165 The magnitude of distributional responses is considered to be negligible, and the sensitivity of the VOR is considered to be medium. Following the matrix approach (Table 11.13), the impact of distributional responses on puffin is therefore considered to be negligible to minor. Given the decrease in survival did not meet the 0.02 percentage point threshold, the significance of the impact is determined to be **Negligible** adverse which is not significant in EIA terms.

Oystercatcher, Lapwing, Curlew, Common Gull and Black-headed Gull

11.10.166 O&M activities for the Export Cable Corridor are equal to or less than those carried out during the construction phase. Therefore, for the purpose of this assessment it is assumed that the level of disturbance is likely to be similar and the potential impact on each species is deemed to be reversible in the short-term as birds are likely to return when activities have been completed.

Summary of Displacement Impacts During O&M

11.10.167 The assessment of displacement impacts for fulmar, gannet, kittiwake, guillemot, razorbill and puffin during the O&M phase showed that the effect is not significant in EIA terms. This was demonstrated either 1) by the decrease in survival rate below 0.02 percentage point change; or 2) by a Proposed Development Alone PVA assessment for a survival rate decrease of 0.02 percentage points or higher. A summary of the significance of disturbance and displacement during the O&M phase is provided in Table 11.45.

Table 11.45: Summary of the Significance of Effect of Displacement During the O&M Phase

Species	Significance of Effect
Fulmar	No significant effect on fulmar arising from displacement during the O&M phase.
Gannet	No significant effect on gannet arising from displacement alone during the O&M phase.

Species	Significance of Effect
Kittiwake	No significant effect on kittiwake arising from displacement alone during the O&M phase.
Guillemot	No significant effect on guillemot arising from displacement during the O&M phase.
Razorbill	No significant effect on razorbill arising from displacement during the O&M phase.
Puffin	No significant effect on puffin arising from displacement during the O&M phase.
Oystercatcher	No significant effect on oystercatcher arising from displacement during the O&M phase.
Lapwing	No significant effect on lapwing arising from displacement during the O&M phase.
Curlew	No significant effect on curlew arising from displacement during the O&M phase.
Common gull	No significant effect on common gull arising from displacement during the O&M phase.
Black-headed gull	No significant effect on black-headed gull arising from displacement during the O&M phase.

Decommissioning Phase

11.10.168 Decommissioning activities for the Proposed Development are equal to or less than those carried out during the construction phase. Therefore, for the purpose of this assessment it is assumed that the level of disturbance is likely to be similar and the potential impact on each species is deemed to be reversible in the short-term as birds are likely to return when activities have been completed.

All Receptors

11.10.169 Overall, it is expected that there would not be a significant effect on any receptor during the decommissioning phase arising from displacement and barrier effects.

IMPACT 3 - DISTURBANCE AND DISPLACEMENT TO BIRDS FROM VESSEL MOVEMENTS

11.10.170 In addition to distributional responses caused by Offshore Infrastructure, further responses can occur due to vessel movements associated with all phases of the Proposed Development. Increased vessel activity is expected to occur throughout the Proposed Developments lifetime, vessels will be required to transport infrastructure during installation or decommissioning, as well as being used to carry out maintenance of these structures during the O&M phase.

11.10.171 As detailed in the MDS (Table 11.9), it is expected that the largest increase in vessel movement will occur during construction and decommissioning phases of the Proposed Development. Vessel activity is expected to be highest within the Array Area where the Wind Turbines will be located. Whereas increased vessel movement along the Export Cable Corridor is likely to occur to a lesser

extent during the installation of the Offshore Export Cables, with lower levels of vessel activity for maintenance occurring during the O&M phase.

11.10.172 Although the exact routes and ports to be used during all phases of the Proposed Development are unknown, the ports presented within this chapter have been chosen due to the proximity to the Proposed Development and knowledge of supply chain and port capabilities. The ports selected are similar to those identified in the assessment of vessel movements within the Addendum to the Report to Inform Appropriate Assessment (RIAA) (Offshore Wind Power Limited, 2024) for the West of Orkney OWF. Therefore, the methodology adopted is consistent with the methodology presented within the Offshore Wind Power Limited (2024).

11.10.173 Individuals impacted by vessel movements are likely to experience short-term displacement and disturbance, with the consequences of these impacts similar to those described in Impact 2 above.

11.10.174 Although the Site Boundary does not overlap with any SPA boundaries, it is expected that vessel routes will have the potential to intersect Moray Firth SPA. It is recommended by NatureScot (2023d) that a range of 15 km should be used to determine whether wintering waterfowl and non-breeding seabirds may be affected. Therefore, further assessment considering vessel movements in the proximity of Moray Firth SPA has been included. An additional assessment has also been undertaken for Ythan Estuary, Sands of Forvie and Meikle Loch SPA and Ramsar Site due to the proximity of vessel movements to the site.

11.10.175 Assessment of the impacts for each Qualifying Feature of Moray Firth SPA and Ythan Estuary, Sands of Forvie and Meikle Loch SPA have been undertaken and presented within the RIAA, Part 3: Special Protection Areas and Ramsar Sites (TWP-BOW-RPS-ENV-RPT-00015).

11.10.176 As the relevant VORs and magnitude of impact are likely to vary by location, disturbance and displacement due to vessel movements has been broken down in three areas:

- Impacts within the Array Area only;
- Impacts within the Export Cable Corridor only; and
- Impacts associated with vessel movements between ports and the Proposed Development.

11.10.177 The relevant VORs for each of the areas are described below and summarised in Table 11.46.

VORs Screened in Due to Impacts from Vessel Movement Within the Array Area

11.10.178 Six VORs have been identified and quantitatively assessed for displacement within the Array Area due to Offshore Infrastructure as discussed in Impact 2 above. Therefore, it is expected these species may be further impacted by vessel activity within the Array Area. These species are:

- fulmar;
- kittiwake;

- gannet;
- guillemot;
- puffin; and
- razorbill.

VORs Screened in Due to Impacts from Vessel Movement Within the Export Cable Corridor

11.10.179 All six species screened in due to impacts from vessels within the Array Area were recorded within intertidal and nearshore surveys and/or DAS surveys. Therefore, the potential impacts of vessel movements along the Export Cable Corridor have also been assessed for all six species.

11.10.180 In addition to these six species, a high number of oystercatcher, lapwing, curlew, common gull and black headed gull were recorded during surveys (Volume 3, Technical Appendix 11.2: Nearshore, Intertidal and Offshore Ornithology Along the Export Cable Corridor Baseline Report). Therefore, these species have been screened in for assessment.

11.10.181 Therefore, the 11 species screened in for assessment due to increased vessel movement within the Export Cable Corridor are:

- fulmar;
- kittiwake;
- gannet;
- guillemot;
- razorbill;
- puffin;
- oystercatcher;
- lapwing;
- curlew;
- common gull; and
- black headed gull.

VORs Screened in Due to Impacts from Vessel Movements Between Ports and the Proposed Development

11.10.182 Although the Proposed Development's boundary does not overlap with any SPA boundaries, it is expected that vessel routes will have the potential to intersect Moray Firth SPA. Although the exact routes and ports to be used during all phases of the Proposed Development are unknown, focus is given to Inverness and Cromarty Firth Green Freeport (a group of developments including Port of Cromarty Firth, Port of Nigg, Port of Inverness, Highland Deephaven, Ardersier Energy Transition Facility and Inverness Campus) and the Port of Aberdeen. Subject to be able to secure capacity for the offshore construction phase, these ports meet the threshold requirements for the construction and marshalling.

Consequently, the following species have been screened in for assessment in accordance with NatureScot guidance (MD-LOT, 2024):

- common eider;
- common scoter;
- goldeneye;
- great northern diver;
- long-tailed duck;
- red-breasted merganser;
- red-throated diver;
- scaup;
- shag;
- Slavonian grebe; and
- velvet scoter.

11.10.183 It is also noted that vessel movements from the Port of Aberdeen have the potential to come within 15 km of Ythan Estuary, Sands of Forvie and Meikle Loch SPA and Ramsar Site. Due to this the following species have been included within the assessment:

- sandwich tern;
- common tern;
- little tern;
- pink footed goose;
- common eider;
- redshank; and
- lapwing.

11.10.184 The assessment of the impacts on the Moray Firth SPA and Ythan Estuary, Sands of Forvie and Meikle Loch SPA and Ramsar Site are presented in the RIAA, Part 3: Special Protection Areas and Ramsar Sites (TWP-BOW-RPS-ENV-RPT-00015).

Table 11.46: Species Sensitivity to Disturbance and Displacement from Increased Vessel Activity in the Proposed Development During All Phases of the Proposed Development

Species	Sensitivity to Vessel Activity[1]	Relevant Area(s) Included Within Assessment
Fulmar	Very Low	Array Area and Export Cable Corridor
Gannet	Low	Array Area and Export Cable Corridor
Kittiwake	Low	Array Area and Export Cable Corridor
Guillemot	Medium	Array Area and Export Cable Corridor
Razorbill	Medium	Array Area and Export Cable Corridor
Puffin	Medium	Array Area and Export Cable Corridor
Oystercatcher	Medium	Export Cable Corridor only
Lapwing	Medium	Export Cable Corridor and Vessel movements between ports and the Proposed Development
Curlew	High	Export Cable Corridor only
Common gull	Low	Export Cable Corridor only
Black-headed gull	Low	Export Cable Corridor only
Common eider	High	Vessel movements between ports and the Proposed Development
Common scoter	High	Vessel movements between ports and the Proposed Development
Goldeneye	High	Vessel movements between ports and the Proposed Development
Great northern diver	High	Vessel movements between ports and the Proposed Development
Long-tailed duck	Medium	Vessel movements between ports and the Proposed Development
Red-breasted merganser	Medium	Vessel movements between ports and the Proposed Development
Red-throated diver	Very high	Vessel movements between ports and the Proposed Development
Scaup	Medium	Vessel movements between ports and the Proposed Development
Shag	High	Vessel movements between ports and the Proposed Development
Slavonian grebe	Medium	Vessel movements between ports and the Proposed Development
Velvet scoter	Medium	Vessel movements between ports and the Proposed Development
Sandwich tern	High	Vessel movements between ports and the Proposed Development
Common tern	Low	Vessel movements between ports and the Proposed Development
Little tern	Low	Vessel movements between ports and the Proposed Development

Species	Sensitivity to Vessel Activity[1]	Relevant Area(s) Included Within Assessment
Pink footed goose	High	Vessel movements between ports and the Proposed Development
Redshank	Low	Vessel movements between ports and the Proposed Development

[1] Sensitivities derived from various sources including Bradbury *et al*. (2014), *Furness et al.* (2013), Garthe and Hüppop (2004), Goodship and Furness (2022), Schweemer *et al*. (2011), Hötker *et al*. (2006) and Wade *et al*. (2016).

Construction Phase

11.10.185 Due to the number of VORs screened into assessment for disturbance and displacement due to vessel movements, VORs have been grouped together by the area impacts in order to reduce repetition.

Impacts from Vessel Movements Within the Array Area

Sensitivity of the VORs

11.10.186 Of the six species screened in for assessment due to increased vessel activity within the Array Area, fulmar were found to have a very low sensitivity, gannet and kittiwake were found to have a low sensitivity and the three auk species (guillemot, razorbill and puffin) were found to have a medium sensitivity to vessel activity based on reviews provided in Wade *et al.* (2016) and *Furness et al.* (2013).

11.10.187 Moreover, as presented in Table 11.7, all species are considered to have a low recoverability except from razorbill which is considered to have a moderate recoverability.

11.10.188 Therefore, it is considered that gannet, kittiwake and fulmar have a low sensitivity, and the three auk species have a medium sensitivity to the impact of disturbance and displacement due to vessel movements.

Characterisation of the Effect

11.10.189 The increase in vessel movements will be the greatest across the Array Area during the construction and decommissioning phases, with a maximum 41 (25 for the Array Area only) vessels and two helicopters on site at any given time (Table 11.9). It is also expected that vessel activity within the Array Area will take place intermittently, with only small areas impacted at a given time.

11.10.190 Although a quantitative assessment has not been carried out, as the effects of increased vessel activity are similar to distributional responses due to Offshore Infrastructure, as birds are expected to be temporarily displaced from the impacted area. Therefore, it can be assumed that individuals within a 2 km buffer of a vessel have the potential to be impacted for the six VORs. This is equivalent to an area of approximately 12.56 km^2 per vessel being impacted at any given time. Using the peak densities recorded within the Array Area plus 2 km buffer derived from DAS (Annex C of Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report) along with the

recommended displacement and mortality rates, the number of birds impacted can be estimated, as shown in Table 11.47.

Table 11.47: Estimated Number of Individuals Impacted by Increased Vessel Activity Within the Array Area at a Given Time, Assuming A Maximum Number of 25 Vessels Within the Array Area

Species	Annual Regional Population	Peak Density Recorded in DAS (birds per km^2)	Estimated Number of Individuals Present Within Impacted Area[1]	Predicted Mortality Estimates[2]	Percentage of Annual Regional Population Impacted
Fulmar	1,128,693	5.16	1,620.24	4.86	0.000
Gannet	841,748	2.65	832.10	8.74	0.001
Kittiwake	627,816	6.09	1,912.26	8.61	0.001
Guillemot	250,506	93.86	29,472.04	442.08	0.176
Razorbill	218,622	13.97	4,386.58	65.80	0.030
Puffin	507,599	2.69	844.66	12.67	0.002

[1] Calculated using an impacted area of 314.00 km^2 (12.56 km^2 x 25)
[2] Calculated using the displacement rate and highest mortality rate for the construction phase presented in Table 11.29.

11.10.191 From Table 11.47, it can be found that each incident of disturbance and displacement due to vessel movement within the Array Area is expected to impact less than 0.1% of the regional population for each species, excluding guillemot, even using the upper range of displacement mortality recommended by NatureScot (2023a) during the construction phase.

11.10.192 However, it should be noted that the methodology used to assess impacts from vessel activity is very precautionary, given the ability of seabirds to avoid vessels (i.e. by flying to another area) and the short period of time an individual is expected to be impacted given vessels will be transiting, thus allowing recovery. The mortality and displacement rates recommended by NatureScot (2023a) are used to assess displacement due to Offshore Infrastructure which will be present for a significantly longer period of time and therefore has the potential to permanently alter the habitat utilisation of individual seabirds. Therefore, the number of mortalities will be substantially lower than those based on these calculations (Table 11.47). Furthermore, the NSVMP to be adopted as part of Embedded Mitigation will also help ensure significant disturbance to seabirds on the water is avoided.

Magnitude of Impact

11.10.193 Due to the short term and small extent of each incidence of disturbance and displacement due to increased vessel movements, it is determined that the magnitude of impact for all VORs within the Array Area is negligible.

Significance of the Effect

11.10.194 The significance of disturbance and displacement due to vessel movement during the construction phase across the Proposed Development is summarised in Table 11.48.

Impacts from Vessel Movement Within the Export Cable Corridor

Sensitivity of the VORs

11.10.195 In total, 11 species were screened in for assessment of disturbance and displacement due to vessel movements within the Export Cable Corridor (Table 11.46).

11.10.196 The sensitivity of the six species (fulmar, gannet, kittiwake, guillemot, razorbill and puffin) screened in for assessment within the Array Area are presented in Table 11.46 and discussed in Paragraphs 11.10.186 to 11.10.188.

11.10.197 The remaining five species assessed were oystercatcher, lapwing, curlew, common gull and black-headed gull.

11.10.198 Within Garthe and Hüppop (2004), it was determined that black-headed gull has a low sensitivity to disturbance by ship and helicopter traffic. A low sensitivity to disturbance was also determined in Bradbury *et al*. (2014) for common gull. In Goodship and Furness (2022), oystercatcher and curlew were determined to have medium and high sensitivity to disturbance respectively. Finally, there was minimal data regarding lapwing disturbance to vessel traffic, however Hötker *et al*. (2006) found that lapwing was disturbed on average 108 m from wind farms and according to Goodship and Furness (2022) this would result in a medium sensitivity.

Characterisation of the Effect

11.10.199 The increase in vessel movements will be the greatest across the Export Cable Corridor during the construction and decommissioning phases, with a maximum 41 (16 for the Export Cable Corridor only) vessels and two helicopters on site at any given time (Table 11.9). Vessel activity associated with the construction of the Export Cable Corridor is expected to show less movement than those associated with the construction of Wind Turbines within the Array Area, with stagnant periods while cables are being laid and short movements between these periods.

11.10.200 Therefore, it can be argued that as activities are only expected to impact birds over a short period of time, with impacts overlapping with only one breeding or non-breeding season for each species, and due to the short-term and small extent of the impacts due to each vessel, that the impact of vessel movements will be less than those experienced within the Array Area.

Magnitude of Impact

11.10.201 Due to the lower levels and nature of the vessel activity associated with construction of the Offshore Export Cables within the Export Cable Corridor, and the short time period for installation, it is determined that the magnitude of impact for all VORs within the Export Cable Corridor is negligible.

Significance of the Effect

11.10.202 The significance of disturbance and displacement due to vessel movement during the construction phase across the Proposed Development is summarised in Table 11.48.

Impacts Due to Vessel Movements Between Ports and the Proposed Development

Sensitivity of the VORs

11.10.203 In total, 17 VORs were screened into assessment due to disturbance and displacement due to vessel movements between ports and the Proposed Development. All 11 VORs that have been screened in are Qualifying Features or named components of the Moray Firth SPA.

11.10.204 Red-throated diver were determined to have a very high sensitivity to vessel movements and great northern diver was determined to have a high sensitivity (Wade *et al.,* 2016). Great northern diver have been found to swim within 200 to 300 m of a passing ferry and are likely to swim (rarely flying) from vessels up to 4 km in distance (Jarrett *et al*., 2018). Whereas red-throated diver has been recorded to have a very high sensitivity to vessels (Wade *et al.,* 2016) with individuals recorded to take flight when within 200 to 300 m of a passing ferry (Jarrett *et al*., 2018). Red-throated diver have also been recorded to fly away from vessels within 1 km away (Schwemmer *et al.,* 2011).

11.10.205 Common eider are expected to have medium to high sensitivity to vessel movements (Goodship and Furness, 2022), with individuals showing a low flushing distance and low levels temporary habitat loss when compared to other seaducks (Schwemmer *et al.,* 2011).

11.10.206 Common scoter are expected to have a high sensitivity to vessel movements, with flushing occurring due to vessels greater than 3 km away (Schweemer *et al.,* 2011). As a precautionary approach, common scoter have been assigned a high sensitivity. Shag was recorded as having a high vulnerability to vessel movements (Wade *et al*., 2016).

11.10.207 Goldeneye is also expected to have a high sensitivity to vessel movements, with a recommended buffer zone of 800 m in the non-breeding season (Goodship and Furness, 2022).

11.10.208 Long-tailed duck, scaup, velvet scoter and Slavonian grebe are all expected to have medium sensitivity to vessel movements (Wade *et al.,* 2016).

11.10.209 Although, red-breasted merganser was not included within Wade *et al.* (2016), it was found that red-breasted merganser are expected to exhibit a medium sensitivity to displacement and it is therefore assumed that the sensitivity to vessels will also be medium.

11.10.210 Sandwich tern, common tern and Little tern are all expected to have low sensitivity to vessel movements (Wade *et al.,* 2016).

11.10.211 Of the species screened in for assessment, both pink footed goose and sandwich tern are expected to have a high sensitivity to disturbance, with a

buffer distance of up to 1,000 m and 200 m recommended for each species respectively (Goodship and Furness, 2022).

11.10.212 Lapwing are considered to have a medium sensitivity as described in Paragraph 11.10.198.

Characterisation of the Effect

Moray Firth SPA

11.10.213 The largest aggregations of waterbirds are expected to occur within marine SPAs. Although the Proposed Development does not directly overlap with any of these SPAs, it is expected that potential ports to be used within all phases of the Proposed Development may lead to vessel movements associated with the Proposed Development intersecting with the boundary of the Moray Firth SPA. Three ports which form part of Inverness and Cromarty Green Freeport are known to be used for the renewables industry: Port of Nigg, Port of Cromarty and Port of Ardersier.

11.10.214 The use of the Port of Nigg, Port of Ardersier and Port of Cromarty during construction activities would result in increased vessel movements within the Moray Firth SPA. The potential routes of vessels from each port and available vessel density data from the National Marine Plan Interactive (NMPi) tool (Marine Scotland, 2026) are shown in Figure 11.3.

11.10.215 Port of Ardersier (Figure 11.3) is located near to Inverness and is currently under development. Once work is finished it is expected to be the largest facility dedicated to the offshore wind industry. The port has been designed to optimise and support offshore wind deployment, meaning the port is expected to be functioning in time for construction of the Proposed Development (Ardersier Port (Scotland) Limited, 2024).

11.10.216 The Port of Cromarty (Figure 11.3) is located within the Cromarty Firth, north-east Scotland. Currently the port is used for various industries such as tourism, oil and gas and renewables. Previously the port has been used an intermediary port for Beatrice, Moray East, Moray West and Kincardine OWFs (Port of Cromarty Firth, 2026).

11.10.217 The Port of Nigg (Figure 11.3) is the largest of the three ports, with a record of supporting other offshore wind developments such as Beatrice, Moray East, Seagreen and Moray West OWFs. Furthermore, the port is promoted as the UK's leading hub for fixed and floating offshore wind logistics, fabrication, and assembly.

11.10.218 Distribution maps for the relevant VORs are presented in the RIAA, Part 3: Special Protection Areas and Ramsar Sites (TWP-BOW-RPS-ENV-RPT-00015), where a SPA-specific assessment has been carried out.

11.10.219 There is potential for a high-density area of common eider off the coast of Balmungle to be impacted by vessels travelling from the Port of Ardersier. However, common eider are typically found in shallow waters during the non-breeding season, suggesting that individuals are unlikely to come within a close enough proximity of vessels to experience disturbance. Goodship and Furness

(2022) recommended a 500 m buffer zone during the non-breeding season to protect roosting and foraging birds from watercraft in nearshore waters.

11.10.220 There is potential for vessels associated with the construction of the Proposed Development to travel through areas with moderate densities of divers recorded throughout the Moray Firth. However, other studies have shown that red-throated diver are typically only present in small numbers within shipping lanes (Schwemmer et al., 2011). Thus, as vessels associated with the Proposed Development will only use pre-existing vessel routes, it is expected the impact to red-throated diver will be reduced.

11.10.221 Although vessels may cause disturbance to areas with high densities of common eider and moderate densities of divers, vessels are only expected to impact a given area for a short period of time and the impacts are reversible.

11.10.222 It is not expected that vessel movements associated with the construction phase of the Proposed Development will interact with areas of low density of common scoter, shag, goldeneye, long-tailed duck, red breasted merganser, scaup, Slavonian grebe and velvet scoter.

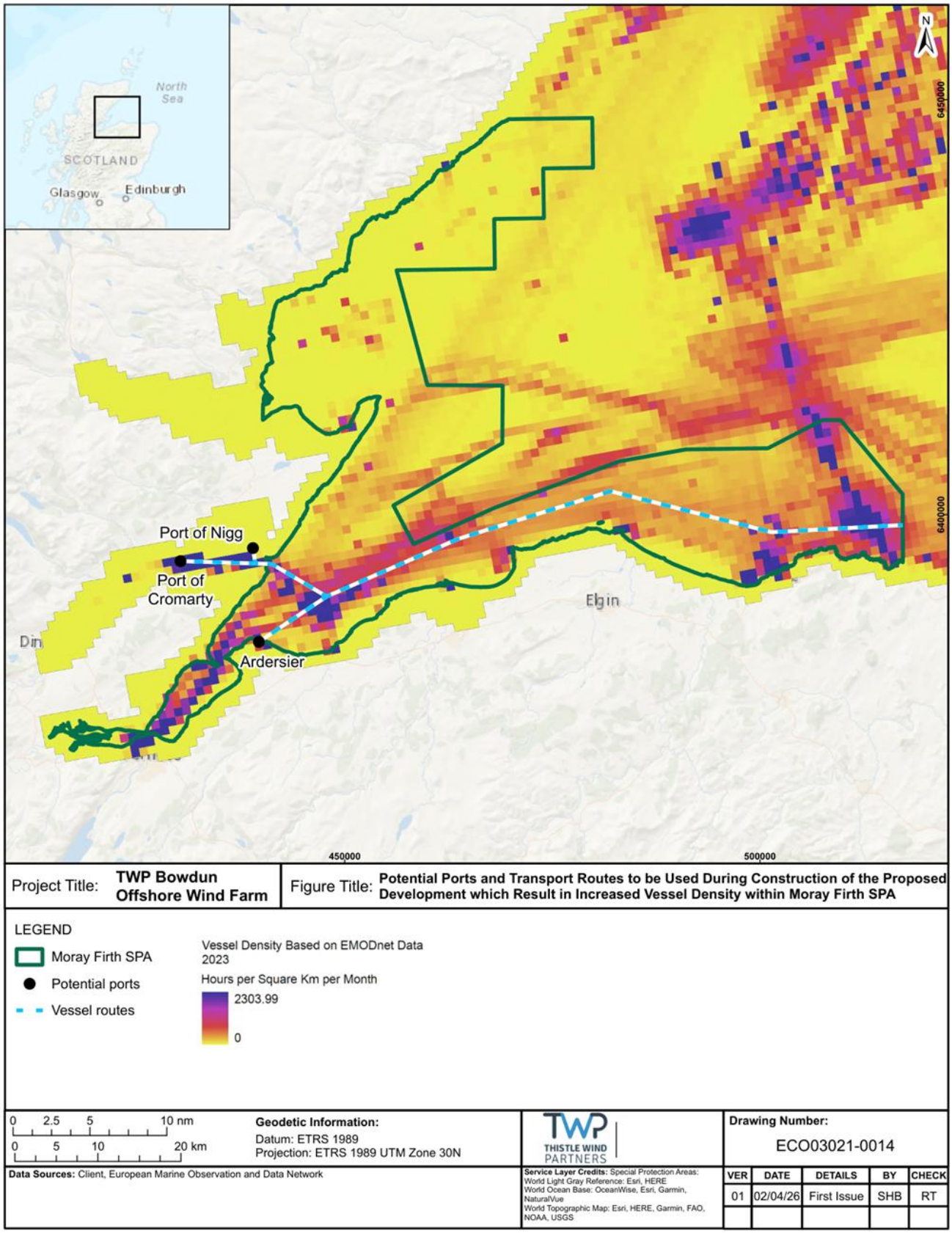

Figure 11.3: Potential Ports and Transport Routes to be Used During Construction of the Proposed Development Which Result in Increase Vessel Density Within Moray Firth SPA.

Ythan Estuary, Sands of Forvie and Meikle Loch SPA and Ramsar Site

11.10.223 Impacts to species within Ythan Estuary, Sands of Forvie and Meikle Loch SPA and Ramsar Site are expected to be similar to those experienced due to distributional responses (see Impact 2). However, it is expected that the impacts from vessel movements will be lower than those experienced in sites for which vessel movements may intersect sites (e.g. Moray Firth SPA). Given the relatively small buffers recommended for impacts, it is expected that individuals are unlikely to have a high probability of interacting and therefore being impacted by vessels associated with the Proposed Development, particularly as vessels are not likely to intersect the SPA boundary where the highest numbers of individuals will be located.

Magnitude of Impact

11.10.224 Due to the nature of the vessel activity associated with travelling from any of the potential ports to the Proposed Development, it is determined that the magnitude of impact to all VORs is negligible.

Significance of the Effect

11.10.225 The significance of disturbance and displacement due to vessel movement during the construction phase between potential ports and the Proposed Development is summarised in Table 11.48.

Summary of the Significance of Disturbance and Displacement due to Vessel Movement During Construction

11.10.226 A summary of the impacts of vessel movements to all VORS assessed are presented in Table 11.48. In cases where a VOR is affected by vessel movements in more than one area, e.g. the Array Area and Export Cable Corridor, the highest magnitude of impact has been selected to determine the significance.

11.10.227 If the significance was determined to be negligible or minor using the matrix approach, as shown in Table 11.13, it has been concluded that the significance of the effect will be **Negligible** adverse. This is due to the short-term and reversible nature of the impact which is expected to only effect a small number of individuals for the relevant VOR at any given time.

Table 11.48: Summary of the Significance of Effect of Disturbance due to Vessel Movements During the Construction Phase

Species	Sensitivity to Vessel Movements	Magnitude of impact			Final Significance
		Array Area	Export Cable Corridor	Movements Between Ports and the Proposed Development	
Fulmar	Very Low	Negligible	Negligible	-	Negligible
Gannet	Low	Negligible	Negligible	-	Negligible
Kittiwake	Low	Negligible	Negligible	-	Negligible
Guillemot	Medium	Negligible	Negligible	-	Negligible
Razorbill	Medium	Negligible	Negligible	-	Negligible

Species	Sensitivity to Vessel Movements	Magnitude of impact			Final Significance
		Array Area	Export Cable Corridor	Movements Between Ports and the Proposed Development	
Puffin	Medium	Negligible	Negligible	-	Negligible
Oystercatcher	Medium	-	Negligible	-	Negligible
Lapwing	Medium	-	Negligible	Negligible	Negligible
Curlew	High	-	Negligible	-	Minor
Common gull	Low	-	Negligible	-	Negligible
Black-headed gull	Low	-	Negligible	-	Negligible
Common eider	High	-	-	Negligible	Minor
Common scoter	High	-	-	Negligible	Minor
Goldeneye	High	-	-	Negligible	Minor
Great northern diver	High	-	-	Negligible	Minor
Long-tailed duck	Medium	-	-	Negligible	Negligible
Red-breasted merganser	Medium	-	-	Negligible	Negligible
Red-throated diver	Very high	-	-	Negligible	Minor
Scaup	Medium	-	-	Negligible	Negligible
Shag	High	-	-	Negligible	Minor
Slavonian grebe	Medium	-	-	Negligible	Negligible
Velvet scoter	Medium	-	-	Negligible	Negligible
Sandwich tern	High	-	-	Negligible	Minor
Common tern	Low	-	-	Negligible	Negligible
Little tern	Low	-	-	Negligible	Negligible
Pink footed goose	High	-	-	Negligible	Minor
Redshank	Low	-	-	Negligible	Negligible

O&M Phase

All Receptors

11.10.228 As detailed in the MDS (Table 11.9), the maximum number of vessels associated with the Proposed Development will decrease from 41 during the construction phase to 36 during the O&M phase. Due to this, the magnitude of disturbance is expected to be less than or equal to those experienced during the construction phase (Table 11.9). Therefore, for each VOR, the effect of disturbance and displacement due to vessel activity is not considered to be significant in EIA terms.

Decommissioning Phase

All Receptors

11.10.229 As detailed in the MDS (Table 11.9), as the decommissioning phase involves the removal of all Offshore Infrastructure it is expected that decommissioning is largely a reversal of construction. Overall, the magnitude of impact of vessel activity in the decommissioning phase is predicted to be less than or equal to the construction phase. Therefore, the significance of disturbance and displacement due to vessel activity in the decommissioning phase is not considered to be significant in EIA terms.

IMPACT 4 - DISTURBANCE TO PREY SPECIES AND THEIR HABITATS

11.10.230 Indirect impacts on seabirds may arise from changes in the distribution, availability, or abundance of prey due to the presence of Offshore Infrastructure in the Array Area during O&M, as well as from construction and decommissioning activities that disturb the seabed (leading to increased SSCs) and creates heightened subsea noise levels along the Export Cable Corridor and the Array Area. A reduction or disruption in prey availability could result in seabirds being displaced from their foraging areas or in a decreased energy intake, which may negatively impact their survival rates or reproductive success in the short term. These reductions in prey availability may be compounded due to rising sea temperatures and increase storminess due to climate change. Therefore, it should be noted that the magnitude of effects and sensitivity of VORs to these effects may increase with time due to the impact of climate change.

11.10.231 During the O&M phase, subsea noise levels are expected to be significantly lower, thereby greatly reducing the potential for negative effects on prey species. Likewise, seabed disturbance and the associated increases in SSCs will be considerably diminished during the O&M phase, primarily occurring only during cable or foundation maintenance activities. However, as requested by NatureScot for the Ossian OWF (SSE Renewables, 2024), changes in prey availability have been assessed for all Proposed Development phases.

Construction Phase

All Receptors

Sensitivity of the VORs

11.10.232 Seabird species react to changes in prey abundance and distribution differently depending on foraging range, prey choice and degree of flexibility in their foraging location and prey species. All of the VORs considered in this assessment have a moderate degree of flexibility in their habitat preferences and prey items (Del Hoyo *et al.*, 1992).

Indeed, gannet prey on a wide variety of prey species including sandeels, mature mackerel and herring (Hamer *et al.*, 2000) and have a large sized foraging range (Woodward *et al.*, 2019). Similarly, both fulmar and Manx shearwater have a large foraging range, in addition to feeding on a vast range of fish species like sandeels, crustaceans (mainly decapods), cephalopods such as squid (Phillips *et al.*, 1999) as well as sprat, whiting, herring, rockling and sandeel (Siddiqi-

Davies *et al.*, 2025) respectively. Due to their large sized foraging range and diverse prey, these species are therefore considered to have low sensitivity to disturbance to prey species and their habitats.

11.10.233 Kittiwake are surface feeders that rely on small shoaling species, namely lesser sandeel during the summer (Furness and Tasker, 2000) and have a moderate sized foraging range (Woodward *et al.*, 2019). Guillemot dive up to 180 m to catch a wide variety of prey, including Clupeidae, Gadidae and sandeels (Ouwehand *et al.*, 2004), with a moderate sized foraging range (Woodward *et al.*, 2019). Puffin also have a moderately sized foraging range, however their prey species mainly consist of Ammodytidae and Clupeidae fish only (Fayet *et al.*, 2021). Similarly, razorbill and European storm petrel have a moderately sized foraging range with a narrow prey spectrum, being mostly restricted to sprats or small herring (Ouwehand *et al.*, 2004) or krill and microzooplankton respectively (Albores-Barajas *et al.*, 2011).

11.10.234 Common gull, black-headed gull, great black-backed gull, and herring gull have a generalist diet, mainly feeding on fish and crustaceans (Steenweg *et al.*, 2011; Kubetzi *et al.*, 1999), the latter two also feed on other seabirds, small mammals and anthropogenic waste (Westerberg *et al.*, 2019), while also having small sized foraging ranges. Arctic tern also have a small sized foraging range and mostly feed on sandeels, however they do also feed on high energy fish such as sprat, herring and Gadidae (Green, 2017). Similarly, oystercatcher can vary between a generalist or specialist diet, mainly concentrated on bivalves, (Van De Pol *et al.,* 2010), lapwing feed on a wide range of soil, surface and aquatic invertebrates (Ausden *et al.*, 2003) and curlew feed on earthworms (Navedo *et al.*, 2020) as well as having a small foraging range.

11.10.235 Therefore, due to their low to moderately sized foraging range and/or narrower prey spectrum, the other VORs discussed are considered to have medium sensitivity to disturbance to prey species and their habitats.

Characterisation of the Effect

11.10.236 The assessment set out in Volume 2, Chapter 7: Physical Processes highlights potential changes to pathways occurring during the construction phase including potential changes to SSCs, bed levels and sediment type, which is further discussed below.

11.10.237 A number of potential impacts on benthic subtidal ecology (including benthic invertebrate prey) have been analysed in Volume 2, Chapter 8: Benthic Ecology, including increased risk of introduction and spread of INNS. The assessment identified an effect of minor adverse significance, which is not significance in EIA terms.

11.10.238 Potential impacts to fish and shellfish prey during construction were analysed in Volume 2, Chapter 9: Fish and Shellfish Ecology, including subsea noise impacting fish and shellfish receptors. The assessment identified an effect of minor to moderate adverse significance. A likely significant effect (moderate adverse) was concluded for herring due to piling, therefore appropriate Additional Mitigation measures will be discussed and agreed with NatureScot and other stakeholders prior to the commencement of piling and will be

included in the Piling Strategy. It is expected that the measures secured within the Piling Strategy will reduce the significance of this impact to minor adverse, which is not significant in EIA terms.

11.10.239 Further potential impacts presented in both Volume 2, Chapter 8: Benthic Ecology and Volume 2, Chapter 9: Fish and Shellfish Ecology are expected to be of minor adverse significance. These include temporary and long-term habitat loss, introduction of artificial habitat and subsequent colonisation of hard substrate and increased SSCs and associated deposition.

Magnitude of the Effect

11.10.240 Construction activities will be restricted temporally and spatially, affecting only a small area of the site at any one time. The impacts associated with construction will be confined to the construction period only, and once this phase concludes adverse impacts will cease and any changes to prey species are likely to be reverted. The impact on ornithological receptors is predicted to be of local spatial extent, medium duration, intermittent and reversible. The magnitude is therefore considered to be negligible.

Significance of the Effect

11.10.241 For species with a medium sensitivity as the magnitude of the impact is negligible, it can be said that the significance of the impact is Negligible to Minor. As these species are more limited in their ability to find new foraging areas, due to their limited foraging ranges, it has been determined that the significance of the impact is **Minor** adverse, which is not significant in EIA terms.

11.10.242 For species with a low sensitivity as the magnitude of the impact is negligible, it can be said that the significance of the impact is Negligible to Minor. As these species are not as limited in their ability to find new foraging areas, due to their larger foraging ranges, it has been determined that the significance of the impact is **Negligible** adverse, which is not significant in EIA terms.

11.10.243 A summary of the sensitivity, magnitude and significance of vessel movements for each species is given in Table 11.49.

Table 11.49: Summary of Conclusions of Significance of Effects due to Disturbance to Prey Species and Their Habitats During the Construction Phase

Species	Sensitivity to Effect	Magnitude of Effect	Significance of Effect
Fulmar	Low	Negligible	Negligible
Gannet	Low	Negligible	Negligible
Kittiwake	Medium	Negligible	Minor
Great black-backed gull	Medium	Negligible	Minor
Herring gull	Medium	Negligible	Minor
Arctic tern	Medium	Negligible	Minor
Guillemot	Medium	Negligible	Minor
Razorbill	Medium	Negligible	Minor
Puffin	Medium	Negligible	Minor

Species	Sensitivity to Effect	Magnitude of Effect	Significance of Effect
Manx shearwater	Low	Negligible	Negligible
European storm petrel	Medium	Negligible	Minor
Oystercatcher	Medium	Negligible	Minor
Lapwing	Medium	Negligible	Minor
Curlew	Medium	Negligible	Minor
Common gull	Medium	Negligible	Minor
Black-headed gull	Medium	Negligible	Minor

O&M Phase

All Receptors

Sensitivity of the VORs

11.10.244 As discussed from Paragraph 11.10.232 to 11.10.235, all of the VORs considered in this assessment have a moderate degree of flexibility in their habitat preferences and prey items (Del Hoyo *et al.*, 1992), with their sensitivity to disturbance to prey species and their habitats ranging from low to medium.

Characterisation of the Effect

11.10.245 The assessment set out in Volume 2, Chapter 7: Physical Processes highlights potential changes to pathways occurring during the O&M phase including potential changes to SSCs, bed levels and sediment type, potential changes to the tidal regime, potential changes to the wave regime, potential changes to the sediment transport regime, and potential changes to the stratification and frontal systems. The potential changes to SSCs, bed levels and sediment type is further discussed below, and all other aforementioned potential changes will not be measurably affected by the Proposed Development.

11.10.246 A number of potential impacts occurring during O&M on benthic subtidal ecology (including benthic invertebrate prey) have been analysed in Volume 2, Chapter 8: Benthic Ecology, including increased risk of introduction and spread of INNS and changes in processes. The assessment identified an effect of negligible to minor adverse significance, which is not significance in EIA terms.

11.10.247 Potential impacts to fish and shellfish prey during O&M were analysed in Volume 2, Chapter 9: Fish and Shellfish Ecology, including subsea noise impacting fish and shellfish receptors. The assessment identified an effect of minor adverse significance, which is not significant in EIA terms, for all species and impacts during the O&M phase of the Proposed Development.

11.10.248 Further potential impacts the during O&M phase presented in both Volume 2, Chapter 8: Benthic Ecology and Volume 2, Chapter 9: Fish and Shellfish Ecology are expected to be of minor adverse significance. These include temporary and long-term habitat loss, introduction of artificial habitat and subsequent colonisation of hard substrate, increased SSCs and associated deposition and impacts to benthic, fish and shellfish ecology due to EMF.

Magnitude of the Effect

11.10.249 As O&M works will be spatially and temporally restricted, covering only a small portion of the Proposed Development at any given time and the assessments identified effects of negligible to minor significance. The magnitude is therefore considered to be negligible.

Significance of the Effect

11.10.250 Given the magnitude of impact is negligible, and the low to medium sensitivity for the species assessed, the significance of the effect for each VOR are the same as for the construction phase, as presented in Table 11.49.

Decommissioning Phase

All Receptors

11.10.251 The MDS for the decommissioning phase is to be less than the construction phase (Table 11.9). Decommissioning is largely a reversal of construction, as such the environmental impact of decommissioning will be the same if not lower than construction, resulting in a precautionary assessment.

11.10.252 A further potential impact to benthic ecology (including benthic invertebrate prey) during the decommissioning phase only has been analysed in Volume 2, Chapter 8: Benthic Ecology, pertaining to the removal of hard substrates. The assessment identified an effect of minor adverse significance, which is not significant in EIA terms.

11.10.253 Therefore, the impacts of disturbance to prey species and their habitats would be equal to or less than these impacts during the construction phase. Consequently, as was concluded in the construction phase, disturbance to prey species and their habitats in the decommissioning phase is not significant in EIA terms.

IMPACT 5 - TEMPORARY HABITAT LOSS AND/OR HABITAT DISTURBANCE

11.10.254 There is a possibility of temporary direct loss of benthic habitat due to activities associated with the construction and decommissioning phases, such as the installation and removal of IACs, Interconnector Cables, and Offshore Export Cables, seabed preparation, piling, and/or drilling. The loss of habitat that these activities entail could impact the foraging efficiency of diving birds. The construction phase is anticipated to last up to five years, with varying activities and locations throughout this period.

11.10.255 In addition to direct habitat loss, temporary disturbances resulting from construction and decommissioning activities of an OWF may displace seabirds from the affected marine areas. In the context of OWF development, displacement is defined as a decrease in the number of seabirds present within or immediately adjacent to the wind farm (Furness *et al.*, 2013).

11.10.256 Displacement can be viewed as a form of indirect habitat loss, as it prevents birds from utilising the habitat in the areas from which they have been displaced. Consequently, the impacts of both direct habitat loss and disturbance have been evaluated together.

Construction Phase

All Receptors

Sensitivity of the VORs

11.10.257 Kittiwake are considered have a low vulnerability to other sources of disturbance such as vessel and helicopter traffic and their recoverability was determined to be low (Table 11.7). Therefore, the sensitivity of this receptor to temporary habitat loss and/or disturbance is high.

11.10.258 Guillemot are considered to have a moderate vulnerability to various sources of disturbance, including vessel and helicopter traffic (Wade *et al.*, 2016). While studies indicate that guillemot react negatively to vessel traffic (Rojek *et al.*, 2007), their behavioural responses to underwater and airborne sounds generated by construction activities remain unknown. Although guillemot are likely to respond to visual stimuli during the construction phase, the resulting disturbance and displacement effects are expected to be short-term, and guillemot have the capacity to return to their baseline abundance and distribution after construction concludes. The recoverability of guillemot was determined to be low (Table 11.7). Therefore, the sensitivity of the guillemot to temporary habitat loss and/or disturbance is medium.

11.10.259 Razorbill are considered to have a moderate vulnerability to various sources of disturbance, including vessel and helicopter traffic (Wade *et al.*, 2016). While razorbill are likely to respond to visual stimuli during the construction phase, the impacts of disturbance and displacement are expected to be short-term, and razorbills have the capacity to return to baseline conditions after construction. The recoverability of razorbill was determined to be moderate (Table 11.7). Therefore, the sensitivity of the razorbill to temporary habitat loss and/or disturbance is high.

11.10.260 Puffin are considered to have moderate vulnerability to various sources of disturbance, including vessel and helicopter traffic (Wade *et al.*, 2016). While behavioural responses to underwater and airborne sounds resulting from construction activities are not well understood, data indicate that puffin possess sensitive in-air hearing (Mooney *et al.*, 2019). Although puffin are likely to respond to visual stimuli during the construction phase, the impacts of disturbance and displacement are expected to be short-term, and puffin have the capacity to return to their baseline abundance and distribution after construction (MacArthur Green, 2023). The recoverability of puffin was determined to be low (Table 11.7). Therefore, the sensitivity of puffin to temporary habitat loss and/or disturbance is high.

11.10.261 Fulmar are considered to have a very low vulnerability to other sources of disturbance such as vessel and helicopter traffic (Wade *et al.*, 2016). The recoverability of fulmar was determined to be low (Table 11.7). Therefore, the sensitivity of the fulmar to temporary habitat loss and/or disturbance is low.

11.10.262 Gannet are considered to have a very low vulnerability to other sources of disturbance such as vessel and helicopter traffic (Wade *et al.*, 2016), and so gannet are considered to be of very low vulnerability. The recoverability of

gannet was determined to be low (Table 11.7). Therefore, the sensitivity of the gannet to temporary habitat loss and/or disturbance is low.

11.10.263 Manx shearwater are considered to have very low vulnerability to other sources of disturbance such as vessels and helicopter traffic (Wade *et al.*, 2016). The recoverability of Manx shearwater was determined to be medium (Table 11.7). Therefore, the sensitivity of the Manx shearwater to temporary habitat loss and/or disturbance is low.

11.10.264 European storm petrel are considered to have a low vulnerability to other sources of disturbance such as vessels and helicopter traffic (Wade *et al.*, 2016). The recoverability of European storm petrel was determined to be medium (Table 11.7). Therefore, the sensitivity of the European storm petrel to temporary habitat loss and/or disturbance is low.

11.10.265 Oystercatcher are considered to have a low vulnerability to other sources of disturbance such as vessels and helicopter traffic and their recoverability was determined to be medium (Table 11.7). Therefore, the sensitivity of the oystercatcher to temporary habitat loss and/or disturbance is low.

11.10.266 Lapwing, curlew and black-headed gull are considered have a high vulnerability to other sources of disturbance such as vessel and helicopter traffic and their recoverability was determined to be low (Table 11.7). Therefore, the sensitivity of these receptors to temporary habitat loss and/or disturbance is high.

11.10.267 Common gull are considered to have a moderate vulnerability to other sources of disturbance such as vessels and helicopter traffic and their recoverability was determined to be low (Table 11.7). Therefore, the sensitivity of the common gull to temporary habitat loss and/or disturbance is medium.

Characterisation of the Effect

11.10.268 Disturbance and temporary habitat loss (including instances where habitat temporarily becomes unsuitable because of disturbance) are anticipated to occur intermittently during the construction phase.

11.10.269 The loss of habitat may lead to displaced birds relocating to areas already inhabited by other birds, resulting in increased intra- or inter-specific competition due to a higher density of individuals competing for the same resources. Alternatively, displaced birds might be compelled to move to lower-quality areas (e.g. regions with reduced prey availability) or travel greater distances to find suitable habitats. This could negatively affect their demographic fitness, including survival rates and breeding productivity, and may also impact other bird populations in the areas to which the displaced birds relocate by intensifying competition for resources.

11.10.270 The MDS (Table 11.9) gives the scenario that would lead to the greatest amount of temporary habitat loss and disturbance during the construction and decommissioning phases. The amount of direct habitat loss is small, with a maximum of 6.66% of the area of the Site Boundary expected to be impacted.

11.10.271 In addition, for all species other than herring, no significant adverse effects are expected on fish, shellfish or benthic invertebrate populations as a result of construction or decommissioning activities (see Volume 2, Chapter 8: Benthic

Ecology and Volume 2, Chapter 9: Fish and Shellfish Ecology). Herring were found to have a moderate adverse effect to piling noise; however this is reduced to a minor adverse effect following the implementation of Additional Mitigation. Therefore, it is expected that disturbance and subsequent displacement of prey is not significant and the indirect impacts to seabirds will be limited.

11.10.272 The assessment is based on a qualitative approach, considering the magnitude of impact and the sensitivity of the receptor. The species considered for temporary habitat and temporary disturbance during construction and decommissioning are kittiwake, guillemot, razorbill, puffin, fulmar, gannet, Manx shearwater, European storm petrel, oystercatcher, lapwing, curlew, common gull and black-headed gull. All other species were excluded on the basis there is no potential for impact as a result of temporary habitat loss and disturbance (Volume 3, Technical Appendix 11.3: Offshore Ornithology Displacement Technical Report). Additionally, there was one individual for both red-throated diver and black throated diver recorded at the Landfall area, with ten and 32 red-throated diver recorded in the DAS Area and Extended DAS Area respectively in addition to one great-norther diver recorded in each DAS area, and one unidentified diver recorded in the DAS Area only (see Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report). Due to the small number of individuals recorded, they are unlikely to be impacted by displacement as a result of construction activities.

11.10.273 Few studies have directly considered displacement rates during the construction phase of an OWF. Most studies have compared pre-construction to post-construction. It is expected that the amount of displacement during the construction and decommissioning phases of the Proposed Development would be less than that during the O&M phase due to there being a smaller footprint whilst the Proposed Development is being constructed.

Magnitude of the Effect

11.10.274 The impact is predicted to be of local spatial extent, intermittent and medium-term duration (although only a small proportion of the total area will be affected at any one time, with individual elements of construction having much shorter durations) and will affect any birds in the vicinity of these activities directly. The construction disturbance and temporary loss of habitat impacts will also be of high reversibility. The magnitude is therefore, considered to be negligible for all species being considered for disturbance and temporary loss of habitat impacts (kittiwake, guillemot, razorbill, puffin, fulmar, gannet, Manx shearwater, European storm petrel, oystercatcher, lapwing, curlew, common gull and black-headed gull).

Significance of the Effect

11.10.275 The significance of temporary habitat loss and/or habitat disturbance during the construction phase across the Proposed Development is summarised in Table 11.50.

11.10.276 The significance was determined to be negligible or minor using the matrix approach, as shown in Table 11.13. Due to the short-term and reversible nature of the impact which is expected to only effect a small number of individuals for

the relevant VOR during construction and decommissioning only, it has been concluded that the significance of the effect will be **Negligible** adverse, which is not significant in EIA terms.

Table 11.50: Summary of the Significance of Habitat Loss and/or Habitat Disturbance During the Construction Phase

Species	Sensitivity to Effect	Magnitude of Effect	Final significance
Kittiwake	High	Negligible	Minor, not significant in EIA terms
Guillemot	Medium		Negligible, not significant in EIA terms
Razorbill	High		Minor, not significant in EIA terms
Puffin	High		Minor, not significant in EIA terms
Fulmar	Low		Negligible, not significant in EIA terms
Gannet	Low		Negligible, not significant in EIA terms
Manx shearwater	Low		Negligible, not significant in EIA terms
European storm petrel	Low		Negligible, not significant in EIA terms
Oystercatcher	Low		Negligible, not significant in EIA terms
Lapwing	High		Minor, not significant in EIA terms
Curlew	High		Minor, not significant in EIA terms
Common gull	Medium		Negligible, not significant in EIA terms
Black-headed gull	High		Minor, not significant in EIA terms

Decommissioning phase

All receptors

11.10.277 MDS for the decommissioning phase is assumed to be equal or less than the construction phase (Table 11.9). As such, the assessment of the impacts is the same and is not repeated here. Therefore, as concluded in the construction phase, the impact of temporary habitat loss and disturbance in the decommissioning phase ranges from **Negligible to Minor** adverse significance, which is not significant in EIA terms.

IMPACT 6 - ATTRACTION TO LIGHT

11.10.278 Artificial light from aviation and navigation lighting from the Proposed Development has the potential to attract or repel sensitive marine bird species and has been scoped into the assessment. As advised by NatureScot (MD-LOT, 2024) Manx shearwater and European storm petrel have been considered for the impact of artificial light from the Proposed Development.

11.10.279 In accordance with the MDS, the magnitude of the potential impact of attracting birds to the artificial light from the Proposed Development is assumed to be the highest during the O&M phase, with the potential impacts of construction and decommissioning phases being the same if not lower (see Table 11.9). Therefore, only the impacts from the O&M are presented in the assessment below.

VORs Screened in Due to Impacts Within the Proposed Development

11.10.280 During the 24-month baseline DAS, Manx shearwater and European storm petrel were recorded in very low numbers. Sixteen Manx shearwater were recorded across eight months in the raw baseline data, with a peak of four individuals in April 2022 resulting in a low abundance. Forty-three European storm petrels were recorded across four months in the raw baseline data, with a peak of 18 individuals in September 2023 resulting in a low abundance.

O&M Phase

Manx shearwater and European storm petrel

Sensitivity of the VORs

11.10.281 Manx shearwater and European storm petrel score moderate and high respectively in proportion of nocturnal flight activity (Bradbury *et al.*, 2014; Wade *et al.*, 2016) and have shown to be attracted to light (Gineste *et al.*, 2017; Miles *et al.*, 2010; Rodriguez *et al.*, 2015a; Medina-Franco *et al.*, 2025; Wilhelm *et al.*, 2021). However, it is considered that these birds are less attracted to offshore windfarms lighting compared to onshore sources of light (Kerlinger *et al.*, 2010). Consequently, these two species are deemed to have medium sensitivity for attraction to light arising from artificial lighting.

Characterisation of Impact on the VOR

11.10.282 Attraction to light could include long distance light attraction and light-induced disorientation (Deakin *et al.,* 2022). Therefore, for the purpose of assessing the impact of the Proposed Development, we need to consider the relationship between the illumination of OWFs and how this is associated to (i) attracting seabirds to the area, and (ii) modifying seabird behaviour in close proximity (Deakin *et al.*, 2022). Furness (2018) investigated the different nocturnal impacts of birds to artificial light which include the positive phototaxis of seabirds (birds attracted to light sources) with consideration for the potential increases in disorientation and/or collision with Wind Turbines.

11.10.283 Manx shearwater and European storm petrel have been identified as at risk to artificial light due to multiple demonstrations of light attraction resulting in the grounding of shearwater and petrel species (Gineste *et al.*, 2017; Miles *et al.*, 2010; Rodriguez *et al.*, 2015a; Medina-Franco *et al.*, 2025; Wilhelm *et al.*, 2021).

Almost all recorded grounding events occur predominantly in fledglings (Miles *et al.*, 2010; Rodriguez *et al.*, 2015a; Medina-Franco *et al.*, 2025; Wilhelm *et al.*, 2021), although age is not always recorded in grounding events (Medina-Franco *et al.*, 2025), and adult grounding events have occurred especially in poor weather conditions (Guilford *et al.*, 2018). The most likely cause of these grounding events is the interference of artificial light with the nighttime navigation of these species (Rodríguez *et al.,* 2017). Both Manx shearwater and European storm petrel nest in burrows, and the chicks fledge independently at night for predation avoidance. When these species fledge, they would naturally navigate out to sea following the higher levels of natural light out to sea as a navigational cue. Consequently, artificial light sources that can be seen from the breeding grounds can result in large quantities of fledgling grounding events. Furthermore, research suggests that differences in response to artificial light between adults and fledglings may be due to the eyesight of fledged individuals not being fully developed (Atchoi *et al.*, 2020; Mitkus *et al.,* 2018). This further suggests that fledglings are the main concern when considering the impact of artificial light from the Proposed Development.

11.10.284 The probability of a grounding event is impacted by several environmental factors that influence light levels such as changes in natural light levels dependent on the moon cycle (Miles *et al.*, 2010; Rodriguez *et al.*, 2014; Syposz *et al.*, 2018; Wilhelm *et al.*, 2021), and weather conditions such as fog (Warham, 1996; Rich and Longcore, 2013; Guilford *et al.*, 2018). Higher numbers of grounding events occur during a moonless night, when natural light levels are at their lowest (Miles *et al.*, 2010; Syposz *et al.*, 2018). Higher numbers of grounding events also occur during adverse weather conditions which can obscure natural light such as fog (Warham, 1996; Guilford *et al.*, 2018). Weather conditions can also influence grounding events indirectly, without altering nighttime light conditions. Syposz *et al.* (2018) and Rodríguez *et al.* (2014) found a relationship between wind direction and speed, with stronger winds coming from the direction of the breeding colony increasing the likelihood of grounding events. This suggests that fledglings being blown off-course towards artificial light sources increases the chances of a grounding event by bringing individuals closer to the light source.

11.10.285 Rodriguez *et al.* (2015b) demonstrated that flight distance between the breeding colony and artificial light source impacts grounding probability on the maiden flight of fledgling Cory shearwaters *Calonectris diomedea*. Consequently, as fledglings are individuals primarily at risk from artificial light, the distance between breeding colonies and the Proposed Development is critical in the assessment of the potential impact of artificial light on Manx shearwater and European storm petrel. The majority of SPA and non-SPA colonies of Manx shearwater occur on the west coast, with the closest non-marine SPA, Rum SPA, approximately 535 km away from the Proposed Development. The closest European storm petrel breeding colony is within the Auskerry SPA, 250.6 km away from the Proposed Development. As the majority of knowledge on grounding from artificial light comes from observational data, there is a lack information on the breeding colony of origin of grounded fledglings, resulting in an important information gap on the critical distance between breeding colony

and artificial light source in relation to light intensity that results in grounding events. However, using tracking data from the maiden flight of Cory shearwaters, Rodríguez *et al.* (2015b) demonstrated that grounding events only occurred when the distance between the artificial light source and breeding colony was under 16 km from the breeding grounds, which was reduced to 9 km for a maiden flight. In relation to the Proposed Development, the artificial light sources reported in Rodriguez *et al.* (2015) were onshore lit areas with steady white light orders of magnitude higher than the Proposed Development. Consequently, the intensity of the light (onshore lit area orders of magnitude brighter than the Proposed Development) and type of light (steady white light instead of the flashing red light of the Proposed Development) reported in Rodríguez *et al.* (2015b), means that a critical distance of under 9 km to 16 km is a substantial overestimation in relation to the Proposed Development. This is further supported by Rodrigues *et al.* (2012) which demonstrated that the largest mean distance between grounding event and colony was under 4 km. Therefore, it can be concluded that there is unlikely to be an impact pathway between the artificial light of the Proposed Development, and grounding events in Manx shearwater and European storm petrel fledglings in their maiden flight from the breeding grounds.

11.10.286 The majority of grounding events occur with fledging individuals attracted to the lighting of onshore artificial lighting of towns. There is little evidence of the negative impact of artificial light from OWF on Manx shearwater or European storm petrel, but Kerlinger *et al.* (2010) did not find a difference in overall bird collision mortality rates when comparing lit and unlit wind turbines in the same OWF. The low impact of artificial lighting on OWFs is likely due to the intensity and type lighting used on OWFs. The lighting on OWFs is orders of magnitude lower than onshore lighting and oil and gas platforms (Furness, 2018). Furthermore, the use of flashing red lights used for aviation lighting on the Proposed Development is reportedly the best type of lighting to reduce potential bird impacts, as both flashing lights and red-light show a strong reduction in the attraction of birds (Deakin *et al.,* 2022; Gehring *et al.,* 2009, Syposz *et al.*, 2021).

11.10.287 The navigational lighting on fishing vessels can attract Manx shearwater and European storm petrel, especially in poor weather conditions. Consequently, the potential impact of artificial lightings from nighttime vessel movement must be considered. Interestingly, Syposz *et al.* (2021) demonstrated the avoidance of artificial light in adult Manx shearwater, however, avoidance may not be possible in certain conditions, with records of grounding events in adult Manx shearwater when light is particularly strong in intensity or weather conditions are poor (Guilford *et al.*, 2018). The navigational lighting on fishing vessels may particularly affect recently fledged individuals, however, the extent of the potential impact of vessel lighting is unclear and to what extent the attraction to vessels is related to the attraction to light or other cues such as visual cues associated with a food source (Deakin *et al.,* 2022). Furthermore, the impact of vessel lighting must be considered in respect the quantity of other vessel movement, with no current reports of large-scale grounding events in relation to vessel movement in the North Sea.

Magnitude of the Effect

11.10.288 Fledgeling Manx shearwater and European storm petrel are the main individuals at risk of being attracted to the artificial lights emanating from the Proposed Development, however it was determined that it is unlikely that there will be an impact pathway of birds being attracted to the OWF or grounded due to artificial lighting from either the Proposed Development or from navigational lighting. Consequently, the magnitude of impact of artificial light from vessel movement is deemed negligible.

Significance of the Effect

11.10.289 Overall, the magnitude of the effect is deemed to be negligible and the sensitivity of both receptors is considered to be medium. Therefore, the effect will be of negligible to minor adverse significance. Although there is potential for both VORs assessed to be affected, the likelihood of individuals to be impacted is low. Therefore, it has been determined that the significance is **Negligible** adverse, which is not significant in EIA terms.

IMPACT 7 - DIRECT IMPACTS FROM UXO CLEARANCE

11.10.290 UXO from World War I, World War II and military training exercises that are found in the marine environment during pre-construction surveys must be cleared to ensure the safety of human life and infrastructure (UK Government *et al.*, 2025). Traditionally, this clearance is accomplished by placing explosive donor charges next to the UXO, which when denotated triggers the UXO itself to explode. The resulting blast can cause injury and disturbance to marine species, as well as damage to the seabed (UK Government *et al.,* 2025). The UK Government *et al.* (2025) now recommends that low-noise methods of clearance be the standard approach for removing UXO. Further details of the UXO assessment specific to the Proposed Development may be found in Volume 3, Technical Appendix 19.2: Unexploded Ordnance Technical Report.

11.10.291 Due to the nature of the activity, only diving seabirds within the vicinity of these activities are expected to be impacted. The VORs screened in for this impact are:

- Gannet;
- Guillemot;
- Razorbill; and
- Puffin

Construction Phase

All Receptors

Sensitivity of the VORs

11.10.292 Consideration of the sensitivity of seabird species to the potential direct impact of UXO clearance is informed by desktop study. The only VORs considered to be at risk are diving seabirds as they will be the only species within reach of the detonations, with all other species screened out. The relevant diving seabirds include gannet, guillemot, razorbill, and puffin.

11.10.293 The detonations have the capacity to kill birds instantly or cause serious injury that eventually prove to be fatal (Yelverton *et al.*, 1973), therefore the sensitivity of the affected birds is very high.

Characterisation of the Effect

11.10.294 In total it is expected that a maximum of 40 UXOs will require clearance, with a maximum of two detonations per 24-hour period. Thus, requiring a maximum of 40 days of clearance activities (Table 11.9).

11.10.295 Direct impacts from UXO clearance are mostly considered for marine mammals and fish (Lepper *et al.*, 2024), though a study has shown that it could directly lead to seabird mortalities through blast injuries (Danil and St Leger, 2011). These are rare and unlikely to impact species on a population level.

11.10.296 As well as direct impacts, indirect impacts such as underwater noise disturbance to birds and prey species can occur. The impact of noise during construction and decommissioning is further assessed in Impact 8 and will not be discussed here.

Magnitude of the Effect

11.10.297 UXO clearance activity will be intermittent and of local spatial extent throughout the construction phase (Table 11.9), affecting only birds in the vicinity of these activities directly. Therefore, the magnitude of UXO clearance is considered to be negligible.

Significance of the Effect

11.10.298 Given the magnitude of impact is negligible, and the sensitivity is very high, the significance of the effects on all diving VORs are concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

IMPACT 8 - INDIRECT IMPACTS FROM CONSTRUCTION/DECOMMISSIONING NOISE

11.10.299 Construction and decommissioning activities can generate noise. Noise generated by these activities can impact bird populations in the offshore environment directly through the displacement of bird populations and indirectly through disturbance to prey species (Volume 2, Chapter 9: Fish and Shellfish Ecology). This disruption could impact the foraging efficiency of these bird populations through movement of prey species, and/or displacement from foraging routes to and from the breeding colonies. This could affect the demographic fitness of the population by impacting survival and/or breeding productivity.

Construction Phase

All Receptors

Sensitivity of the VORs

11.10.300 The sensitivity of seabird species to the noise of construction activities is difficult to ascertain in isolation of other forms of disturbance caused by these activities, so as a precautionary approach the sensitivity of all VORs is deemed to be high for the assessment. However, as seabirds will be able to adapt to

noise (e.g. moving location) it is expected that the sensitivity of some seabirds will be lower in reality, affording a precautionary margin to the assessment.

Characterisation of Impact on the VOR

11.10.301 The MDS (Table 11.9) outlines the construction and decommissioning scenarios which would result in the greatest levels of noise. Construction and decommissioning activities that generate noise include:

- installation of foundations will generate underwater noise from piling activities;
- equipment use such as noise from cranes and heavy machinery can generate above water noise;
- vessel movements will generate underwater and above water noise; and
- UXO clearance will generate underwater noise from controlled UXO detonation.

11.10.302 Separating the impact of noise from the visual disturbance of these activities is challenging and likely species dependent. In line with this, noise is a likely contributing factor of the disturbance and displacement of birds caused by the installation of Offshore Infrastructure, vessel movements and UXO clearance which are discussed in Impact 2, Impact 3 and Impact 8. Noise is also a likely contributing factor to the disturbance of prey species which is discussed in Impact 4. As these impacts were deemed not significant, the impact of noise in isolation of other forms of disturbance caused by these activities, is likely to be small.

Magnitude of the Effect

11.10.303 Construction activities that cause noise (listed above) will be intermittent and of local spatial extent throughout the construction phase, affecting only birds in the vicinity of these activities directly temporarily and highly localised. Consequently, the magnitude of impact from noise in isolation of other forms of disturbance caused by these activities, is deemed negligible.

Significance of the Effect

11.10.304 Given the magnitude of impact is negligible, and the sensitivity of species is considered to be high, the effect of the indirect impact of noise in the construction phase is of **Minor** adverse significance, which is not significant in EIA terms.

Decommissioning Phase

All Receptors

11.10.305 The MDS for the decommissioning phase is assumed to be equal or less than the construction phase (Table 11.9). As such, magnitude of impact is deemed to be negligible and the sensitivity of receptors is deemed to be high. Therefore, as concluded in the construction phase, the indirect impact of noise in the decommissioning phase is of **Minor** adverse significance, which is not significant in EIA terms.

INTER-RELATED EFFECT OF IMPACT 1 – COLLISION RISK AND IMPACT 2 – DISTRIBUTIONAL RESPONSES

11.10.306 Following consultation (Table 11.3), both gannet and kittiwake have been assessed for both collision risk and distributional response during the O&M phase of the Proposed Development and therefore have been identified as an inter-related effect (see Section 11.11). Therefore, to determine the full potential impact of the Proposed Development on each VOR, the effects of the two impacts have been combined.

11.10.307 It is acknowledged that evaluating these two potential impacts together could lead to double counting, as birds that experience displacement would not be at risk of collision since they are assumed to have not entered the Array Area. Similarly, birds estimated to be at risk of collision mortality would not also be counted as experiencing displacement mortality. Consequently, the results presented in this section are considered to be highly precautionary, particularly for species with high displacement rates, such as gannets.

11.10.308 At present, no refined method has been agreed upon with NatureScot for assessing displacement and collision together. Therefore, this assessment is highly precautionary (considering the additive effects being highly unlikely).

O&M Phase

Gannet

Sensitivity of Gannet to Collision Risk and Displacement

11.10.309 Within this assessment, the sensitivity of gannet to collision risk is high and the sensitivity to displacement is low. As a precautionary approach, a high sensitivity has been used as the sensitivity for assessment of the inter-related effects of collision risk and displacement.

Characterisation of the Effect

11.10.310 The predicted annual mortality of gannet from the inter-related impact of collision risk and displacement was between 29 to 35 individuals (Table 11.51). This comprises of an annual mortality of between 28 to 37 individuals in the breeding season, and between one and two individuals in the non-breeding season (Table 11.51).

Table 11.51: Predicted Combined Collision Risk and Displacement Impacts for Gannet on Seasonal and Annual Basis Against a Resulting Decrease in Survival of Relevant Regional Populations

Bio-season	Regional Baseline Population	Number of Gannet Subject to Mortality	Decrease in Survival (percentage point change)
Breeding	841,748	28 to 37	0.003 to 0.004
Non-breeding	248,385	1 to 2	0.001 to 0.001
Annual	841,748	29 to 39	0.003 to 0.005

Magnitude of the Effect

11.10.311 As it was found that the decrease in survival did not exceed the 0.02 percentage point threshold for PVA, as recommended by NatureScot (2023g), no PVAs were

required and the magnitude of the effect on the VOR is considered to be negligible.

Significance of the Effect

11.10.312 The magnitude of the inter-related effect is considered to be negligible, and the sensitivity of the VOR to collision risk and displacement is considered to be high. Following the matrix approach (Table 11.13), the impact of collision risk and distributional responses gannet is therefore considered to be **Minor** adverse, which is not significant in EIA terms.

Kittiwake

11.10.313 Additional CRM has been undertaken for kittiwake in order to incorporate site-specific LiDAR data using 0.008 as the proportion of kittiwake flying at potential collision risk height and is presented under Option 1. Further information on LiDAR surveys can be found in Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report, Annex E: Flight Height Data Report.

Sensitivity of Kittiwake to Collision Risk and Displacement

11.10.314 Within this assessment, the sensitivity of kittiwake to collision risk is high and the sensitivity to displacement is low. As a precautionary approach, a high sensitivity has been used as the sensitivity to the inter-related effects of collision risk and displacement.

Characterisation of Impact on the VOR

11.10.315 The predicted annual mortality of kittiwake from in-combination impact of collision risk and displacement was between 54 to 68 individuals for Option 2 (Table 11.52), which was reduced to 12 to 26 individuals when incorporating site-specific LiDAR data (Option 1). This comprises of an annual mortality of between 43 to 54 individuals in the breeding season, and between 11 and 14 individuals in the non-breeding season for Option 2 (Table 11.52). In Option 1, this is reduced to an annual mortality of 10 to 21 individuals in the breeding season, and between two to five individuals in the non-breeding season (Table 11.52).

Table 11.52: Predicted Combined Collision Risk and Displacement Impacts for Kittiwake on Seasonal and Annual Basis Against a Resulting Decrease in Survival of Relevant Regional Populations for Option 1 and Option 2

Bio-season	Model Option	Regional Baseline Population	Wind Turbine Scenario	Number of Kittiwake Subject to Mortality	Decrease in Survival (percentage point change)
Breeding	1	604,582	MLS	10 to 21	0.002 to 0.003
Non-breeding		627,816		2 to 5	0.000 to 0.001
Annual		627,816		12 to 26	0.002 to 0.004
Breeding	2	604,582	WCS	43 to 54	0.007 to 0.009
Non-breeding		627,816		11 to 14	0.002 to 0.002
Annual		627,816		54 to 68	0.009 to 0.011

Magnitude of the Effect

11.10.316 As it was found that the decrease in survival did not exceed the 0.02 percentage point threshold for PVA, as recommended by NatureScot (2023g), no PVAs were required and the magnitude of the effect on the VOR is considered to be negligible.

Significance of the Effect

11.10.317 The magnitude of the inter-related effect is considered to be negligible, and the sensitivity of the VOR to collision risk and displacement is considered to be high. Following the matrix approach (Table 11.13), the impact of distributional responses on fulmar is therefore considered to be **Minor** adverse, which is not significant in EIA terms.

11.11 Inter-Related Effects

11.11.1 A description of the likely inter-related effects arising from the Proposed Development on offshore ornithology is provided in Volume 2, Chapter 23: Inter-Related Effects.

11.11.2 Inter-relationships are considered to be the impacts and associated effects of different aspects of the Proposed Development on the same receptor. Inter-related effects are considered to be either:

- Lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of Bowdun OWF (construction, O&M and decommissioning), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three project stages (e.g. underwater sound effects from piling, operational Wind Turbines, vessels and decommissioning); and
- Receptor-led effects: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, all effects on Infrastructure and Other Users, such as displacement of recreational activities and impacts to cables or pipelines or restrictions on access to these assets, may interact to produce a different, or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects may be short-term, temporary or transient effects, or incorporate longer-term effects."

11.11.3 For offshore ornithology, the following potential impacts have been considered within the inter-related assessment:

- collision risk mortality due to collision with rotor blades;
- distributional responses, displacement and barrier effects from Offshore Infrastructure;
- disturbance and displacement to birds from vessel movements;
- disturbance to prey species and their habitats;
- temporary habitat loss and/or habitat disturbance;
- attraction to light;

- direct impacts from UXO clearance; and
- indirect impacts from construction/decommissioning noise.

11.11.4 Table 11.53 lists the inter-related effects (project lifetime effects) that are predicted to arise during construction, O&M and decommissioning of the Proposed Development, as well as the inter-related effects (receptor-led effects) that are predicted to arise for ornithological receptors.

11.11.5 It is not expected that effects on ornithological receptors will have the potential to lead to secondary effects on other receptors. However, the impacts discussed in the following chapters of this Offshore EIA are expected to have secondary effects on ornithological receptors:

- Physical Processes – Impacts to the SSCs and changes to the stratification and frontal systems can indirectly impact ornithological receptors due to changes in prey species and their habitats (Volume 2, Chapter 7: Physical Processes). This is assessed in Impact 4.
- Benthic Ecology – Impacts to benthic habitats and species can indirectly impact ornithological receptors due to changes in prey species availability and their habitats (Volume 2, Chapter 8: Benthic Ecology). This is assessed in Impact 4.
- Fish and Shellfish Ecology – Impacts to fish and shellfish ecology can indirectly impact offshore ornithological receptors, as changes to the distribution and abundance of fish and shellfish may lead to changes in prey availability for offshore ornithology (Chapter 9: Fish and Shellfish Ecology). This is assessed in Impact 4.

Table 11.53: Summary of Likely Significant Inter-Related Effects for Offshore Ornithology from Individual Effects Occurring Across the Construction, O&M and Decommissioning Phase of the Proposed Development (Project Lifetime Effects)

Description of Impact	Phase*			Likely Significant Inter-Related Effects
	C	O	D	
Project Lifetime Effects				
Impact 1 - Collision Risk Mortality Due to Collision with Rotor Blades	×	✓	×	This effect will only arise during the O&M phase. Therefore, no inter-related Project lifetime effects will occur.
Impact 2 - Distributional responses, displacement and barrier effects from Offshore Infrastructure	✓	✓	✓	During construction, O&M and decommissioning, activities will be highly localised and only occur at any given time over a short period of time within the Proposed Development or beyond. Therefore, across the Proposed Development lifetime, the effects on seabird receptors are not anticipated to interact in such a way as to result in inter-related effects of greater significance than the assessments presented for each individual phase.
Impact 3 - Disturbance and displacement to birds from vessel movements	✓	✓	✓	The impacts to seabirds from vessel movements will be highly localised and temporary. Therefore, across the Project lifetime, the effects on seabird receptors are not anticipated to interact in such a way as to result in inter-related effects of greater significance than the assessments presented for each individual phase.
Impact 4 - Disturbance to prey species and their habitats	✓	✓	✓	The changes to prey availability during all phases are expected to be temporary, with prey availability recovering rapidly. Therefore, across the Project lifetime, the effects on seabird receptors are not anticipated to interact in such a way as to result in inter-related effects of greater significance than the assessments presented for each individual phase.
Impact 5 - Temporary habitat loss and/or habitat disturbance	✓	×	✓	The majority of the disturbance during construction and decommissioning will be highly localised and the habitats affected are predicted to recover quickly following completion of maintenance activities with prey species for seabirds recovering into the affected areas. Therefore, across the Project lifetime, the effects on seabird receptors are not anticipated to interact in such a way as to result in inter-related effects of greater significance than the assessments presented for each individual phase.
Impact 6 - Attraction to light	✓	✓	✓	The impacts from artificial light attraction are predicted to be highly localised. Therefore, across the Project lifetime, the effects on seabird receptors are not anticipated to interact in such a way as to result in inter-

Description of Impact	Phase*			Likely Significant Inter-Related Effects
	C	O	D	
				related effects of greater significance than the assessments presented for each individual phase.
Impact 7 - Direct impacts from UXO clearance	✓	×	×	This effect will only arise during the construction phase. Therefore, no inter-related Project lifetime effects will occur.
Impact 8 - Indirect impacts from construction/ decommissioning noise	✓	×	✓	The majority of indirect impacts from construction/decommissioning noise will be highly localised and temporary. Therefore, across the Project lifetime, the effects on seabird receptors are not anticipated to interact in such a way as to result in inter-related effects of greater significance than the assessments presented for each individual phase.
Receptor-led Effects				
• **Impact 1 – Collision Risk Mortality Due to Collision with Rotor Blades** • **Impact 2 – Distributional responses, displacement and barrier effects from Offshore Infrastructure**	✓ (Only Impact 2)	✓	✓ (Only Impact 2)	There is potential for spatial and temporal interactions between the effects arising from collision risk and distributional responses. Given both impacts are expected to have the highest impacts during the O&M phase of the Proposed Development, the ZoI (Array Area only and Array Area plus a 2 km buffer for collision risk and distributional responses respectively) for both impacts overlap, and have the potential to result in direct or indirect mortality of seabirds an assessment of the combined effect of both impacts has been carried out and presented in Section 11.10 and Section 11.11.
• **Impact 4 – Disturbance to prey species and their habitats** • **Impact 5 – Temporary habitat loss and/or disturbance** • **Impact 7 – Direct impacts from UXO clearance** • **Impact 8 – Indirect impacts from construction/ decommissioning**	✓	✓ (Only Impact 4)	✓ (Excluding Impact 7)	There is potential for spatial and temporal interactions between the effects arising from Impact 4, Impact 5, Impact 7 and Impact 8, as all impacts are expected to contribute to the disturbance of prey species, which will have indirect effects on ornithological receptors. The effect is expected to be highest during the construction phase of the Proposed Development as this is the only phase where all four impacts have the potential to occur. It is expected that the combined area within the Site Boundary impacted at any given time is expected to be small, and the impacts are only expected to occur intermittently in a given area. Additionally, due to the temporary nature of these impacts it is expected that any effects will be reversible. Therefore, it is determined that the combined impact is expected to be no greater than the individual effects assessed in isolation and therefore the receptor-led effects are of a minor adverse significance, which is not significant in EIA terms.

*Proposed Development phase refers to construction (C), operation and maintenance (O) and decommissioning (D) phases.

11.12 Cumulative Effects Assessment

Methodology

11.12.1 The CEA assesses the impacts associated with the Proposed Development cumulatively with the impacts of other relevant projects. As the impacts assessed in the CEA are only related to Offshore Infrastructure in the Array Area (displacement and CRM, see Table 11.57), this section focusses solely on the Array Area and the Array Area + 2km respectively. The projects were selected as relevant to the CEA based upon the results of a screening exercise (for full details see Volume 3, Technical Appendix 4.4: Cumulative Effects Assessment - Screening). The projects have been individually considered for screening in or out of this chapter's CEA based upon data confidence, effect-receptor pathways, and the spatial/temporal scales involved.

11.12.2 The CEA methodology has followed the methodology set out in Volume 1, Chapter 4: Environmental Impact Assessment Methodology. As part of the assessment, all projects considered alongside the Proposed Development have been allocated into 'tiers' reflecting their current stage within the planning and development process. The tiered approach to the CEA is as follows:

- **Tier 1** – The onshore elements of the Project;
- **Tier 2** – Projects that have an application submitted, are consented, under construction or operational to the extent not already captured with the baseline;
- **Tier 3** – Projects which have submitted a Scoping Report and/or have received a Scoping Opinion; and
- **Tier 4** – Reasonably foreseeable projects including those with Crown Estate Scotland (CES) option or lease agreements.

11.12.3 This tiered approach has been adopted to provide a clear assessment of the Proposed Development alongside other projects. The specific projects scoped into the CEA, are outlined for each topic below in their respective sections.

11.12.4 As outlined in Volume 1, Chapter 3: Project Description, the construction phase of the Proposed Development is anticipated to start in 2031 and to be completed by 2036 (i.e. a five-year construction period). It is expected that the O&M phase of the Proposed Development will last 30 years.

Offshore Ornithology

11.12.5 The finalised long list of projects, selected as relevant to the CEA based on the screening exercise (for full details see Volume 3, Technical Appendix 4.4: Cumulative Effects Assessment - Screening) was refined based on the CEA study area for this topic and availability of data (Table 11.55 and Figure 11.4)

11.12.6 For offshore ornithology, the finalised long list of projects was reduced to a short list for each species, using the recommended foraging ranges (NatureScot, 2023b) and, for all species except from guillemot and herring gull, the relevant BDMPS region from Furness (2015) to determine the projects within range. If a project was found to be outside the foraging range (provided by Woodward *et al.* (2019) as recommended by NatureScot, 2023b) or relevant BDMPS region

(Furness, 2015) for all species, then it has been deemed to be 'out of impact range' and therefore not included in the CEA as there is no impact pathway for the given project (Table 11.55).

11.12.7 Only Tier 2 and 3 projects are considered in the CEA for this topic. Tier 4 projects are not considered in the CEA as they are predominantly 'proposed' or only identified in the development plans and so have insufficient data available for detailed quantitative analysis. Tier 1, which refers to the onshore elements of the Project, has no direct pathway with the species considered. The specific projects scoped into the CEA for offshore ornithology are outlined in Table 11.55 and Figure 11.4.

11.12.8 For offshore ornithology, a number of impacts considered for the Proposed Development alone (Table 11.9) have not been considered within the CEA (see Figure 11.4 for more information). Of the impacts considered within the CEA, projects are only considered cumulatively for each species dependent on the spatial ranges of the species for each season (e.g. breeding and non-breeding season). During the breeding season, projects within the species' foraging range were considered as there is potential to have connectivity between the Proposed Development and other projects (Woodward *et al.*, 2019). Within the non-breeding season, projects within the BDMPS area relevant to a species are included in species assessment (Furness, 2015), except guillemot and herring gull. The non-breeding season range of guillemot is considered to be equal to the guillemot foraging range (Buckingham *et al.*, 2022). The non-breeding season range for herring gull is considered to be the breeding season foraging range with an adjustment factor of 0.67, to account for the influx of individuals from non-UK colonies (see Volume 3, Technical Appendix 11.6 Offshore Ornithology Apportioning Technical Report for more information).

11.12.9 As the strategic level CEF, being developed by the CEH on behalf of the MD-LOT, is not published at the time of writing this report, the current assessment follows the methodology outlined by the NEEOG, as outlined in the Scoping Report (BOWFL, 2024) and agreed upon by NatureScot (see Table 11.3). All data for the CEA originates from Grant (2025) except data for great black-backed gull, and data for Aspen, Ayre, Buchan and MarramWind OWFs as the EIAs for these projects were submitted following the work by Grant (2025).

11.12.10 Great black-backed gull CEA data are not available in Grant (2025). Therefore, data is derived from Table 6.75 of Caledonia North Wind Farm (Caledonia North, 2024). Furthermore, data from Aspen Offshore Wind Farm and Buchan Offshore Wind is derived from their EIA Report (Aspen, 2025) and technical reports (Buchan Offshore Wind, 2025a; Buchan Offshore Wind, 2025b) respectively.

11.12.11 From the finalised long list of projects, selected as relevant to the CEA based on the screening exercise (for full details see Volume 3, Technical Appendix 4.4: Cumulative Effects Assessment – Screening), 46 projects have been excluded from further consideration (Table 11.55). Of these, 14 OWFs in Tier 3 were excluded from assessment as they are still in the earlier stages of application or the application did not become publicly available more than three months before the Proposed Developments submission deadline. Therefore, these OWFs were not included within the quantitative analysis due to lack of available

information: Arven, Bellrock, Broadshore, Dogger Bank D, Havbredey, Machairwind Morven North, Morven South, Scaraben, Sinclair, Spiorad na Mara, Stromar, Stoura and Talisk. Twenty three OWFs within Tier 2 from the finalised long list of projects were excluded from further consideration as they are out of impact range of the Proposed Development based on of the largest VOR foraging range (gannet) during the breeding season and the relevant BDMPS during the non-breeding season, there was no overlap or the impacts were considered to be negligible within Grant (2025).

11.12.12 It should be noted that both Spiorad na Mara and Bellrock OWFs are now Tier 2 projects as of March 2026 and April 2026 respectively, as both projects are now in the planning phase with their EIA Reports submitted. However, according to the CEA methodology described in Volume 1, Chapter 4: Environmental Impact Assessment Methodology, these projects have remained assessed as Tier 3 projects within the CEA presented here for offshore ornithology and therefore not included within the quantitative assessment.

11.12.13 However, it is expected that the impacts from Spiorad na Mara and Bellrock OWFs are unlikely to impact the conclusions provided within this Offshore EIA, increase in impacts (percentage point change in survival) occurring for guillemot and razorbill. The impacts for both Bellrock and Spiorad na Mara OWFs alone and combined are presented in Table 11.54.

Table 11.54: Relevant Annual Impacts from Collision Risk and/or Distributional Reponses to VORs Due to Spiorad na Mara and Bellrock OWFs

Species	Population Size	Spiorad na Mara OWF Impacts[1]		Bellrock OWF Impacts[2]		Spiorad na Mara and Bellrock and OWFs Impacts Combined	
		Number of mortalities	Change in survival (percentage points)	Number of mortalities	Change in survival (percentage points)	Number of mortalities	Change in survival (percentage points)
Fulmar[3]	1,128,693	N/A					
Gannet	841,748	29.30 to 41.30	0.003 to 0.005	22.33 to 31.23	0.003 to 0.004	51.53 to 72.53	0.006 to 0.009
Kittiwake	627,816	N/A[5]		20.37 to 23.27	0.003 to 0.004	20.37 to 23.27	0.003 to 0.004
Great black-backed gull	91,399	N/A[5]		1.14	0.001	1.14	0.001
Herring gull[4]	59,816	N/A					
Guillemot	250,506	N/A[5]		50.30 to 132.00	0.020 to 0.053	50.30 to 132.00	0.020 to 0.053
Razorbill	218,622	N/A[5]		24.00 to 40.90	0.011 to 0.018	24.00 to 40.90	0.011 to 0.018
Puffin	507,599	N/A[5]		8.60 to 17.00	0.002 to 0.003	8.60 to 17.00	0.002 to 0.003

[1] Values taken from Spiorad na mara (2026)
[2] Values taken from Nadara (2026)
[3] Fulmar not assessed for distributional responses for both Spiorad na Mara and Bellrock OWFs
[4] Herring gull outside of impact range for Spiorad na Mara OWF and not assessed for collision risk in Bellrock OWF
[5] Project outside of impact range

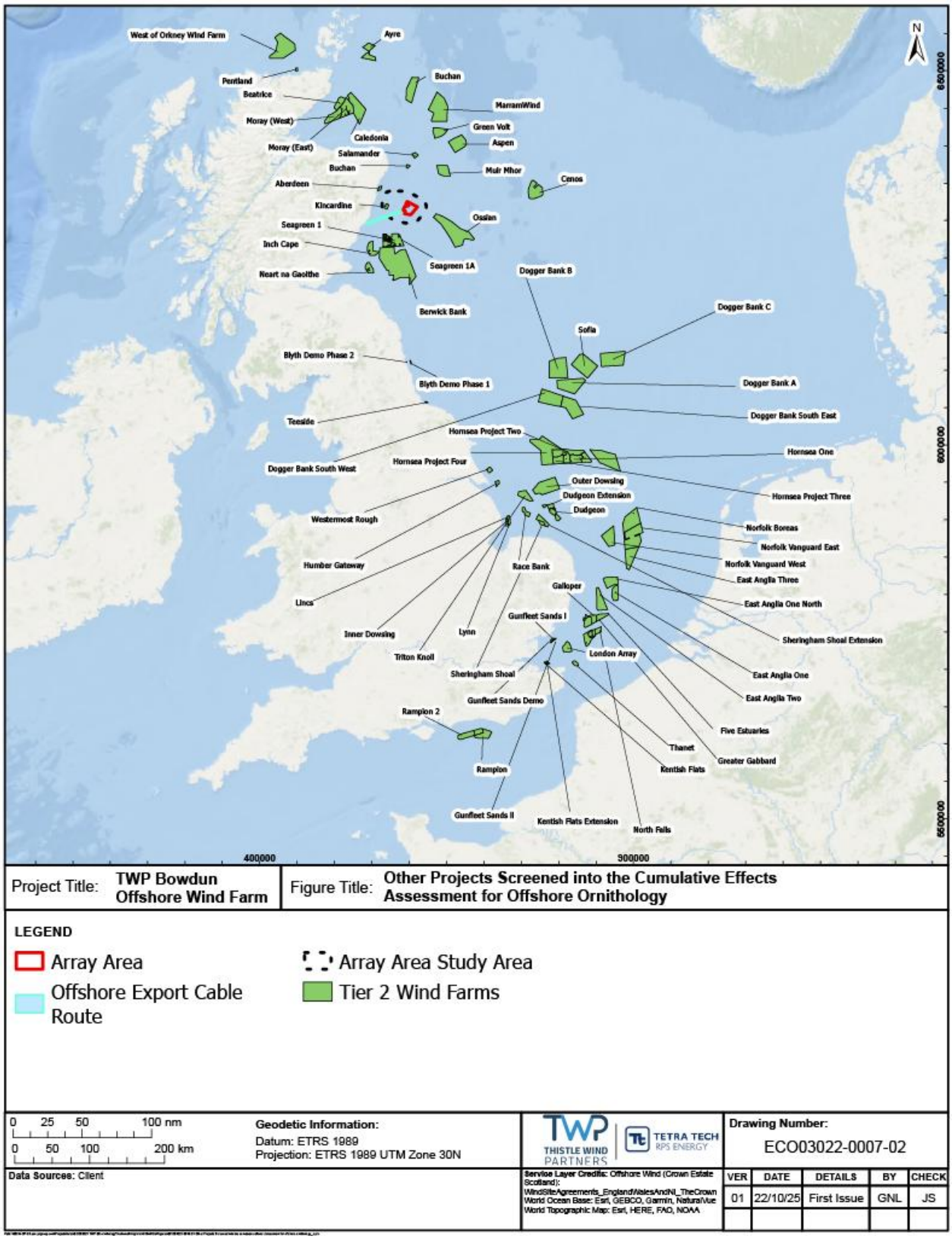

Figure 11.4: Other Projects Screened into the Cumulative Effects Assessment for Offshore Ornithology

Table 11.55: List of Other Projects Considered within the CEA for Offshore Ornithology (Note: C = Construction, O&M – Operation and Maintenance and D = Decommissioning)

Project	Status	Distance from Array Area (km)	Distance from Export Cable (km)	Dates of Construction (If Applicable)	Dates of Operation (If Applicable)	Overlap with the Proposed Development	Included in Further Assessment[1]
Tier 1							
Bowdun Onshore Infrastructure	Application submitted but not yet determined	50.37	0.00	2031 to 2034	2035 to unknown	-	No, onshore elements of the project
Tier 2							
Kincardine OWF	Operational	20.14	7.63	N/A	Until 2046	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Ossian OWF	Application submitted but not yet determined	25.36	40.14	2031 to 2038	2039 to 2073	Project C and O&M phases will overlap with Proposed Development C, O&M and D phases	**Yes**
Seagreen 1 OWF	Operational	27.87	19.88	N/A	Until 2048	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Seagreen 1A Project	Consented	36.30	19.47	2029 to 2032	2033 to 2057	Project C,O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Aberdeen OWF	Operational	38.60	34.71	N/A	Until 2042	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Hywind Scotland Wind Farm (Buchan Deep Demo)	Operational	44.43	54.73	N/A	Until 2037	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Berwick Bank Wind Farm	Consented	46.53	47.70	2027 to 2032	2033 to 2067	Project C, O&M and D phases will overlap with Proposed Development C and O&M and D phases	**Yes**
Muir Mhòr OWF	Application submitted but not yet determined	52.50	66.47	2027 to 2030	2031 to 2055	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Inch Cape OWF	Under construction	56.03	23.40	2025 to 2026	2027 to 2051	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Salamander OWF	Consented	58.68	69.52	2027 to 2029	2030 to 2054	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Neart Na Gaoithe OWF	Operational	80.49	51.16	N/A	Until 2049	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Aspen OWF	Application submitted but not yet determined	88.37	102.23	2027 to 2031	2032 to 2056	Project C, O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Green Volt OWF	Consented	92.16	103.35	2027 to 2029	2030 to 2054	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
MarramWind OWF	Application submitted but not yet determined	112.04	123.12	2030 to 2040	2041 to 2065	Project C, O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Caledonia South OWF	Application submitted but not yet determined	121.35	126.87	2028 to 2030	2031 to 2065	Project O&M phase will overlap with Proposed Development C, O&M and D phases	**Yes**
Forthwind	Consented	126.27	83.53	-	-	-	No, project timeline not available
Methil Demo	Operational	126.29	83.24	N/A	Until 2028	No temporal overlap	No, no temporal overlap

Project	Status	Distance from Array Area (km)	Distance from Export Cable (km)	Dates of Construction (If Applicable)	Dates of Operation (If Applicable)	Overlap with the Proposed Development	Included in Further Assessment[1]
Buchan OWF	Application submitted but not yet determined	131.73	142.09	2028 to 2030	2031 to 2065	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Caledonia North OWF	Application submitted but not yet determined	136.29	142.03	2028 to 2030	2031 to 2065	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Moray OWF (East)	Operational	138.55	143.71	N/A	Until 2046	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Moray OWF (West)	Operational	143.99	143.00	N/A	Until 2049	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Cenos OWF	Application submitted but not yet determined	149.39	167.54	2030 to 2034	2035 to 2059	Project C and O&M phases will overlap with Proposed Development C, O&M and D phases	**Yes**
Beatrice OWF	Operational	153.88	154.85	N/A	Until 2044	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Blyth Demo Phase 2	Consented/ Discontinued	185.47	185.47	-	-	-	**Yes**, project consented as part of the wider Blyth Demo project (along with Phase 1). Therefore, impacts for both Phase 1 and Phase 2 are combined within Grant (2025).
Culzean Floating Offshore Wind Turbine Pilot Project	Consented	185.50	203.81	2026	2027 to 2051	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, excluded from Grant (2025) due to negligible impact
Ayre OWF	Application submitted but not yet determined	192.87	201.77	2030 to 2034	2035 to 2065	Project C, O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Blyth Demo OWF Phase 1	Operational	194.76	190.95	N/A	Until 2044	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Pentland Floating Offshore Wind	Consented	228.04	222.69	2027 to 2029	2030 to 2054	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Teesside	Operational	250.26	249.31	N/A	Until 2038	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
West of Orkney Wind Farm	Consented	251.46	246.29	2028 to 2031	2032 to 2056	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Dogger Bank B	Under construction	269.36	279.70	Until 2026	2027 to 2051	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Robin Rigg East	Operational	275.06	241.25	N/A	Until 2035	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, outside of impact range
Robin Rigg West	Operational	278.56	244.59	N/A	Until 2035	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, outside of impact range
Dogger Bank South West	Application submitted but not yet determined	291.47	301.48	2027 to 2030	2031 to 2055	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Sofia OWF	Under construction	293.22	303.78	Until 2026	2027 to 2051	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Dogger Bank A	Under construction	295.29	305.54	Until 2026	2027 to 2051	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**

Project	Status	Distance from Array Area (km)	Distance from Export Cable (km)	Dates of Construction (If Applicable)	Dates of Operation (If Applicable)	Overlap with the Proposed Development	Included in Further Assessment[1]
Dogger Bank C	Under construction	313.37	324.63	Until 2026	2027 to 2051	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Dogger Bank South East	Application submitted but not yet determined	316.71	326.90	2027 to 2030	2031 to 2055	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Ormonde	Operational	336.46	308.47	N/A	Until 2039	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, outside of impact range
Walney 2	Operational	339.15	309.58	N/A	Until 2037	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, outside of impact range
Hornsea Project Four	Consented/ Discontinued	340.09	349.44	-	-	-	**Yes**, Project is 'consented' and has been considered at the CEA screening stage. However, based upon publicly available information, there are no plans to develop this project in its current form, and no current programme is available.
Walney Extension 3	Operational	341.08	309.87	N/A	Until 2043	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, outside of impact range
Walney Extension 4	Operational	341.42	310.91	N/A	Until 2043	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, outside of impact range
Walney 1	Operational	341.92	313.35	N/A	Until 2036	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, outside of impact range
Barrow OWF	Operational	343.44	316.99	N/A	Until 2030	No temporal overlap	No, outside of impact range and no temporal overlap
West of Duddon Sands	Operational	344.66	317.01	N/A	Until 2039	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, outside of impact range
Morgan OWF	Consented/Discontinued	353.03	320.62	-	-	-	No, outside of impact range
Westermost Rough	Operational	353.17	361.17	N/A	Until 2040	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Morecambe OWF	Consented	366.78	339.50	2027 to 2029	2030 to 2054	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, outside of impact range
Mona OWF	Consented	369.32	337.42	2027 to 2029	2030 to 2054	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, outside of impact range
Hornsea Project Two	Operational	374.05	383.79	N/A	Until 2047	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Humber Gateway	Operational	373.60	381.05	N/A	Until 2040	Project O&M and D phases overlap with Proposed Development construction, and O&M phases.	**Yes**
Hornsea One	Operational	385.62	395.40	N/A	Until 2044	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Hornsea Project Three	Under construction	393.37	403.39	2025 to 2029	2030 to 2054	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Burbo Bank	Operational	395.19	371.33	N/A	Until 2032	Project C and D phases will overlap with Proposed Development C phase	No, outside of impact range
Burbo Bank Extension	Operational	395.82	371.71	N/A	Until 2042	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, outside of impact range
Outer Dowsing Offshore Wind	Application submitted but not yet determined	396.96	406.07	2027 to 2029	2030 to 2054	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**

Project	Status	Distance from Array Area (km)	Distance from Export Cable (km)	Dates of Construction (If Applicable)	Dates of Operation (If Applicable)	Overlap with the Proposed Development	Included in Further Assessment[1]
Triton Knoll	Operational	397.15	405.84	N/A	Until 2047	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Gwynt y Môr OWF	Operational	402.92	376.60	N/A	Until 2040	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, outside of impact range
Awel y Môr OWF	Consented	404.81	377.89	2027 to 2031	2032 to 2056	Project C, O&M and D phases will overlap with Proposed Development C and O&M phases	No, outside of impact range
North Hoyle OWF	Operational	407.25	381.86	N/A	Until 2033	Project O&M and D phases will overlap with Proposed Development C phase	No, no temporal overlap with O&M phases
Rhyl Flats	Operational	416.07	389.17	N/A	Until 2034	Project O&M and D phases will overlap with Proposed Development C phase	No, outside of impact range
Race Bank OWF	Operational	418.83	427.47	N/A	Until 2043	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Lincs	Operational	422.90	430.90	N/A	Until 2037	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Inner Dowsing OWF	Operational	425.49	433.34	N/A	Until 2033	Project O&M and D phases will overlap with Proposed Development C phase	**Yes**
Dudgeon Extension	Consented	425.83	434.83	2026 to 2028	2029 to 2053	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Lynn OWF	Operational	432.58	440.30	N/A	Until 2033	Project O&M and D phases will overlap with Proposed Development C phase	**Yes**
Dudgeon OWF	Operational	433.91	443.02	N/A	Until 2060	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Sheringham Shoal Extension	Consented	435.18	444.05	2027 to 2028	2029 to 2053	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Sheringham Shoal	Operational	442.31	451.13	N/A	Until 2037	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Norfolk Boreas OWF	Consented	494.38	504.42	2027 to 2028	2029 to 2053	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Norfolk Vanguard West	Consented	496.63	506.37	2027 to 2028	2029 to 2053	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Norfolk Vanguard East	Consented	511.67	521.46	2027 to 2028	2029 to 2053	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Scroby Sands	Operational	512.18	521.29	N/A	Until 2029	No temporal overlap	No, no temporal overlap
East Anglia Three	Under Construction	531.16	540.86	Until 2026	2027 to 2052	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
East Anglia One North	Consented	550.23	559.58	2026 to 2028	2029 to 2053	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
East Anglia Two	Consented	557.06	566.25	2026 to 2027	2028 to 2052	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
East Anglia One	Operational	566.19	575.58	N/A	Until 2044	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
North Falls OWF	Application submitted but not yet determined	583.14	592.05	2027 to 2030	2031 to 2055	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**

Project	Status	Distance from Array Area (km)	Distance from Export Cable (km)	Dates of Construction (If Applicable)	Dates of Operation (If Applicable)	Overlap with the Proposed Development	Included in Further Assessment[1]
Galloper	Operational	586.42	595.40	N/A	Until 2042	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Greater Gabbard	Operational	587.29	596.22	N/A	Until 2037	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Five Estuaries OWF	Consented	590.34	599.37	2027 to 2029	2030 to 2069	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Gunfleet Sands I	Operational	596.97	605.15	N/A	Until 2035	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Gunfleet Sands II	Operational	598.32	606.61	N/A	Until 2035	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Gunfleet Sands Demo	Operational	600.28	608.30	N/A	Until 2038	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
London Array	Operational	607.17	615.72	N/A	Until 2038	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Kentish Flats Extension	Operational	624.13	631.07	N/A	Until 2040	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Kentish Flats	Operational	624.25	631.29	N/A	Until 2030	Project D phase will overlap with Proposed Development C phase	**Yes**
Thanet	Operational	634.92	643.46	N/A	Until 2035	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Erebus Floating Wind Demo	Under Construction	660.14	627.58	Until 2026	2027 to 2051	Project O&M phase will overlap with Proposed Development C, O&M and D phases	No, outside of impact range
Rampion	Operational	693.06	690.73	Until 2018	2018 to 2042	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Rampion 2	Consented	694.43	691.26	2027 to 2029	2030 to 2054	Project O&M and D phases will overlap with Proposed Development C and O&M phases	**Yes**
Twin Hub (Wave hub)	Consented	776.24	746.00	2026	2027 to 2051	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, outside of impact range
Tier 3							
Morven North OWF	Pre-Application	10.03	22.20	2030 to 2036	2037 to 2061	Project C, O&M and D phases will overlap with Proposed Development C and O&M phases	No, low data confidence or availability
Morven South OWF	Pre-Application	43.61	53.83	2030 to 2036	2037 to 2061	Project C, O&M and D phases will overlap with Proposed Development C and O&M phases	No, low data confidence or availability
Bellrock OWF	Pre-Application	62.23	79.55	2027 to 2030	2031 to 2055	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, low data confidence or availability
Broadshore OWF	Pre-Application	120.09	128.93	2028 to 2029	2030 to 2054	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, low data confidence or availability
Scaraben OWF	Pre-Application	125.19	134.69	2028 to 2029	2030 to 2054	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, low data confidence or availability
Sinclair OWF	Pre-Application	128.11	137.39	2028 to 2029	2030 to 2054	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, low data confidence or availability
Stromar	Pre-Application	153.38	161.99	2028 to 2032	2033 to 2057	Project C, O&M and D phases will overlap with Proposed Development C and O&M phases	No, low data confidence or availability

Project	Status	Distance from Array Area (km)	Distance from Export Cable (km)	Dates of Construction (If Applicable)	Dates of Operation (If Applicable)	Overlap with the Proposed Development	Included in Further Assessment[1]
Havbredey OWF	Pre-Application	303.20	284.98	2032 to 2035	2036 to 2060	Project C, O&M and D phases will overlap with Proposed Development C, O&M and D phases	No, low data confidence or availability
MachairWind OWF	Pre-Application	319.51	267.30	2029 to 2032	2033 to 2057	Project C, O&M and D phases will overlap with Proposed Development C and O&M phases	No, low data confidence or availability
Dogger Bank D	Pre-Application	319.71	331.23	2029 to 2034	2035 to 2059	Project C, O&M and D phases will overlap with Proposed Development C and O&M phases	No, low data confidence or availability
Spiorad na Mara	Pre-Application	345.58	314.08	2028 to 2031	2032 to 2056	Project C, O&M and D phases will overlap with Proposed Development C and O&M phases	No, low data confidence or availability
Talisk Offshore Wind Project	Pre-Application	346.58	322.07	2029 to 2031	2032 to 2056	Project C, O&M and D phases will overlap with Proposed Development C and O&M phases	No, low data confidence or availability
Arven	Pre-Application	352.16	362.94	2030 to 2034	2035 to 2059	Project C, O&M and D phases will overlap with Proposed Development C and O&M phases	No, low data confidence or availability
Stoura OWF	Pre-Application	381.15	391.89	2031 to 2035	2036 to 2070	Project C, O&M and D phases will overlap with Proposed Development C, O&M and D phases	No, low data confidence or availability
Tier 4							
Flora Floating Wind Farm	Pre-Planning	46.83	57.79	Unknown	Unknown	Unknown	No, low data confidence or availability
Cedar	Pre-Planning	104.26	122.51	2026 to 2027	2028 to 2052	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, low data confidence or availability
Beech Offshore Wind Farm	Pre-Planning	189.50	207.09	2026 to 2027	2028 to 2052	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, low data confidence or availability
Judy (HE Project)	Pre-Planning	212.25	229.40	Unknown	Unknown	Unknown	No, low data confidence or availability
Malin Sea Wind Offshore Wind Farm	Pre-Planning	358.19	306.98	2030	2031 to 2055	Project O&M and D phases will overlap with Proposed Development C and O&M phases	No, low data confidence or availability
Gwynt Glas Floating Offshore Wind Farm	Pre-Planning	667.31	635.10	Unknown	Unknown	Unknown	No, low data confidence or availability
Floating Offshore Wind Leasing Round 5 - Project Development Area 2	Pre-Planning	690.11	658.10	Unknown	Unknown	Unknown	No, low data confidence or availability
Floating Offshore Wind Leasing Round 5 - Project Development Area 3	Pre-Planning	699.05	668.85	Unknown	Unknown	Unknown	No, low data confidence or availability

[1] If a project or plan is not within the foraging range (NatureScot, 2023b) or relevant BDMPS for any species, and therefore not relevant to the assessment, it is determined to be 'out of impact range'

Table 11.56: Potential Cumulative Effects for Ornithological Receptors

Potential Impact	Phase*			Potential for Cumulative Effect	Rationale
	C	O	D		
Collision risk mortality due to collision with rotor blades	×	✓	×	Yes	There is potential for a cumulative effect, so a detailed, quantitative CEA is required.
Distributional responses, displacement and barrier effects from Offshore Infrastructure	✓	✓	✓	Yes	There is potential for a cumulative effect, so a detailed, quantitative CEA is required.
Disturbance to birds from vessel movements	✓	✓	✓	No	The construction phase of multiple projects (Table 11.54) are expected to overlap with the Proposed Development construction phase, the projects are widely spaced with substantial separation distances between them. Given the impacts of vessel activity will be intermittent and of local spatial extent throughout the construction phase of each project, it is not expected that there will be potential for significant cumulative effects to arise. During the O&M phase, there will be a lower impact from vessel activity compared to the construction phase due to reduced vessel numbers, which are restricted to a more localised scale around individual Wind Turbines. Therefore, it is considered that there is no potential for a cumulative effect to arise due to the cumulative impacts of vessel disturbance.
Disturbance to prey species and their habitats	✓	✓	✓	No	None of the VORs considered in this assessment are highly specialist. Thus, all VORs have a moderate degree of flexibility in their habitat preferences and prey items. Thus, as the VORs included within the assessment are expected to be able to adapt to changes in prey species, and the impacts to prey species are expected to be temporary, there is no potential for a cumulative effect.
Temporary habitat loss and/or habitat disturbance	✓	×	✓	No	During construction, the impacts of temporary habitat loss and/or habitat disturbances are predicted to occur intermittently for a medium-term duration. The impacts are expected to cover a local spatial extent, with only a small proportion of the Site Boundary impacted at a given time. The MDS for the decommissioning phase is assumed to be equal or less than the construction phase. As only a small number of projects screened in for CEA have overlapping construction phases (Table 11.55) with the Proposed Development and each project is only expected to temporary impact habitats within their respective Site Boundaries, it is considered that there is no potential for a significant cumulative effect.
Attraction to light	✓	✓	✓	No	It is expected that the impacts arising from increased light associated with the Proposed Development and other projects will be intermittent and covering a small spatial extent. Therefore, due to the distance between projects and highly localised nature of impacts it is not expected that additional light arising from the Proposed Development and other projects will result in a cumulative effect.
Direct impacts from UXO clearance	✓	×	×	No	The impacts on birds from UXO clearance will be highly localised and temporary. Considering these impacts are reversible and only likely to cover a small area of the Proposed Development, it is not expected that impacts from UXO clearance from other projects will be in close enough proximity to result in cumulative impacts.
Indirect impacts from construction/decommissioning noise	✓	×	✓	No	The impact for indirect impacts of noise will be highly localised and temporary. Due to this, it is not expected that the impacts of the Proposed Development will cumulatively impact ornithological receptors.

*Proposed Development phase refers to construction (C), operation and maintenance (O) and decommissioning (D) phases

Maximum Design Scenario

11.12.14 The MDS identified in Table 11.57 have been selected as those having the potential to result in the greatest effect offshore ornithological receptors. The cumulative effects presented and assessed in this section have been selected from the details provided in Volume 1, Chapter 3: Project Description as well as the information available on other projects (see Volume 3, Technical Appendix 4.4: Cumulative Effects Assessment - Screening), to inform an MDS. Any other development scenario within the PDE, will result in in the same, or less, level of environmental effect.

Table 11.57: Maximum Design Scenario Considered for Each Impact as Part of the Assessment of Likely Significant Cumulative Effects on Offshore Ornithology

Potential Cumulative Effect	Phase*			Maximum Design Scenario	Justification
	C	O	D		
Collision risk mortality due to collision with rotor blades	×	✓	×	MDS as described for the Proposed Development (Table 11.9) assessed cumulatively with the following projects: Tier 1 Excluded from assessment Tier 2 Of the Tier 2 projects listed in Table 11.55 69 are considered for cumulative assessment. Tier 3 Tier 3 projects listed in Table 11.55 are not considered for cumulative assessment due to low data confidence or availability. Tier 4 Excluded from assessment.	Tier 1 The onshore elements of the Project are excluded as collision risk is not applicable. Tier 2 There is potential for a cumulative effect from O&M activities and so a CEA is required. Tier 3 There is potential for a cumulative effect from O&M activities and so a CEA is required. For projects within Tier 3, impact information may be limited, with insufficient information to allow for cumulative assessment of those projects to be undertaken. Tier 4 Projects included within Tier 4 have been excluded as impact information is not available in Grant (2025) and the Projects application has not been submitted at the time of writing this Offshore EIA.
Distributional responses, displacement and barrier effects from Offshore Infrastructure	✓	✓	✓	MDS as described for the Proposed Development (Table 11.9) assessed cumulatively with the following projects: Tier 1 Excluded from assessment Tier 2 Of the Tier 2 projects listed in Table 11.55 69 are considered for cumulative assessment.	There is potential for a cumulative effect from O&M activities. Therefore, a cumulative effect assessment is required. Although there is the potential for cumulative effects across all development phases, construction and decommissioning impacts are less than during the O&M phase when the number of Offshore Infrastructure is greatest. Tier 1 The onshore elements of the Project are excluded as no direct impact pathway to species considered.

Potential Cumulative Effect	Phase*			Maximum Design Scenario	Justification
	C	O	D		
				Tier 3 Tier 3 projects listed in Table 11.55 are not considered for cumulative assessment due to low data confidence or availability. Tier 4 Excluded from assessment.	Tier 2 There is potential for a cumulative effect from O&M activities and so a CEA is required. Tier 3 There is potential for a cumulative effect from O&M activities and so a CEA is required. For projects within Tier 3, impact information may be limited, with insufficient information to allow for cumulative assessment of those projects to be undertaken. Tier 4 Projects included within Tier 4 have been excluded as impact information is not available in Grant (2025) and the Projects application has not been submitted at the time of writing this Offshore EIA.

*Project Phase refers to construction (C), operation and maintenance (O) and decommissioning (D) phases.

Cumulative Effects Assessment

11.12.15 An assessment of the likely significance of the cumulative effects of the Proposed Development upon offshore ornithology receptors arising from each identified impact is given below.

11.12.16 For the CEA, impacts from Tier 2 projects have been assessed together. If any Tier 2 projects do not get built to the scale within consent applications, the assessment presented here still includes the consented project design, meaning this provides the most precautionary assessment of impacts on the relevant receptor population (Table 11.55).

11.12.17 During the preparation of this EIA, Berwick Bank OWF has been granted consent by Scottish Ministers (Scottish Ministers, 2025). However, following advice within the Scoping Opinion impacts including and excluding Berwick Bank OWF have been presented for relevant species (MD-LOT, 2024). As Berwick Bank OWF is not within the foraging range of herring gull and guillemot and did not require assessment of great black-backed gull, only one cumulative scenario has been presented for these species.

11.12.18 Following NatureScot (2023g) guidance, cumulative PVAs were conducted to assess the magnitude of a cumulative effect if the decrease in survival was predicted to be equal to or greater than 0.02 percentage points. For the purpose of this assessment, results after 30 years (the operational lifespan of the Proposed Development) have been presented, with the results after 50 years presented in Volume 3, Technical Appendix 11.7: Offshore Ornithology Population Viability Analysis Technical Report.

11.12.19 For information regarding proposed monitoring for the assessed cumulative effects see Section 11.13.

11.12.20 Moreover, it should be noted that within the CEA that the numbers presented within this section are rounded, with the unrounded values used within calculations.

Collision Risk Mortality Due to Collision with Rotor Blades

11.12.21 The Proposed Development, together with other connected OWFs, may contribute to cumulative collision risk, in the event of the O&M phases of different projects overlap.

11.12.22 As stated, data used within the assessment of cumulative collision risk is based on published information produced by the respective project developers. As such, the input parameters (e.g. avoidance rates) and the collision risk model used (e.g. deterministic) may vary from those put forward in this chapter.

11.12.23 The species assessed for cumulative collision impacts were gannet, kittiwake, great black-backed gull and herring gull. Cumulative assessment was not conducted for Arctic tern as only two other publicly available OWF applications were found to assess Arctic tern at the time of writing this report. West of Orkney OWF was estimated to produce a mean annual sCRM mortality of 0.43 (MacArthur Green, 2024), and Ayre OWF was estimated to produce a mean annual sCRM mortality of 1.04 (AOWFL, 2025).

11.12.24 There is no cumulative collision impact from the proposed onshore application (i.e. Tier 1).

Gannet

Sensitivity of Gannet to Collision Risk

11.12.25 As shown in Table 11.16, the sensitivity of gannet to collision risk is high.

Characterisation of the Impact

11.12.26 The estimated collision mortalities of gannet for the purpose of estimating cumulative collision impacts are given in Table 11.58. Gannet collision mortalities for the Array Area used a 70% reduction in monthly densities in the non-breeding season (NatureScot, 2023g; Pavat *et al.,* 2023) to account for the macro-avoidance demonstrated by this species (NatureScot, 2023g; Furness *et al.,* 2013; Ozsanlav-Harris *et al.,* 2023).

Table 11.58: Gannet Cumulative Mortalities Per Year due to Collision Risk Mortality due to Collision with Rotor Blades. Only Projects Which Contribute Mortalities Have Been Presented.

Project	Breeding Season	Non-breeding Season
Aberdeen	2.21	0.63
Aspen	15.58	1.58
Ayre	4.84	0.47
Beatrice	16.51	5.43
Blyth Demo	2.55	0.84
Buchan	2.98	0.75
Caledonia	12.35	0.67
Cenos	17.15	2.90
Dogger Bank A and B	58.98	22.53
Dogger Bank C and Sofia	10.76	3.53
Dogger Bank South	26.76	4.29
Dudgeon	7.49	4.30
East Anglia One	N/A (outside foraging range)	13.78
East Anglia One North	N/A (outside foraging range)	2.64
East Anglia Two	N/A (outside foraging range)	5.91
East Anglia Three	N/A (outside foraging range)	5.76
Five Estuaries	N/A (outside foraging range)	2.57
Galloper	N/A (outside foraging range)	2.99
Greater Gabbard	N/A (outside foraging range)	2.11
Green Volt	14.90	0.90
Hornsea One	1.90	2.03
Hornsea Project Two	5.09	3.19
Hornsea Project Three	7.10	2.06
Hornsea Project Four	11.49	1.42
Humber Gateway	0.68	0.22

Project	Breeding Season	Non-breeding Season
Hywind	4.07	0.27
Inch Cape	78.55	1.96
Kentish Flats	N/A (outside foraging range)	1.22
Kincardine	2.18	0.00
Lincs	1.53	2.11
London Array	N/A (outside foraging range)	0.90
Lynn and Inner Dowsing	0.20	0.24
MarramWind	39.78	3.18
Moray (East)	58.62	6.86
Moray (West)	7.13	0.48
Muir Mhòr	9.59	0.83
Neart Na Gaoithe	64.73	3.05
Norfolk Boreas	10.25	3.62
Norfolk Vanguard	5.96	5.21
North Falls	N/A (outside foraging range)	1.57
Ossian	28.18	1.20
Outer Dowsing	1.05	0.56
Pentland	1.45	0.00
Race Bank	13.07	1.33
Rampion	N/A (outside foraging range)	6.70
Rampion 2	N/A (outside foraging range)	2.02
Salamander	6.50	0.75
Seagreen (1 and 1A)	208.41	6.64
Sheringham Shoal	13.22	2.20
Sheringham Shoal Extension and Dudgeon Extension	0.40	0.60
Teesside	2.39	0.17
Triton Knoll	6.83	5.29
Westermost Rough	0.12	2.93
West of Orkney	35.30	0.04
Total	818.82	155.43
Berwick Bank	123.64	4.58
Bowdun	23.64	0.42
Total (including Berwick Bank)	**966.10**	**160.44**
Total (excluding Berwick Bank)	**842.46**	**155.86**

11.12.27 The cumulative collision mortality including and excluding Berwick Bank for gannet is given in Table 11.59.

Table 11.59: Gannet Cumulative Collision Mortality Estimates Including and Excluding Berwick Bank

Bio-season	Regional Baseline Population	Number of Gannet Subject to Mortality	Decrease in Survival (percentage point change)
Including Berwick Bank			
Breeding	841,748	966.10	**0.115**
Non-breeding	248,385	160.44	**0.065**
Annual	841,748	1,126.54	**0.134**
Excluding Berwick Bank			
Breeding	841,748	842.46	**0.100**
Non-breeding	248,385	155.86	**0.063**
Annual	841,748	998.32	**0.119**

Magnitude of the Impact

11.12.28 The cumulative impact of collision risk on gannets did reach the 0.02 percentage point threshold for PVA (NatureScot, 2023g). However, as gannet are impacted by both collision risk and distributional responses, a PVA has been carried out for the inter-related effects as detailed in Paragraphs 11.12.118 to 11.12.129.

Significance of the Effect

11.12.29 As gannet have been assessed for the inter-related effect of collision risk and distributional responses, the significance of the cumulative effect has been determined in Paragraphs 11.12.118 to 11.12.129.

Kittiwake

Sensitivity of Kittiwake to Collision Risk

11.12.30 As shown in Table 11.16, the sensitivity of kittiwake to collision risk is high.

Characterisation of the Impact

11.12.31 The estimated collision mortalities of kittiwake for the purpose of estimating cumulative collision impacts are given in Table 11.60.

Table 11.60: Kittiwake Cumulative Mortalities Per Year due to Collision Risk Mortality due to Collision with Rotor Blades. Mortalities using Model Option 1 are Presented in Parentheses and Only Projects Which Contribute Mortalities Have Been Presented.

Season	Breeding Season	Non-breeding Season
Aberdeen	5.74	3.11
Aspen	7.33	3.68
Ayre	5.48	12.40
Beatrice	33.16	17.35
Blyth Demo	1.08	2.22
Buchan	3.50	2.72
Caledonia	55.27	11.74

Season	Breeding Season	Non-breeding Season
Cenos	8.05	5.05
Dogger Bank A and B	183.65	266.23
Dogger Bank C and Sofia	87.12	190.60
Dogger Bank South	105.69	179.16
East Anglia One	N/A (outside foraging range)	82.82
East Anglia One North	N/A (outside foraging range)	8.44
East Anglia Two	N/A (outside foraging range)	52.34
East Anglia Three	N/A (outside foraging range)	9.31
Five Estuaries	N/A (outside foraging range)	20.04
Galloper	N/A (outside foraging range)	15.28
Greater Gabbard	N/A (outside foraging range)	15.95
Green Volt	4.94	9.50
Hornsea One	N/A (outside foraging range)	4.62
Hornsea Project Two	N/A (outside foraging range)	7.13
Hornsea Project Three	N/A (outside foraging range)	50.28
Hornsea Project Four	N/A (outside foraging range)	13.45
Humber Gateway	N/A (outside foraging range)	1.31
Hywind	10.56	1.09
Inch Cape	25.45	23.27
Kentish Flats	N/A (outside foraging range)	0.97
Kentish Flats Extension	N/A (outside foraging range)	1.40
Kincardine	14.00	5.85
Lincs	N/A (outside foraging range)	1.14
London Array	N/A (outside foraging range)	0.95
MarramWind	22.54	16.06
Moray (East)	15.27	5.09
Moray (West)	49.00	21.82
Muir Mhòr	61.73	9.29
Neart Na Gaoithe	5.09	13.82
Norfolk Boreas	N/A (outside foraging range)	32.07
Norfolk Vanguard	N/A (outside foraging range)	25.96
North Falls	N/A (outside foraging range)	14.84
Ossian	28.13	11.59
Outer Dowsing	N/A (outside foraging range)	16.84
Pentland	4.45	0.73
Race Bank	N/A (outside foraging range)	10.26
Salamander	14.00	0.00
Seagreen (1 and 1A)	80.90	159.91

Season	Breeding Season	Non-breeding Season
Sheringham Shoal Extension	N/A (outside foraging range)	5.20
Teesside	20.63	13.09
Thanet	N/A (outside foraging range)	0.25
Triton Knoll	N/A (outside foraging range)	39.75
Westermost Rough	N/A (outside foraging range)	0.18
West of Orkney	17.86	38.18
Total	870.62	1,454.32
Berwick Bank	392.64	268.36
Bowdun	37.59 (4.69)	9.98 (1.24)
Total (including Berwick Bank)	**1,300.85 (1,267.95)**	**1,732.67 (1,723.93)**
Total (excluding Berwick Bank)	**908.21 (876.31)**	**1,464.30 (1,445.56)**

11.12.32 The cumulative collision mortality including and excluding Berwick Bank for kittiwake is given in Table 11.61.

Table 11.61: Kittiwake Cumulative Collision Mortality Estimates Including and Excluding Berwick Bank

Bio-season	Regional Baseline Population	Number of Kittiwake Subject to Mortality	Decrease in Survival (percentage point change)
Including Berwick Bank (Model Option 1)			
Breeding	602,897	1,267.95	**0.210**
Non-breeding	627,816	1,723.93	**0.275**
Annual	627,816	2,991.87	**0.477**
Excluding Berwick Bank (Model Option 1)			
Breeding	602,897	875.31	**0.145**
Non-breeding	627,816	1,455.56	**0.232**
Annual	627,816	2,330.86	**0.371**
Including Berwick Bank (Model Option 2)			
Breeding	602,897	1,300.85	**0.215**
Non-breeding	627,816	1,732.67	**0.276**
Annual	627,816	3,033.52	**0.483**
Excluding Berwick Bank (Model Option 2)			
Breeding	602,897	908.21	**0.150**
Non-breeding	627,816	1,464.30	**0.233**
Annual	627,816	2,372.51	**0.378**

Magnitude of Impact

11.12.33 The cumulative impact of collision risk on kittiwake did reach the 0.02 percentage point threshold for PVA (NatureScot, 2023g). However, as kittiwake are impacted by both collision risk and distributional responses, a PVA has been

carried out for the inter-related effects as detailed in Paragraphs 11.12.130 to 11.12.141.

Significance of the Effect

11.12.34 As kittiwake have been assessed for inter-related effect of collision risk and distributional responses, the significance of the cumulative effect has been determined in Paragraphs 11.12.130 to 11.12.141.

Great black-backed gull

Sensitivity of Great Black-backed Gull

11.12.35 As shown in Table 11.16, the sensitivity of great black-backed gull to collision risk is very high.

Characterisation of the Impact

11.12.36 The estimated collision mortalities of great black-backed gull for the purpose of estimating cumulative collision impacts are given in Table 11.62. Although Berwick Bank was found to have connectivity during the breeding and non-breeding season, the application did not assess great black-backed gull for collision risk and therefore only one scenario has been presented.

Table 11.62: Great Black-backed Gull Cumulative Mortalities Per Year due to Collision Risk Mortality due to Collision with Rotor Blades. Only Projects Which Contribute Mortalities Have Been Presented.

Project	Breeding Season	Non-breeding Season
Aberdeen	0.59	2.13
Aspen	N/A (outside foraging range)	9.72
Ayre	N/A (outside foraging range)	21.70
Beatrice	N/A (outside foraging range)	84.50
Buchan	N/A (outside foraging range)	2.85
Caledonia	N/A (outside foraging range)	14.98
Dogger Bank A and B	N/A (outside foraging range)	28.00
Dogger Bank C and Sofia	N/A (outside foraging range)	30.60
Dogger Bank South	N/A (outside foraging range)	2.72
Dudgeon	N/A (outside foraging range)	6.10
East Anglia One North	N/A (outside foraging range)	1.40
East Anglia Two	N/A (outside foraging range)	4.10
East Anglia Three	N/A (outside foraging range)	49.14
Five Estuaries	N/A (outside foraging range)	1.16
Galloper	N/A (outside foraging range)	22.82
Greater Gabbard	N/A (outside foraging range)	21.17
Green Volt	N/A (outside foraging range)	6.87
Gunfleet Sands	N/A (outside foraging range)	200.00
Hornsea Project Two	N/A (outside foraging range)	82.30
Hornsea Project Three	N/A (outside foraging range)	33.60

Project	Breeding Season	Non-breeding Season
Hornsea Project Four	N/A (outside foraging range)	10.60
Humber Gateway	N/A (outside foraging range)	10.67
Hywind	0.40	6.10
Inch Cape	0.00	17.94
Kentish Flats	N/A (outside foraging range)	5.40
Kincardine	0.00	0.20
MarramWind	N/A (outside foraging range)	16.66
Moray (East)	N/A (outside foraging range)	0.80
Moray (West)	N/A (outside foraging range)	6.00
Neart Na Gaoithe	N/A (outside foraging range)	24.83
Norfolk Boreas	N/A (outside foraging range)	34.40
Norfolk Vanguard	N/A (outside foraging range)	25.80
North Falls	N/A (outside foraging range)	3.04
Outer Dowsing	N/A (outside foraging range)	3.44
Race Bank	N/A (outside foraging range)	2.48
Salamander	0.00	3.00
Seagreen (1 and 1A)	17.20	25.00
Teesside	N/A (outside foraging range)	38.46
Thanet	N/A (outside foraging range)	41.80
Triton Knoll	N/A (outside foraging range)	0.18
Westermost Rough	N/A (outside foraging range)	68.88
West of Orkney	N/A (outside foraging range)	6.00
Total (excluding Bowdun)	18.19	977.53
Bowdun	0.00	2.30
Total (including Bowdun)	**18.19**	**979.83**

11.12.37 The cumulative collision mortality excluding and including great black-backed gull is given in Table 11.63.

Table 11.63: Great Black-backed Gull Cumulative Collision Mortality Estimates Excluding Berwick Bank

Bio-season	Regional Baseline Population	Number of Individual Mortalities	Decrease in Survival (Percentage Point Change)
Breeding[1]	364	18.19	**4.996**
Non-breeding	91,399	979.83	**1.072**
Annual	91,399	998.01	**1.092**

[1] As the Proposed Development was not found to result in any mortalities during the breeding season, this has been presented for context only and a PVA has not been conducted.

11.12.38 As shown in Table 11.63, as the 0.02 percentage point threshold was met for the breeding season, non-breeding season and annual scenarios. Although the cumulative impacts to great black-backed gull met the 0.02 percentage point threshold for the breeding season, a PVA was not run as the Proposed Development contributed 0.00 mortalities to the cumulative total.

11.12.39 Two PVAs were required to further determine the magnitude of impact (see Volume 3, Technical Appendix 11.7: Offshore Ornithology Population Viability Analysis Technical Report for more information).

Cumulative PVA Assessment

Non-breeding Season

11.12.40 When considering the cumulative impact during the non-breeding season on the regional population, the PVA predicted that the CPGR was 0.988 (Table 11.64) which translates to a decrease of 1.2% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.698 (Table 11.64), which is equivalent to a 30.2% decrease in population size. The results of the PVA suggest that the magnitude of impact during the non-breeding season will be medium.

Annual

11.12.41 When considering the annual cumulative impact on the regional population, the PVA predicted that the CPGR was 0.988 (Table 11.64) which translates to a decrease of 1.2% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.694 (Table 11.64), which is equivalent to a 30.6% decrease in population size. The results of the PVA suggest that the magnitude of impact annually will be medium.

Table 11.64: Outputs of PVA for Cumulative Assessment of Collision Risk Impacts for Great Black-backed Gull for the Operational Life of the Proposed Development (up to 30 years). CI = Confidence Intervals Around Counterfactual Ratio Metrics Given in Parentheses

Bio-season	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
Non-breeding Season	Baseline	7,539,512	1.153 (1.131 to 1.174)	-	-
	Impacted	5,263,245	1.140 (1.118 to 1.161)	0.988 (0.988 to 0.989)	0.698 (0.692 to 0.704)
Annual	Baseline	7,539,512	1.153 (1.131 to 1.174)	-	-
	Impacted	5,225,747	1.139 (1.118 to 1.160)	0.988 (0.988 to 0.989)	0.694 (0.687 to 0.700)

Magnitude of Impact

11.12.42 From the results of the PVA, it is predicted that the maximum impact on growth rate is 1.2%, equivalent to a 30.6% decrease in population size for the annual scenario. Therefore, it can be determined that the magnitude of impact is medium.

Significance of the Effect

11.12.43 The magnitude of cumulative impact of collision risk is considered to be medium, and the sensitivity of the VOR is considered to be very high. Following the matrix approach (Table 11.13), the cumulative impact of collision risk on great black-backed gull is therefore considered to be **Major** adverse, which is significant in EIA terms.

Herring gull

Sensitivity of Herring Gull

11.12.44 As shown in Table 11.16, the sensitivity of herring gull to collision risk is very high.

Characterisation of the Impact

11.12.45 The rounded estimated collision mortalities of herring gull for the purpose of estimating cumulative collision impacts are given in Table 11.65.

Table 11.65: Herring Gull Cumulative Mortalities Per Year due to Collision Risk Mortality due to Collision with Rotor Blades. Only Projects Which Contribute Mortalities Have Been Presented.

Project	Breeding Season	Non-breeding Season
Aberdeen	5.76	0.00
Hywind	0.72	9.36
Inch Cape	1.20	3.60
Muir Mhòr	0.85	1.73
Neart na Gaoithe	2.40	4.80
Ossian	0.00	2.74
Salamander	0.00	4.00
Seagreen (1 and 1A)	9.43	16.97
Total	20.36	43.20
Bowdun	32.15	1.46
Berwick Bank	51.60	8.40
Total (including Berwick Bank)	**104.11**	**53.06**
Total (excluding Berwick Bank)	**52.51**	**44.66**

11.12.46 The cumulative collision mortality including and excluding Berwick Bank for herring gull is given in Table 11.66.

Table 11.66: Herring gull Cumulative Collision Mortality Estimates Including and Excluding Berwick Bank

Bio-season	Regional Baseline Population	Number of Herring gull Subject to Mortality	Decrease in Survival (percentage point change)
Including Berwick Bank			
Breeding	40,076	104.11	**0.260**
Non-breeding	59,815	53.06	**0.089**
Annual	59,815	157.17	**0.263**

Bio-season	Regional Baseline Population	Number of Herring gull Subject to Mortality	Decrease in Survival (percentage point change)
Excluding Berwick Bank			
Breeding	40,076	52.51	**0.131**
Non-breeding	59,815	44.66	**0.075**
Annual	59,815	97.17	**0.162**

11.12.47 As shown in Table 11.66, as the 0.02 percentage point threshold was met for the breeding season, non-breeding season and annual scenarios including and excluding Berwick Bank. Therefore, six PVAs were required to further determine the magnitude of impact (see Volume 3, Technical Appendix 11.7: Offshore Ornithology Population Viability Analysis Technical Report for more information).

Cumulative PVA Assessment Including Berwick Bank

Breeding Season

11.12.48 When considering the cumulative impact during the breeding season on the regional population, the PVA predicted that the CPGR was 0.997 (Table 11.67) which translates to a decrease of 0.3% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.907 (Table 11.67), which is equivalent to a 9.3% decrease in population size. The results of the PVA suggest that the magnitude of impact during the breeding season will be low.

Non-breeding Season

11.12.49 When considering the cumulative impact during the non-breeding season on the regional population, the PVA predicted that the CPGR was 0.999 (Table 11.67) which translates to a decrease of 0.1% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.967 (Table 11.67), which is equivalent to a 3.3% decrease in population size. The results of the PVA suggest that the magnitude of impact during the breeding season will be negligible.

Annual

11.12.50 When considering the cumulative annual impact during on the regional population, the PVA predicted that the CPGR was 0.997 (Table 11.67) which translates to a decrease of 0.3% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.906 (Table 11.67), which is equivalent to an 9.4% decrease in population size. The results of the PVA suggest that the magnitude of impact annually will be low.

Table 11.67: Outputs of PVA for Cumulative Assessment of Collision Risk Impacts for Herring Gull for the Operational Life of the Proposed Development (up to 30 years) Including Berwick Bank. CI = Confidence Intervals Around Counterfactual Ratio Metrics Given in Parentheses

Bio-season	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
Breeding Season	Baseline	47,451	1.004 (0.976 to 1.031)	-	-

Bio-season	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
	Impacted	42,953	1.001 (0.973 to 1.028)	0.997 (0.996 to 0.998)	0.907 (0.868 to 0.950)
Non-breeding Season	Baseline	70,648	1.004 (0.976 to 1.031)	-	-
	Impacted	68,305	1.003 (0.975 to 1.030)	0.999 (0.998 to 1.000)	0.967 (0.934 to 1.003)
Annual	Baseline	70,648	1.004 (0.976 to 1.031)	-	-
	Impacted	63,962	1.001 (0.973 to 1.028)	0.997 (0.996 to 0.998)	0.906 (0.873 to 0.939)

Cumulative PVA Assessment Excluding Berwick Bank

Breeding Season

11.12.51 When considering the cumulative impact during the breeding season on the regional population, the PVA predicted that the CPGR was 0.998 (Table 11.68) which translates to a decrease of 0.2% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.952 (Table 11.68), which is equivalent to a 4.8% decrease in population size. The results of the PVA suggest that the magnitude of impact during the breeding season will be low.

Non-breeding Season

11.12.52 When considering the cumulative impact during the non-breeding season on the regional population, the PVA predicted that the CPGR was 0.999 (Table 11.68) which translates to a decrease of 0.1% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.972 (Table 11.68), which is equivalent to a 2.8% decrease in population size. The results of the PVA suggest that the magnitude of impact during the breeding season will be low.

Annual

11.12.53 When considering the annual cumulative impact on the regional population, the PVA predicted that the CPGR was 0.998 (Table 11.68) which translates to a decrease of 0.2% in the growth rate (rounded to 1 decimal place) after 30 years compared to the unimpacted population. The CPS was 0.940 (Table 11.68), which is equivalent to a 6.0% decrease in population size. The results of the PVA suggest that the magnitude of impact during the breeding season will be low.

Table 11.68: Outputs of PVA for Cumulative Assessment of Collision Risk Impacts for Herring Gull for the Operational Life of the Proposed Development (up to 30 years) Excluding Berwick Bank. CI = Confidence Intervals Around Counterfactual Ratio Metrics Given in Parentheses

Bio-season	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
Breeding Season	Baseline	47,451	1.004 (0.976 to 1.031)	-	-

Bio-season	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
	Impacted	45,095	1.002 (0.975 to 1.030)	0.998 (0.997 to 1.000)	0.952 (0.910 to 0.996)
Non-breeding Season	Baseline	70,648	1.004 (0.976 to 1.031)	-	-
	Impacted	68,648	1.003 (0.975 to 1.030)	0.999 (0.998 to 1.000)	0.972 (0.938 to 1.008)
Annual	Baseline	70,648	1.004 (0.976 to 1.031)	-	-
	Impacted	66,357	1.002 (0.974 to 1.029)	0.998 (0.997 to 0.999)	0.940 (0.907 to 0.975)

Magnitude of the Impact

11.12.54 From the results of the PVA, it is predicted that the annual impact on growth rate is 0.3%, equivalent to an 9.4% decrease in population size for the annual scenario. Therefore, it can be determined that the magnitude of impact is low.

11.12.55 Although only the scenario with the highest impact has been taken forward to determine significance, it is noted that the results excluding Berwick Bank would result in no change to the magnitude of the impact.

Significance of the Effect

11.12.56 The magnitude of distributional responses is considered to be low, and the sensitivity of the VOR is considered to be very high. Following the matrix approach, as presented in Table 11.13, the cumulative impact of collision risk on herring gull is therefore considered to be moderate or major. Given herring gull are considered to have a moderate ability to recover from impacts and that the median growth rate indicated that the population will increase in all scenarios modelled, the impacts are considered to be **Moderate** adverse, which is significant in EIA terms.

Summary of the Effect

11.12.57 The assessment of cumulative collision risk during the O&M phase for great black-backed gull and herring gull found that the effect is expected to be significant in EIA terms (Table 11.69). As both gannet and kittiwake are expected to be impacted by both collision risk and displacement, the cumulative effect for the inter-related effect has been presented separately (from Paragraph 11.12.118).

11.12.58 It should be noted that the assessment of collision risk was carried out before the Applicant received a response from MD-LOT regarding the treatment of consented projects (Table 11.3). Within this response it was advised that Berwick Bank, Green Volt, Salamander and West of Orkney OWFs mortalities could be excluded from the cumulative assessment, meaning the assessment presented can be considered precautionary.

11.12.59 The removal of the four OWFs from the CEA would result in a notable change to the impact collision risk for three of the four species assessed, in particular herring gull where the number of mortalities could be expected to be reduced by close to 50%. The reduction of mortalities (compared to the including Berwick Bank scenario) and updated change in survival for each species assessed are:

- **Herring gull:** the number of mortalities is reduced by 64.00 (40.72%), resulting in an annual change in survival of 0.156 percentage points.
- **Kittiwake:** the number of mortalities is reduced by 745.48 (24.57%), resulting in an annual change in survival of 0.364 percentage points.
- **Gannet:** the number of mortalities is reduced by 189.50 (16.82%), resulting in an annual change in survival of 0.111 percentage points.
- **Great black-backed gull**: the number of mortalities is reduced by 15.87 (1.59%), resulting in an annual change in survival of 1.075 percentage points.

Table 11.69: Summary of Likely Significant Effect of Cumulative Collision Risk during the O&M Phase

Species	Significance of Effect of Impacts
Gannet	Although the potential for a significant effect, including and excluding Berwick Bank, due to collision risk alone was identified, as gannet are expected to be impacted by both collision risk and distributional responses a quantitative assessment was only carried out for the inter-related effects.
Kittiwake	Although the potential for a significant effect, including and excluding Berwick Bank, due to collision risk alone was identified, as kittiwake are expected to be impacted by both collision risk and distributional responses a quantitative assessment was only carried out for the inter-related effects.
Great black-backed gull	It is expected that there will be a significant effect on great black-backed gull arising from cumulative collision risk.
Herring gull	It is expected that there will be a significant effect on herring gull arising from cumulative collision risk.

Distributional Responses, Displacement and Barrier Effects from Offshore Infrastructure

11.12.60 The impact of distributional responses has the potential to occur cumulatively with other projects. As impacts are expected to be highest during the O&M phase of all developments, only impacts during the O&M phase have been assessed within the cumulative assessment.

11.12.61 Disturbance and subsequent displacement of seabirds during the construction phase is primarily centred around where construction vessels and construction activities are occurring. The activities may displace individuals that would normally reside within and around the area of sea where the Proposed Development is located. This in effect represents indirect habitat loss, which will potentially reduce the area available to those seabirds to forage, loaf and/or moult. The most realistic assumption is that at most there will be a degree of

construction overlap for all projects (and hence increased vessel and helicopter activity), but that it will be limited to a small number of cumulative effects associated with projects and other activities. As construction and decommissioning activities are temporary and highly localised, the impact from construction and decommissioning will be small with no significant effects occurring.

11.12.62 During the O&M phase, the presence of Wind Turbines has the potential to directly disturb and displace seabirds that would normally reside within and around the area of sea where the OWFs 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.

11.12.63 The species assessed for cumulative displacement impacts were gannet, kittiwake, guillemot, razorbill and puffin. Cumulative PVAs were not conducted for fulmar as this species has only recently started being considered quantitatively within assessments, meaning any cumulative assessment using available information is unlikely to be accurate.

11.12.64 There is no displacement impact from the proposed onshore application. Whilst there may be a displacement resulting from maintenance/repair activities associated with the Offshore Export Cables, any such displacement would be highly localised and temporary in nature and is therefore expected to be negligible.

Gannet

Sensitivity of Gannet to Displacement

11.12.65 As shown in Table 11.29, gannet is considered to have a low sensitivity to displacement.

Characterisation of the Impact

11.12.66 The estimated abundance of gannet for the purpose of estimating displacement impacts is given in Table 11.70.

Table 11.70: Gannet Cumulative Abundance Estimates. Only Projects Which Contribute Mortalities Have Been Presented.

Project	Breeding Season	Non-breeding Season
Aberdeen	35	5
Aspen	405	385
Ayre	181	91
Beatrice	151	0
Buchan	235	240
Caledonia	909	344
Cenos	216	263
Dogger Bank A and B	1,155	2,442
Dogger Bank C and Sofia	2,250	1,351
Dogger Bank South	1,560	2,473

Project	Breeding Season	Non-breeding Season
Dudgeon	53	36
East Anglia One	N/A (outside foraging range)	3,714
East Anglia One North	N/A (outside foraging range)	512
East Anglia Two	N/A (outside foraging range)	1,083
East Anglia Three	N/A (outside foraging range)	1,793
Five Estuaries	N/A (outside foraging range)	759
Galloper	N/A (outside foraging range)	1,183
Greater Gabbard	N/A (outside foraging range)	174
Green Volt	198	126
Gunfleet Sands	N/A (outside foraging range)	21
Hornsea One	671	944
Hornsea Project Two	457	1,264
Hornsea Project Three	1,333	1,508
Hornsea Project Four	976	1,191
Hywind	10	4
Inch Cape	2,398	915
Kentish Flats Extension	N/A (outside foraging range)	13
Kincardine	120	0
MarramWind	642	304
Moray (East)	564	319
Moray (West)	2,827	583
Muir Mhòr	597	667
Neart Na Gaoithe	1,987	833
Norfolk Boreas	1,229	2,249
Norfolk Vanguard	271	2,890
North Falls	N/A (outside foraging range)	483
Ossian	1,393	817
Outer Dowsing	554	779
Pentland	166	32
Race Bank	92	61
Rampion	N/A (outside foraging range)	590
Rampion 2	N/A (outside foraging range)	225
Salamander	442	369
Seagreen (1 and 1A)	2,956	996
Sheringham Shoal	47	33
Sheringham Shoal Extension and Dudgeon Extension	440	695
Teesside	1	0
Triton Knoll	211	39

Project	Breeding Season	Non-breeding Season
West of Orkney	852	1,508
Total	28,584	37,305
Berwick Bank	4,735	1,769
Bowdun	613	104
Total (including Berwick Bank)	**33,932**	**39,178**
Total (excluding Berwick Bank)	**29,197**	**37,409**

11.12.67 The cumulative displacement mortality of gannet is given in Table 11.71. Mortality was calculated using a 70% displacement and a range of 1% to 3% mortality in both the breeding and non-breeding season, in line with guidance (NatureScot, 2023a).

Table 11.71: Gannet Cumulative Displacement Mortality Estimates Per Year

Bio-season	Mean Peak Abundance	Regional Baseline Population	Number of Gannet Subject to Mortality	Decrease in Survival (percentage point change)
Including Berwick Bank				
Breeding	33,932	841,748	237.52 to 712.57	**0.028 to 0.085**
Non-breeding	39,178	248,385	274.25 to 822.74	**0.110 to 0.331**
Annual	-	841,748	511.77 to 1,535.32	**0.061 to 0.182**
Excluding Berwick Bank				
Breeding	29,197	841,748	204.38 to 613.14	**0.024 to 0.073**
Non-breeding	37,409	248,385	261.87 to 785.60	**0.105 to 0.316**
Annual	-	841,748	466.24 to 1,398.73	**0.055 to 0.166**

Magnitude of impact

11.12.68 The cumulative impact of displacement on gannet did reach the 0.02 percentage point threshold for PVA (NatureScot, 2023g). However, as gannet are impacted by both collision risk and distributional responses, a PVA has been carried out for the inter-related effects as detailed in Paragraphs 11.12.118 to 11.12.129.

Significance of the Effect

11.12.69 As gannet have been assessed for the inter-related effect of collision risk and distributional responses, the significance of the cumulative effect has been determined in Paragraphs 11.12.118 to 11.12.129.

Kittiwake

Sensitivity of Kittiwake to Displacement

11.12.70 As shown in Table 11.29, kittiwake is considered to have a low sensitivity to displacement.

Characterisation of the Effect

11.12.71 The estimated abundance of kittiwake for the purpose of estimating displacement impacts is given in Table 11.72.

Table 11.72: Kittiwake Cumulative Abundance Estimates Per Year. Only Projects Which Contribute Mortalities Have Been Presented.

Project	Breeding Season	Non-breeding Season
Aberdeen	663	37
Aspen	129	128
Ayre	430	806
Beatrice	1,430	2,224
Blyth Demo	591	1,480
Buchan	183	450
Caledonia	2,039	598
Cenos	208	97
Dogger Bank A and B	7,898	18,932
Dogger Bank C and Sofia	4,395	13,986
Dogger Bank South	10,915	18,660
East Anglia One	N/A (outside foraging range)	1,916
East Anglia One North	N/A (outside foraging range)	594
East Anglia Two	N/A (outside foraging range)	428
East Anglia Three	N/A (outside foraging range)	4,728
Five Estuaries	N/A (outside foraging range)	811
Green Volt	183	232
Hornsea One	N/A (outside foraging range)	32,248
Hornsea Project Two	N/A (outside foraging range)	3,424
Hornsea Project Three	N/A (outside foraging range)	6,345
Hornsea Project Four	N/A (outside foraging range)	6,234
Hywind	112	0
Inch Cape	3,866	2,138
Kincardine	229	0
MarramWind	890	144
Moray (East)	1,963	0
Moray (West)	6,902	2,544
Muir Mhòr	3,252	809
Neart Na Gaoithe	2,164	2,155
Norfolk Boreas	N/A (outside foraging range)	3,525
Norfolk Vanguard	N/A (outside foraging range)	2,210
North Falls	N/A (outside foraging range)	1,312
Ossian	3,183	1,147
Outer Dowsing	N/A (outside foraging range)	6,967

Project	Breeding Season	Non-breeding Season
Pentland	546	159
Salamander	3,719	220
Seagreen (1 and 1A)	3,235	4,572
Sheringham Shoal Extension and Dudgeon Extension	N/A (outside foraging range)	2,698
Triton Knoll	N/A (outside foraging range)	558
West of Orkney	1,113	2,016
Total	**60,238**	**147,530**
Berwick Bank	21,141	24,956
Bowdun	1,749	410
Total (including Berwick Bank)	**83,128**	**172,896**
Total (excluding Berwick Bank)	**61,987**	**147,940**

11.12.72 The cumulative displacement mortality of kittiwake is given in Table 11.73. Mortality was calculated using a 30% displacement and a range of 1% to 3% mortality in both the breeding and non-breeding season, in line with guidance (NatureScot, 2023a).

Table 11.73: Kittiwake Cumulative Displacement Mortality Estimates Per Year

Bio-season	Mean Peak Abundance	Regional Baseline Population	Number of Kittiwake Subject to Mortality	Decrease in Survival (percentage point change)
Including Berwick Bank				
Breeding	83,128	604,582	249.38 to 748.15	**0.041 to 0.124**
Non-breeding	172,896	627,816	518.69 to 1,556.07	**0.083 to 0.248**
Annual	-	627,816	768.07 to 2,304.22	**0.122 to 0.367**
Excluding Berwick Bank				
Breeding	61,987	602,897	185.96 to 557.88	**0.031 to 0.092**
Non-breeding	147,940	627,816	443.82 to 1,331.46	**0.071 to 0.212**
Annual	-	627,816	629.78 to 1,889.35	**0.100 to 0.301**

Magnitude of impact

11.12.73 The cumulative impact of displacement on kittiwake did reach the 0.02 percentage point threshold for PVA (NatureScot, 2023g). However, as kittiwake are impacted by both collision risk and distributional responses, a PVA has been carried out for the inter-related effects as detailed in Paragraphs 11.12.130 to 11.12.141.

Significance of the Effect

11.12.74 As kittiwake have been assessed for the inter-related effect of collision risk and distributional responses, the significance of the cumulative effect has been determined in Paragraphs 11.12.130 to 11.12.141.

Guillemot

Sensitivity of Guillemot to Displacement

11.12.75 As shown in Table 11.28, guillemot is considered to have a medium sensitivity to displacement.

Characterisation of the Effect

11.12.76 The estimated abundance of guillemot for the purpose of estimating displacement impacts is given in Table 11.74.

Table 11.74: Guillemot Cumulative Abundance Estimates. Only Projects Which Contribute Mortalities Have Been Presented.

Project	Breeding Season	Non-breeding Season
Aberdeen	547	225
Aspen	464	5,039
Green Volt	4,429	16,105
Hywind	249	2,136
Inch Cape	4,371	3,177
Kincardine	632	0
Muir Mhòr	13,122	11,863
Neart Na Gaoithe	1,755	3,761
Ossian	27,247	48,340
Salamander	3,616	11,779
Seagreen (1 and 1A)	24,724	8,800
Total	81,156	111,225
Berwick Bank	74,154	44,171
Bowdun	15,960	18,212
Total (including Berwick Bank)	**171,270**	**173,608**
Total (excluding Berwick Bank)	**97,116**	**129,437**

11.12.77 The cumulative displacement mortality of guillemot is given in Table 11.75. Mortality was calculated using a 60% displacement, and a range of 3% to 5% mortality for the breeding season, and 1% to 3% mortality for the non-breeding season, in line with guidance (NatureScot, 2023a).

Table 11.75: Guillemot Cumulative Displacement Mortality Estimates Per Year

Bio-season	Mean Peak Abundance	Regional Baseline Population	Number of Guillemot Subject to Mortality	Decrease in Survival (percentage point change)
Including Berwick Bank				
Breeding	171,270	250,506	3,082.87 to 5,138.11	**1.231 to 2.051**
Non-breeding	173,608	250,506	1,041.65 to 3,124.94	**0.416 to 1.247**
Annual	-	250,506	4,124.51 to 8,263.05	**1.646 to 3.299**

Bio-season	Mean Peak Abundance	Regional Baseline Population	Number of Guillemot Subject to Mortality	Decrease in Survival (percentage point change)
Excluding Berwick Bank				
Breeding	97,116	250,506	1,748.10 to 2,913.49	**0.698 to 1.163**
Non-breeding	129,437	250,506	776.62 to 2,329.86	**0.310 to 0.930**
Annual	-	250,506	2,542.72 to 5,243.35	**1.008 to 2.093**

11.12.78 As shown in Table 11.75, as the 0.02 percentage point threshold was met for the breeding season, non-breeding season and annual scenarios both including and excluding Berwick Bank. Therefore, six PVAs were required to further determine the magnitude of impact (see Volume 3, Technical Appendix 11.7: Offshore Ornithology Population Viability Analysis Technical Report for more information).

Cumulative PVA Assessment Including Berwick Bank

Breeding Season

11.12.79 When considering the cumulative impact during the breeding season on the regional population, the PVA predicted that the CPGR was 0.986 and 0.977 for the low and high impact scenario respectively (Table 11.76) which translates to a decrease of 1.4% to 2.3% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.649 to 0.485 for the low and high impact scenario respectively (Table 11.76), which is equivalent to a 35.1% to 51.5% decrease in population size. The results of the PVA suggest that the magnitude of impact during the breeding season will be medium.

Non-breeding Season

11.12.80 When considering the cumulative impact during the non-breeding season on the regional population, the PVA predicted that the CPGR was 0.995 and 0.986 for the low and high impact scenario respectively (Table 11.76) which translates to a decrease of 0.5% to 1.4% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.865 to 0.645 for the low and high impact scenario respectively (Table 11.76), which is equivalent to a 13.5% to 35.5% decrease in population size. The results of the PVA suggest that the magnitude of impact during the non-breeding season will be medium.

Annual

11.12.81 When considering the annual cumulative impact on the regional population, the PVA predicted that the CPGR was 0.981 and 0.963 for the low to high impact scenario respectively (Table 11.76) which translates to a decrease of 1.9% to 3.7% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.310 to 0.560 for the high and low impact scenario respectively (Table 11.76), which is equivalent to a 44.0% to 69.0% decrease in population size. The results of the PVA suggest that the magnitude of impact annually will be medium.

Table 11.76: Outputs of PVA for Cumulative Assessment of Distributional Responses for Guillemot for the Operational Life of the Proposed Development (up to 30 years) Including Berwick Bank. CI = Confidence Intervals Around Counterfactual Ratio Metrics Given in Parentheses

Bio-season	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
Breeding Season	Baseline	957,118	1.034 (1.024 to 1.044)	-	-
	Impacted: Low	621,097	1.020 (1.009 to 1.030)	0.986 (0.986 to 0.986)	0.649 (0.642 to 0.655)
	Impacted: High	463,772	1.010 (1.000 to 1.020)	0.977 (0.977 to 0.977)	0.485 (0.479 to 0.490)
Non-breeding Season	Baseline	957,118	1.034 (1.024 to 1.044)	-	-
	Impacted: Low	827,290	1.029 (1.019 to 1.039)	0.995 (0.995 to 0.996)	0.865 (0.857 to 0.872)
	Impacted: High	617,313	1.020 (1.009 to 1.030)	0.986 (0.986 to 0.986)	0.645 (0.639 to 0.651)
Annual	Baseline	957,118	1.034 (1.024 to 1.044)	-	-
	Impacted: Low	535,622	1.015 (1.005 to 1.025)	0.981 (0.981 to 0.982)	0.560 (0.554 to 0.566)
	Impacted: High	296,254	0.996 (0.985 to 1.006)	0.963 (0.962 to 0.963)	0.310 (0.305 to 0.314)

Cumulative PVA Assessment Excluding Berwick Bank

Breeding Season

11.12.82 When considering the cumulative impact during the breeding season on the regional population, the PVA predicted that the CPGR was 0.992 and 0.987 for the low and high impact scenario respectively (Table 11.77) which translates to a decrease of 0.8% to 1.3% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.783 to 0.665 for the low and high impact scenario respectively (Table 11.77), which is equivalent to a 21.7% to 36.5% decrease in population size. The results of the PVA suggest that the magnitude of impact during the breeding season will be medium.

Non-breeding Season

11.12.83 When considering the cumulative impact during the non-breeding season on the regional population, the PVA predicted that the CPGR was 0.997 and 0.990 for the low and high impact scenario respectively (Table 11.77) which translates to a decrease of 0.3% to 1.0% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.897 to 0.722 for the low and high impact scenario respectively (Table 11.77), which is equivalent to a 10.3% to 27.8% decrease in population size. The results of the PVA suggest that the magnitude of impact during the non-breeding season will be medium.

Annual

11.12.84 When considering the annual cumulative impact during the non-breeding season on the regional population, the PVA predicted that the CPGR was 0.989 and 0.976 for the low and high impact scenario respectively (Table 11.77) which translates to a decrease of 1.1% to 2.4% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.702 to 0.478 for the low and high impact scenario respectively (Table 11.77), which is equivalent to a 28.8% to 52.2% decrease in population size. The results of the PVA suggest that the magnitude of impact annually will be medium.

Table 11.77: Outputs of PVA for Cumulative Assessment of Distributional Responses for Guillemot for the Operational Life of the Proposed Development (up to 30 years) Excluding Berwick Bank. CI = Confidence Intervals Around Counterfactual Ratio Metrics Given in Parentheses

Bio-season	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
Breeding Season	Baseline	957,118	1.034 (1.024 to 1.044)	-	-
	Impacted: Low	749,754	1.026 (1.016 to 1.036)	0.992 (0.992 to 0.992)	0.783 (0.776 to 0.790)
	Impacted: High	635,939	1.021 (1.010 to 1.031)	0.987 (0.987 to 0.987)	0.665 (0.658 to 0.671)
Non-breeding Season	Baseline	957,118	1.034 (1.024 to 1.044)	-	-
	Impacted: Low	858,140	1.031 (1.020 to 1.041)	0.997 (0.996 to 0.997)	0.897 (0.890 to 0.905)
	Impacted: High	690,781	1.023 (1.013 to 1.033)	0.990 (0.989 to 0.990)	0.722 (0.715 to 0.728)
Annual	Baseline	957,118	1.034 (1.024 to 1.044)	-	-
	Impacted: Low	672,128	1.023 (1.012 to 1.033)	0.989 (0.988 to 0.989)	0.702 (0.695 to 0.709)
	Impacted: High	456,978	1.010 (0.999 to 1.020)	0.976 (0.976 to 0.977)	0.478 (0.472 to 0.483)

Magnitude of impact

11.12.85 From the results of the PVAs, it is predicted that the maximum impact on growth rate is 3.7%, equivalent to a 55.8% decrease in population size for the annual scenario. Therefore, it can be determined that the magnitude of impact during is medium.

11.12.86 Although only the scenario with the highest impact has been taken forward to determine significance, it is noted that the results excluding Berwick Bank would result in no change to the magnitude of the impact.

Significance of the Effect

11.12.87 The magnitude of impact is considered to be medium, and the sensitivity of the VOR is considered to be medium. Following the matrix approach, as presented in Table 11.13, the cumulative impact of displacement on guillemot is therefore considered to be **Moderate** adverse, which is significant in EIA terms.

Razorbill

Sensitivity of Razorbill to Displacement

11.12.88 As shown in Table 11.28, razorbill is considered to have a medium sensitivity to displacement.

Characterisation of the Effect

11.12.89 The estimated abundance of razorbill for the purpose of estimating displacement impacts is given in Table 11.78.

Table 11.78: Razorbill Cumulative Abundance Estimates. Only Projects Which Contribute Mortalities Have Been Presented.

Project	Breeding Season	Non-breeding Season
Aberdeen	161	97
Aspen	79	61
Ayre	1,204	1,178
Beatrice	N/A (outside foraging range)	2,221
Blyth Demo	N/A (outside foraging range)	243
Buchan	N/A (outside foraging range)	218
Caledonia	1,762	2,624
Dogger Bank A	N/A (outside foraging range)	7,453
Dogger Bank B	N/A (outside foraging range)	9,359
Dogger Bank C	N/A (outside foraging range)	3,188
Dogger Bank South	N/A (outside foraging range)	27,654
Dudgeon	N/A (outside foraging range)	1,437
Dudgeon Extension	N/A (outside foraging range)	1,589
East Anglia One	N/A (outside foraging range)	517
East Anglia One North	N/A (outside foraging range)	346
East Anglia Two	N/A (outside foraging range)	410
East Anglia Three	N/A (outside foraging range)	4,145
Five Estuaries	N/A (outside foraging range)	2,086
Galloper	N/A (outside foraging range)	543
Greater Gabbard	N/A (outside foraging range)	471
Green Volt	457	99
Gunfleet Sands	N/A (outside foraging range)	30
Hornsea One	N/A (outside foraging range)	8,133
Hornsea Project Two	N/A (outside foraging range)	6,609
Hornsea Project Three	N/A (outside foraging range)	7,774

Project	Breeding Season	Non-breeding Season
Hornsea Project Four	N/A (outside foraging range)	5,215
Humber Gateway	N/A (outside foraging range)	53
Hywind	30	729
Inch Cape	1,436	3,521
Kincardine	22	0
Lincs and Lynn and Inner Dowsing	N/A (outside foraging range)	90
London Array	N/A (outside foraging range)	54
MarriamWind	356	1,214
Moray (East)	N/A (outside foraging range)	1,301
Moray (West)	N/A (outside foraging range)	7,313
Muir Mhòr	1,549	1,547
Neart Na Gaoithe	331	6,000
Norfolk Boreas	N/A (outside foraging range)	1,673
Norfolk Vanguard	N/A (outside foraging range)	2,629
North Falls	N/A (outside foraging range)	3,770
Ossian	2,608	1,855
Outer Dowsing	N/A (outside foraging range)	9,098
Race Bank	N/A (outside foraging range)	112
Rampion	N/A (outside foraging range)	4,637
Rampion 2	N/A (outside foraging range)	7,522
Salamander	334	484
Seagreen 1	5,876	1,103
Seagreen 1A Project	3,698	1,272
Sheringham Shoal	N/A (outside foraging range)	1,584
Sheringham Shoal Extension	N/A (outside foraging range)	4,906
Sofia	N/A (outside foraging range)	4,971
Teesside	N/A (outside foraging range)	83
Thanet	N/A (outside foraging range)	35
Triton Knoll	N/A (outside foraging range)	1,226
Westermost Rough	N/A (outside foraging range)	364
Total	19,903	162,846
Berwick Bank	4,040	17,728
Bowdun	2,675	728
Total (including Berwick Bank)	**26,618**	**181,302**
Total (excluding Berwick Bank)	**22,578**	**163,574**

11.12.90 The cumulative displacement mortality of razorbill is given in Table 11.79. Mortality was calculated using a 60% displacement, and a range of 3% to 5%

mortality for the breeding season, and 1% to 3% mortality for the non-breeding season, in line with guidance (NatureScot, 2023a).

Table 11.79: Razorbill Cumulative Displacement Mortality Estimates Per Year

Bio-season	Mean Peak Abundance	Regional Baseline Population	Number of Razorbill Subject to Mortality	Decrease in Survival (percentage point change)
Including Berwick Bank				
Breeding	26,618	90,519	479.12 to 798.54	**0.529 to 0.882**
Non-breeding	181,263	218,622	1,087.81 to 3,263.43	**0.498 to 1.493**
Annual	-	218,622	1,566.93 to 4,061.97	**0.717 to 1.858**
Excluding Berwick Bank				
Breeding	22,675	90,519	406.40 to 677.34	**0.449 to 0.748**
Non-breeding	163,535	218,622	981.44 to 2,944.33	**0.449 to 1.347**
Annual	-	218,622	1,387.84 to 3,621.66	**0.635 to 1.657**

11.12.91 As shown in Table 11.79, as the 0.02 percentage point threshold was met for the breeding season, non-breeding season and annual scenarios. Therefore, six PVAs were required to further determine the magnitude of impact (see Volume 3, Technical Appendix 11.7: Offshore Ornithology Population Viability Analysis Technical Report for more information).

Cumulative PVA Assessment Including Berwick Bank

Breeding season

11.12.92 When considering the cumulative impact during the breeding season on the regional population, the PVA predicted that the CPGR was 0.994 and 0.990 for the low and high impact scenario respectively (Table 11.80) which translates to a decrease of 0.6% to 1.0% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.828 to 0.730 for the low and high impact scenario respectively (Table 11.80), which is equivalent to a 17.2% to 27.0% decrease in population size. The results of the PVA suggest that the magnitude of impact during the breeding season will be medium.

Non-breeding Season

11.12.93 When considering the cumulative impact during the non-breeding season on the regional population, the PVA predicted that the CPGR was 0.994 and 0.983 for the low and high impact scenario respectively (Table 11.80) which translates to a decrease of 0.6% to 1.7% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.838 to 0.586 for the low and high impact scenario respectively (Table 11.80), which is equivalent to a 16.2% to 41.4% decrease in population size. The results of the PVA suggest that the magnitude of impact during the breeding season will be medium.

Annual

11.12.94 When considering the annual cumulative impact annually on the regional population, the PVA predicted that the CPGR was 0992 and 0.979 for the low

and high impact scenario respectively (Table 11.80) which translates to a decrease of 0.8% to 2.1% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.775 to 0.514 for the low and high impact scenario respectively (Table 11.80), which is equivalent to a 22.5% to 48.6% decrease in population size. The results of the PVA suggest that the magnitude of impact annually will be medium.

Table 11.80: Outputs of PVA for Cumulative Assessment of Distributional Responses for Razorbill Including Berwick Bank for the Operational Life of the Proposed Development (up to 30 years). CI = Confidence Intervals Around Counterfactual Ratio Metrics Given in Parentheses

Bio-season	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
Breeding Season	Baseline	156,072	1.014 (0.988 to 1.038)	-	-
	Impacted: Low	129,071	1.008 (0.982 to 1.032)	0.994 (0.993 to 0.995)	0.828 (0.810 to 0.846)
	Impacted: High	113,953	1.003 (0.978 to 1.028)	0.990 (0.989 to 0.991)	0.730 (0.714 to 0.746)
Non-breeding Season	Baseline	421,881	1.013 (0.988 to 1.038)	-	-
	Impacted: Low	353,315	1.008 (0.982 to 1.032)	0.994 (0.994 to 0.995)	0.838 (0.825 to 0.850)
	Impacted: High	247,494	0.996 (0.971 to 1.021)	0.983 (0.982 to 0.983)	0.586 (0.574 to 0.597)
Annual	Baseline	421,881	1.013 (0.988 to 1.038)	-	-
	Impacted: Low	327,190	1.005 (0.980 to 1.030)	0.992 (0.991 to 0.992)	0.775 (0.762 to 0.787)
	Impacted: High	216,769	0.992 (0.967 to 1.016)	0.979 (0.978 to 0.979)	0.514 (0.502 to 0.524)

Cumulative PVA Assessment Excluding Berwick Bank

Breeding season

11.12.95 When considering the cumulative impact during the breeding season on the regional population, the PVA predicted that the CPGR was 0.995 and 0.991 for the low and high impact scenario respectively (Table 11.81) which translates to a decrease of 0.5% to 0.9% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.852 to 0.766 for the low and high impact scenario respectively (Table 11.81), which is equivalent to a 14.8% to 23.4% decrease in population size. The results of the PVA suggest that the magnitude of impact during the breeding season will be medium.

Non-breeding Season

11.12.96 When considering the cumulative impact during the non-breeding season on the regional population, the PVA predicted that the CPGR was 0.995 and 0.985

for the low and high impact scenario respectively (Table 11.81) which translates to a decrease of 0.5% to 1.5% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.853 to 0.618 for the low and high impact scenario respectively (Table 11.81), which is equivalent to a 14.7% to 38.2% decrease in population size. The results of the PVA suggest that the magnitude of impact during the non-breeding season will be medium.

Annual

11.12.97 When considering the annual cumulative impact during the non-breeding season on the regional population, the PVA predicted that the CPGR was 0.993 and 0.981 for the low and high impact scenario respectively (Table 11.81) which translates to a decrease of 0.7% to 1.9% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.798 to 0.553 for the low and high impact scenario respectively (Table 11.81), which is equivalent to a 20.2% to 44.7% decrease in population size. The results of the PVA suggest that the magnitude of impact during the breeding season will be medium.

Table 11.81: Outputs of PVA for Cumulative Assessment of Distributional Responses for Razorbill Excluding Berwick Bank for the Operational Life of the Proposed Development (up to 30 years). CI = Confidence Intervals Around Counterfactual Ratio Metrics Given in Parentheses

Bio-season	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
Breeding Season	Baseline	156,072	1.014 (0.988 to 1.038)	-	-
	Impacted: Low	133,039	1.009 (0.983 to 1.033)	0.995 (0.994 to 0.995)	0.852 (0.834 to 0.870)
	Impacted: High	119,292	1.005 (0.980 to 1.029)	0.991 (0.991 to 0.992)	0.766 (0.748 to 0.782)
Non-breeding Season	Baseline	421,881	1.013 (0.988 to 1.038)	-	-
	Impacted: Low	359,481	1.008 (0.983 to 1.033)	0.995 (0.994 to 0.995)	0.853 (0.840 to 0.865)
	Impacted: High	260,862	0.998 (0.973 to 1.022)	0.985 (0.984 to 0.985)	0.618 (0.606 to 0.629)
Annual	Baseline	421,881	1.013 (0.988 to 1.038)	-	-
	Impacted: Low	336,480	1.006 (0.981 to 1.031)	0.993 (0.992 to 0.993)	0.798 (0.785 to 0.810)
	Impacted: High	233,136	0.994 (0.969 to 1.019)	0.981 (0.980 to 0.982)	0.553 (0.541 to 0.563)

Magnitude of the Impact

11.12.98 From the results of the PVA, it is predicted that the maximum impact on growth rate is 2.1%, equivalent to a 48.6% decrease in population size for the annual scenario. Therefore, it can be determined that the magnitude of impact is medium.

11.12.99 Although only the scenario with the highest impact has been taken forward to determine significance, it is noted that the results excluding Berwick Bank would result in no change to the magnitude of the impact.

Significance of the Effect

11.12.100 The magnitude of impact is considered to be medium, and the sensitivity of the VOR is considered to be medium. Following the matrix approach, as presented in Table 11.13, the cumulative impact of displacement on razorbill is therefore considered to be **Moderate** adverse, which is significant in EIA terms.

Puffin

Sensitivity of Puffin to Displacement

11.12.101 As shown in Table 11.28, puffin is considered to have a medium sensitivity to displacement.

Characterisation of the Effect

11.12.102 The estimated abundance of puffin for the purpose of estimating displacement impacts is given in Table 11.82.

Table 11.82: Puffin Cumulative Abundance Estimates. Only Projects Which Contribute Mortalities Have Been Presented.

Project	Breeding Season	Non-breeding Season
Aberdeen	42	82
Aspen	355	112
Ayre	791	1,360
Beatrice	2,858	2,435
Blyth Demo	235	123
Buchan	938	524
Caledonia	2,061	1,336
Cenos	221	67
Dogger Bank A	N/A (outside foraging range)	295
Dogger Bank B	N/A (outside foraging range)	743
Dogger Bank C	N/A (outside foraging range)	273
Dogger Bank South	N/A (outside foraging range)	373
Dudgeon	N/A (outside foraging range)	3
Dudgeon Extension	N/A (outside foraging range)	46
East Anglia One	N/A (outside foraging range)	32
East Anglia Three	N/A (outside foraging range)	307
Galloper	N/A (outside foraging range)	1
Greater Gabbard	N/A (outside foraging range)	1
Green Volt	250	41
Hornsea One	N/A (outside foraging range)	1,257
Hornsea Project Two	N/A (outside foraging range)	2,039
Hornsea Project Three	N/A (outside foraging range)	67

Project	Breeding Season	Non-breeding Season
Hornsea Project Four	N/A (outside foraging range)	442
Humber Gateway	N/A (outside foraging range)	10
Hywind	119	85
Inch Cape	2,956	2,688
Kentish Flats Extension	N/A (outside foraging range)	6
Kincardine	19	0
Lincs, Lynn and Inner Dowsing	N/A (outside foraging range)	6
London Array	N/A (outside foraging range)	1
MarramWind	564	50
Moray (East)	2,795	656
Moray (West)	1,115	3,966
Muir Mhòr	1,812	1,812
Neart Na Gaoithe	2,562	2,103
Norfolk Boreas	N/A (outside foraging range)	23
Norfolk Vanguard	N/A (outside foraging range)	112
North Falls	N/A (outside foraging range)	1
Ossian	1,928	1,178
Outer Dowsing	N/A (outside foraging range)	696
Pentland	6,521	6
Race Bank	N/A (outside foraging range)	10
Salamander	357	0
Seagreen 1	2,572	1,526
Seagreen 1A Project	3,582	3,863
Sheringham Shoal	N/A (outside foraging range)	26
Sheringham Shoal Extension	N/A (outside foraging range)	18
Sofia	N/A (outside foraging range)	329
Teesside	35	18
Triton Knoll	N/A (outside foraging range)	71
Westermost Rough	N/A (outside foraging range)	35
West of Orkney	5,272	2,136
Total	39,960	33,390
Berwick Bank	4,513	8,892
Bowdun	377	705
Total (including Berwick Bank)	**44,850**	**42,987**
Total (excluding Berwick Bank)	**40,337**	**34,095**

11.12.103 The cumulative displacement mortality of puffin is given in Table 11.83. Mortality was calculated using a 60% displacement, and a range of 3% to 5% mortality

for the breeding season, and 1% to 3% mortality for the non-breeding season, in line with guidance (NatureScot, 2023a).

Table 11.83: Puffin Cumulative Displacement Mortality Estimates Per Year

Bio-season	Mean Peak Abundance	Regional Baseline Population	Number of Puffin Subject to Mortality	Decrease in Survival (percentage point change)
Including Berwick Bank				
Breeding	44,850	507,599	807.30 to 1,345.49	**0.159 to 0.265**
Non-breeding	42,987	231,957	257.92 to 773.76	**0.111 to 0.334**
Annual	-	507,599	1,065.22 to 2,119.26	**0.210 to 0.418**
Excluding Berwick Bank				
Breeding	40,337	507,599	726.06 to 1,210.10	**0.143 to 0.238**
Non-breeding	34,095	231,957	204.57 to 613.71	**0.088 to 0.265**
Annual	-	507,599	930.63 to 1,823.81	**0.183 to 0.359**

11.12.104 As shown in Table 11.83, as the 0.02 percentage point threshold was met for the breeding season, non-breeding season and annual scenarios, both including and excluding Berwick Bank. Therefore, six PVAs were required to further determine the magnitude of impact (see Volume 3, Technical Appendix 11.7: Offshore Ornithology Population Viability Analysis Technical Report for more information).

Cumulative PVA Assessment Including Berwick Bank

Breeding Season

11.12.105 When considering the cumulative impact during the breeding season on the regional population, the PVA predicted that the CPGR was 0.998 and 0.997 for the low and high impact scenario respectively (Table 11.84) which translates to a decrease of 0.2% to 0.3% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.942 to 0.905 for the low and high impact scenario respectively (Table 11.84), which is equivalent to a 5.8% to 9.5% decrease in population size. The results of the PVA suggest that the magnitude of impact during the breeding season will be low.

Non-breeding Season

11.12.106 When considering the cumulative impact during the non-breeding season on the regional population, the PVA predicted that the CPGR was 0.999 and 0.996 for the low and high impact scenario respectively (Table 11.84) which translates to a decrease of 0.1% to 0.4% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.959 to 0.881 for the low and high impact scenario respectively (Table 11.84), which is equivalent to a 4.1% to 11.9% decrease in population size. The results of the PVA suggest that the magnitude of impact during the non-breeding season will be low.

Annual

11.12.107 When considering the annual cumulative impact on the regional population, the PVA predicted that the CPGR was 0.997 and 0.995 for the low and high impact

scenario respectively (Table 11.84) which translates to a decrease of 0.3% to 0.5% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.924 to 0.854 for the low and high impact scenario respectively (Table 11.84), which is equivalent to a 7.6% to 14.6% decrease in population size. The results of the PVA suggest that the magnitude of impact annually will be low.

Table 11.84: Outputs of PVA for Cumulative Assessment of Distributional Responses for Puffin Including Berwick Bank for the Operational Life of the Proposed Development (up to 30 years). CPS = Counterfactual (Ratio) of Final Population Size, CPC = Counterfactual (Ratio) of Population Growth Rate, CI = Confidence Intervals Around Counterfactual Ratio Metrics Given in Parentheses

Bio-season	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
Breeding Season	Baseline	97,840	0.960 (0.940 to 0.980)	-	-
	Impacted: Low	92,061	0.958 (0.938 to 0.978)	0.998 (0.997 to 0.999)	0.942 (0.922 to 0.961)
	Impacted: High	88,352	0.957 (0.936 to 0.977)	0.997 (0.996 to 0.997)	0.905 (0.886 to 0.923)
Non-breeding Season	Baseline	31,139	0.960 (0.939 to 0.980)	-	-
	Impacted: Low	29,878	0.959 (0.938 to 0.979)	0.999 (0.998 to 1.000)	0.959 (0.924 to 0.995)
	Impacted: High	27,415	0.956 (0.935 to 0.977)	0.996 (0.995 to 0.997)	0.881 (0.847 to 0.915)
Annual	Baseline	97,840	0.960 (0.940 to 0.980)	-	-
	Impacted: Low	90,154	0.957 (0.937 to 0.978)	0.997 (0.997 to 0.998)	0.924 (0.904 to 0.943)
	Impacted: High	83,478	0.955 (0.935 to 0.975)	0.995 (0.994 to 0.996)	0.854 (0.835 to 0.872)

Cumulative PVA Assessment Excluding Berwick Bank

Breeding Season

11.12.108 When considering the cumulative impact during the breeding season on the regional population, the PVA predicted that the CPGR was 0.998 and 0.997 for the low and high impact scenario respectively (Table 11.85) which translates to a decrease of 0.2% to 0.3% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.948 to 0.914 for the low and high impact scenario respectively (Table 11.85), which is equivalent to a 5.2% to 8.6% decrease in population size. The results of the PVA suggest that the magnitude of impact during the breeding season will be low.

Non-breeding Season

11.12.109 When considering the cumulative impact during the non-breeding season on the regional population, the PVA predicted that the CPGR was 0.999 and 0.997 for the low and high impact scenario respectively (Table 11.85) which translates to a decrease of 0.1% to 0.3% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.967 to 0.905 for the low and high impact scenario respectively (Table 11.85), which is equivalent to a 3.3% to 9.5% decrease in population size. The results of the PVA suggest that the magnitude of impact during the non-breeding season will be low.

Annual

11.12.110 When considering the annual cumulative impact on the regional population, the PVA predicted that the CPGR was 0.998 and 0.996 for the low and high impact scenario respectively (Table 11.85) which translates to a decrease of 0.2% to 0.4% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.933 to 0.873 for the low and high impact scenario respectively (Table 11.85), which is equivalent to a 6.7% to 12.7% decrease in population size. The results of the PVA suggest that the magnitude of impact annually will be low.

Table 11.85: Outputs of PVA for Cumulative Assessment of Distributional Responses for Puffin Excluding Berwick Bank for the Operational Life of the Proposed Development (up to 30 years). CPS = Counterfactual (Ratio) of Final Population Size, CPC = Counterfactual (Ratio) of Population Growth Rate, CI = Confidence Intervals Around Counterfactual Ratio Metrics Given in Parentheses

Bio-season	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
Breeding Season	Baseline	97,840	0.960 (0.940 to 0.980)	-	-
	Impacted: Low	92,550	0.958 (0.938 to 0.978)	0.998 (0.998 to 0.999)	0.948 (0.928 to 0.967)
	Impacted: High	89,298	0.957 (0.937 to 0.977)	0.997 (0.996 to 0.998)	0.914 (0.895 to 0.932)
Non-breeding Season	Baseline	31,139	0.960 (0.939 to 0.980)	-	-
	Impacted: Low	30,126	0.959 (0.938 to 0.980)	0.999 (0.998 to 1.000)	0.967 (0.930 to 1.005)
	Impacted: High	28,199	0.957 (0.936 to 0.977)	0.997 (0.996 to 0.998)	0.905 (0.871 to 0.942)
Annual	Baseline	97,840	0.960 (0.940 to 0.980)	-	-
	Impacted: Low	91,208	0.958 (0.937 to 0.978)	0.998 (0.997 to 0.998)	0.933 (0.914 to 0.952)
	Impacted: High	85,235	0.956 (0.935 to 0.976)	0.996 (0.995 to 0.996)	0.873 (0.854 to 0.891)

Magnitude of Impact

11.12.111 From the results of the PVA, it is predicted that the maximum impact on growth rate is 0.5%, equivalent to a 14.6% decrease in population size for the annual scenario. Therefore, it can be determined that the magnitude of impact is low.

11.12.112 Although only the scenario with the highest impact has been taken forward to determine the significance, it is noted that the results excluding Berwick Bank would result in no change to the magnitude of the impact.

Significance of the Effect

11.12.113 The magnitude of impact is considered to be low, and the sensitivity of the VOR is considered to be medium. Following the matrix approach, as presented in Table 11.13, the cumulative impact of displacement on puffin is therefore considered to be **Minor** adverse, which is not significant in EIA terms.

Summary of the Effect

11.12.114 The assessment of cumulative displacement during the O&M phase for puffin found that the effect is not expected to be significant in EIA terms (Table 11.86). Whereas the assessment of guillemot and razorbill found that there is expected to be a significant effect in EIA terms, due to the cumulative effect of displacement.

11.12.115 As both gannet and kittiwake are expected to be impacted by both collision risk and displacement, the cumulative effect for the inter-related effect has been presented separately (from Paragraph 11.12.118).

11.12.116 It should be noted that the assessment of distributional responses was carried out before the Applicant received a response from MD-LOT regarding the treatment of consented projects (Table 11.3). Within this response it was advised that Berwick Bank, Green Volt, Salamander and West of Orkney OWFs mortalities could be excluded from the cumulative assessment, meaning the assessment presented can be considered precautionary.

11.12.117 The removal of the four OWFs from the CEA would result in a notable change to the impact distributional responses for four of the five species assessed, in particular guillemot where the number of mortalities could be expected to be reduced by close to 50%. The reduction of mortalities (compared to the high displacement, including Berwick Bank scenario) and updated change in survival for each species assessed are:

- Guillemot: the number of mortalities is reduced by 3,762.96 (45.54%), resulting in an annual change in survival of 1.796 percentage points.
- Kittiwake: the number of mortalities is reduced by 482.21 (20.93%), resulting in an annual change in survival of 0.290 percentage points.
- Razorbill: the number of mortalities is reduced by 772.44 (19.02%), resulting in an annual change in survival of 1.505 percentage points.
- Gannet: the number of mortalities is reduced by 209.96 (13.68%), resulting in an annual change in survival of 0.157 percentage points.

- Puffin: the number of mortalities is reduced by 57.40 (2.71%), resulting in an annual change in survival of 0.406 percentage points.

Table 11.86: Summary of Significant Effect of Cumulative Distributional Responses During the O&M Phase

Species	Significance of Effect of Residual Impacts After Additional Mitigation
Gannet	Although the potential for a significant effect, including and excluding Berwick Bank, due to distributional responses alone was identified, as gannet are expected to be impacted by both collision risk and distributional responses a quantitative assessment was only carried out for the inter-related effects.
Kittiwake	Although the potential for a significant effect, including and excluding Berwick Bank, due to distributional responses alone was identified, as kittiwake are expected to be impacted by both collision risk and distributional responses a quantitative assessment was only carried out for the inter-related effects.
Guillemot	There would be a likely significant effect on guillemot arising from cumulative displacement.
Razorbill	There would be a likely significant effect on razorbill arising from cumulative displacement.
Puffin	There would not be a likely significant effect on puffin arising from cumulative displacement.

Inter-related Effects of Collision Risk and Distributional Responses

Gannet

Sensitivity of Gannet to Collision Risk and Displacement

11.12.118 Within the assessment, the sensitivity of gannet to collision risk is high (Table 11.16) and the sensitivity to displacement is low (Table 11.29). As a precautionary approach, a high sensitivity has been used as the sensitivity to the inter-related effects of collision risk and displacement.

Characterisation of the Effect

11.12.119 The cumulative combined mortality for collision risk and displacement impacts of gannet is given in Table 11.87. Mortality was calculated using a 70% displacement and a range of 1% to 3% mortality in both the breeding and non-breeding season, in line with guidance (NatureScot, 2023a).

Table 11.87: Gannet Cumulative Combined Collision Risk and Displacement Impacts Per Year Exclusive of Berwick Bank

Bio-season	Regional Baseline Population	Number of Gannet Subject to Mortality	Decrease in Survival (percentage point change)
Including Berwick Bank			
Breeding	841,748	1,203.63 to 1,678.68	**0.143 to 0.199**
Non-breeding	248,385	434.69 to 983.18	**0.175 to 0.396**
Annual	841,748	1,638.31 to 2,661.86	**0.195 to 0.316**

Bio-season	Regional Baseline Population	Number of Gannet Subject to Mortality	Decrease in Survival (percentage point change)
Excluding Berwick Bank			
Breeding	841,748	1,046.84 to 1,455.60	**0.124 to 0.173**
Non-breeding	248,385	417.72 to 941.45	**0.168 to 0.379**
Annual	841,748	1,464.56 to 2,397.05	**0.174 to 0.285**

11.12.120 As shown in Table 11.87, as the 0.02 percentage point threshold was met for the breeding season, non-breeding season and annual scenarios, both including and excluding Berwick Bank. Therefore, six PVAs were required to further determine the magnitude of impact (see Volume 3, Technical Appendix 11.7: Offshore Ornithology Population Viability Analysis Technical Report for more information).

Cumulative PVA Assessment Including Berwick Bank

Breeding Season

11.12.121 When considering the cumulative impact during the breeding season on the regional population, the PVA predicted that the CPGR was 0.998 for both the low and high impact scenarios (Table 11.88), which translates to a decrease of 0.2% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.949 to 0.929 for the low and high impact scenario respectively (Table 11.88), which is equivalent to a 5.1% to 7.1% decrease in population size. The results of the PVA suggest that the magnitude of impact during the breeding season will be low.

Non-breeding Season

11.12.122 When considering the cumulative impact during the non-breeding season on the regional population, the PVA predicted that the CPGR was 0.998 and 0.995 for the low and high impact scenario respectively (Table 11.88) which translates to a decrease of 0.2% to 0.5% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.938 to 0.865 for the low and high impact scenario respectively (Table 11.88), which is equivalent to a 6.2% to 13.5% decrease in population size. The results of the PVA suggest that the magnitude of impact during the non-breeding season will be low.

Annual

11.12.123 When considering the annual cumulative impact on the regional population, the PVA predicted that the CPGR was 0.998 and 0.996 for the low and high impact scenario respectively (Table 11.88) which translates to a decrease of 0.2% to 0.4% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.931 to 0.890 for the low and high impact scenario respectively (Table 11.88), which is equivalent to an 6.9% to 11.0% decrease in population size. The results of the PVA suggest that the magnitude of impact annually will be low.

Table 11.88: Outputs of PVA for Cumulative Assessment of Combined Collision and Displacement Impacts for Gannet Including Berwick Bank for the Operational Life of the Proposed Development (up to 30 years). CI = Confidence Intervals Around Counterfactual Ratio Metrics Given in Parentheses

Bio-season	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
Breeding Season	Baseline	1,097,475	1.006 (0.994 to 1.018)	-	-
	Impacted: Low	1,042,201	1.005 (0.992 to 1.016)	0.998 (0.998 to 0.999)	0.949 (0.942 to 0.956)
	Impacted: High	1,019,567	1.004 (0.991 to 1.015)	0.998 (0.997 to 0.998)	0.929 (0.922 to 0.936)
Non-breeding Season	Baseline	335,699	1.006 (0.994 to 1.018)	-	-
	Impacted: Low	315,047	1.004 (0.992 to 1.016)	0.998 (0.998 to 0.998)	0.938 (0.925 to 0.951)
	Impacted: High	290,198	1.002 (0.989 to 1.013)	0.995 (0.995 to 0.996)	0.865 (0.852 to 0.877)
Annual	Baseline	1,097,475	1.006 (0.994 to 1.018)	-	-
	Impacted: Low	1,021,871	1.004 (0.991 to 1.015)	0.998 (0.997 to 0.998)	0.931 (0.924 to 0.938)
	Impacted: High	977,592	1.002 (0.990 to 1.014)	0.996 (0.996 to 0.996)	0.890 (0.884 to 0.897)

Cumulative PVA Assessment Excluding Berwick Bank

Breeding Season

11.12.124 When considering the cumulative impact during the breeding season on the regional population, the PVA predicted that the CPGR was 0.999 to 0.998 for the low and high impact scenario respectively (Table 11.89), which translates to a decrease of 0.1% to 0.2% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.955 to 0.938 for the low and high impact scenario respectively (Table 11.89), which is equivalent to a 4.5% to 6.2% decrease in population size. The results of the PVA suggest that the magnitude of impact during the breeding season will be negligible.

Non-breeding Season

11.12.125 When considering the cumulative impact during the non-breeding season on the regional population, the PVA predicted that the CPGR was 0.998 and 0.996 for the low and high impact scenario respectively (Table 11.89) which translates to a decrease of 0.2% to 0.4% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.940 to 0.870 for the low and high impact scenario respectively (Table 11.89), which is equivalent to a 6.0% to 13.0% decrease in population size. The results of the PVA suggest that the magnitude of impact during the non-breeding season will be low.

Annual

11.12.126 When considering the annual cumulative impact on the regional population, the PVA predicted that the CPGR was 0.998 and 0.997 for the low and high impact scenario respectively (Table 11.89) which translates to a decrease of 0.2% to 0.3% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.938 to 0.901 for the low and high impact scenario respectively (Table 11.89), which is equivalent to a 6.2% to 9.9% decrease in population size. The results of the PVA suggest that the magnitude of impact annually will be low.

Table 11.89: Outputs of PVA for Cumulative Assessment of Combined Collision and Displacement Impacts for Gannet Excluding Berwick Bank for the Operational Life of the Proposed Development (up to 30 years). CI = Confidence Intervals Around Counterfactual Ratio Metrics Given in Parentheses

Bio-season	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
Breeding Season	Baseline	1,097,475	1.006 (0.994 to 1.018)	-	-
	Impacted: Low	1,048,600	1.005 (0.992 to 1.016)	0.999 (0.998 to 0.999)	0.955 (0.948 to 0.962)
	Impacted: High	1,030,002	1.004 (0.992 to 1.016)	0.998 (0.998 to 0.998)	0.938 (0.932 to 0.945)
Non-breeding Season	Baseline	335,699	1.006 (0.994 to 1.018)	-	-
	Impacted: Low	315,446	1.004 (0.992 to 1.016)	0.998 (0.998 to 0.998)	0.940 (0.927 to 0.953)
	Impacted: High	292,303	1.002 (0.989 to 1.014)	0.996 (0.995 to 0.996)	0.870 (0.857 to 0.882)
Annual	Baseline	1,097,475	1.006 (0.994 to 1.018)	-	-
	Impacted: Low	1,029,260	1.004 (0.992 to 1.016)	0.998 (0.998 to 0.998)	0.938 (0.931 to 0.945)
	Impacted: High	988,535	1.003 (0.990 to 1.014)	0.997 (0.996 to 0.997)	0.901 (0.894 to 0.907)

Magnitude of Impact

11.12.127 From the results of the PVA, it is predicted that the maximum annual impact on growth rate is 0.5%, equivalent to a 13.5% decrease in population size for the annual scenario. Therefore, it can be determined that the magnitude of impact is low.

11.12.128 Although only the scenario with the highest impact has been taken forward to determine significance, it is noted that the results excluding Berwick Bank would result in no change to the magnitude of the impact.

Significance of the Effect

11.12.129 The magnitude of impact is considered to be low, and the sensitivity of the VOR is considered to be high. Following the matrix approach, as presented in Table 11.13, the cumulative impact of combined collision risk and displacement on gannet is therefore considered to be minor to moderate. However, as the impact to the growth rate is expected to be 0.5% and the majority of mortalities are expected to be due to displacement, which gannet have a low sensitivity to, it has been determined that the significance of the effect is **Minor** adverse, which is not significant in EIA terms.

Kittiwake

Sensitivity of Kittiwake to Collision Risk and Displacement

11.12.130 Within the assessment, the sensitivity of kittiwake to collision risk is high and the sensitivity to displacement is low. As a precautionary approach, a high sensitivity has been used as the sensitivity to the inter-related effects of collision risk and displacement.

Characterisation of the Effect

11.12.131 The cumulative mortality for collision risk and displacement impacts of kittiwake is given in Table 11.90. Mortality was calculated using a 30% displacement and a range of 1% to 3% mortality in both the breeding and non-breeding season, in line with guidance (NatureScot, 2023a).

Table 11.90: Kittiwake Cumulative Combined Collision Risk and Displacement Impacts Per Year

Bio-season	Regional Baseline Population	Number of Kittiwake Subject to Mortality	Decrease in Survival (percentage point change)
Including Berwick Bank (Model Option 1)			
Breeding	602,897	1,517.33 to 2,016.10	**0.251 to 0.333**
Non-breeding	627,816	2,242.62 to 3,279.99	**0.357 to 0.522**
Annual	627,816	3,759.94 to 5,296.09	**0.599 to 0.884**
Excluding Berwick Bank (Model Option 1)			
Breeding	602,897	1,062.27 to 1,433.19	**0.176 to 0.237**
Non-breeding	627,816	1,899.38 to 2,787.03	**0.303 to 0.444**
Annual	627,816	2,960.65 to 4,220.21	**0.472 to 0.672**
Including Berwick Bank (Model Option 2)			
Breeding	602,897	1,550.23 to 2,049.00	**0.256 to 0.339**
Non-breeding	627,816	2,251.36 to 3,288.73	**0.359 to 0.524**
Annual	627,816	3,801.59 to 5,337.74	**0.606 to 0.850**
Excluding Berwick Bank (Model Option 2)			
Breeding	602,897	1,094.17 to 1,466.09	**0.181 to 0.242**
Non-breeding	627,816	1,908.12 to 2,795.77	**0.304 to 0.445**
Annual	627,816	3,002.30 to 4,261.86	**0.478 to 0.679**

11.12.132 As shown in Table 11.90, as the 0.02 percentage point threshold was met for the breeding season, non-breeding season and annual scenarios, both including and excluding Berwick Bank for both model options. Therefore, 12 PVAs were required to further determine the magnitude of impact (see Volume 3, Technical Appendix 11.7: Offshore Ornithology Population Viability Analysis Technical Report for more information).

Cumulative PVA Assessment Including Berwick Bank

Breeding Season

11.12.133 When considering the cumulative impact during the breeding season on the regional population, the PVA predicted that the CPGR was 0.997 to 0.996 for the low and high impact scenario for both Option 1 and Option 2 respectively (Table 11.91), which translates to a decrease of 0.3% to 0.4% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.911 to 0.884 and 0.910 to 0.882 for the low and high impact scenario for Option 1 and Option 2 respectively (Table 11.91), which is equivalent to a 8.9% to 11.6% and 9.0% to 11.8% decrease in population size. The results of the PVA suggest that the magnitude of impact during the breeding season will be low.

Non-breeding Season

11.12.134 When considering the cumulative impact during the non-breeding season on the regional population, the PVA predicted that the CPGR was 0.996 and 0.994 for the low and high impact scenario for both Option 1 and Option 2 respectively (Table 11.92) which translates to a decrease of 0.4% to 0.6% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.877 to 0.825 and 0.876 to 0.824 for the low and high impact scenario for Option 1 and Option 2 respectively (Table 11.91), which is equivalent to a 12.3% to 17.5% and 12.4% to 17.6% decrease in population size. The results of the PVA suggest that the magnitude of impact during the non-breeding season will be low.

Annual

11.12.135 When considering the annual cumulative impact during the non-breeding season on the regional population, the PVA predicted that the CPGR was 0.993 and 0.990 for the low and high impact scenario for both Option 1 and Option 2 respectively (Table 11.91) which translates to a decrease of 0.7% to 1.0% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.802 to 0.732 and 0.800 to 0.730 for the low and high impact scenario for Option 1 and Option 2 respectively (Table 11.91) which is equivalent to a 19.8% to 26.8% and 20.0% to 27.0% decrease in population size. The results of the PVA suggest that the magnitude of impact annually will be medium.

Table 11.91: Outputs of PVA for Cumulative Assessment of Combined Collision and Displacement Impacts for Kittiwake Including Berwick Bank for the Operational Life of the Proposed Development (up to 30 years). CI = Confidence Intervals Around Counterfactual Ratio Metrics Given in Parentheses

Bio-season	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
Option 1					
Breeding Season	Baseline	1,041,157	1.014 (0.987 to 1.040)	-	-
	Impacted: Low	949,761	1.011 (0.984 to 1.037)	0.997 (0.997 to 0.997)	0.912 (0.902 to 0.921)
	Impacted: High	919,318	1.010 (0.983 to 1.036)	0.996 (0.996 to 0.996)	0.884 (0.875 to 0.893)
Non-breeding Season	Baseline	1,198,546	1.013 (0.986 to 1.038)	-	-
	Impacted: Low	1,049,193	1.009 (0.982 to 1.034)	0.996 (0.995 to 0.996)	0.877 (0.867 to 0.887)
	Impacted: High	987,878	1.007 (0.980 to 1.032)	0.994 (0.993 to 0.994)	0.825 (0.815 to 0.834)
Annual	Baseline	1,198,546	1.013 (0.986 to 1.038)	-	-
	Impacted: Low	959,141	1.006 (0.979 to 1.031)	0.993 (0.993 to 0.993)	0.802 (0.792 to 0.811)
	Impacted: High	876,554	1.003 (0.976 to 1.028)	0.990 (0.990 to 0.990)	0.732 (0.723 to 0.741)
Option 2					
Breeding Season	Baseline	1,041,157	1.014 (0.987 to 1.040)	-	-
	Impacted: Low	947,553	1.011 (0.983 to 1.036)	0.997 (0.997 to 0.997)	0.910 (0.900 to 0.919)
	Impacted: High	918,505	1.010 (0.982 to 1.035)	0.996 (0.996 to 0.996)	0.883 (0.874 to 0.892)
Non-breeding Season	Baseline	1,198,546	1.013 (0.986 to 1.038)	-	-
	Impacted: Low	1,048,945	1.009 (0.982 to 1.034)	0.996 (0.995 to 0.996)	0.876 (0.866 to 0.886)

Bio-season	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
	Impacted: High	986,676	1.007 (0.980 to 1.032)	0.994 (0.993 to 0.994)	0.824 (0.815 to 0.833)
Annual	Baseline	1,198,546	1.013 (0.986 to 1.038)	-	-
	Impacted: Low	956,728	1.006 (0.979 to 1.031)	0.993 (0.993 to 0.993)	0.800 (0.790 to 0.809)
	Impacted: High	875,973	1.003 (0.976 to 1.028)	0.990 (0.990 to 0.990)	0.730 (0.721 to 0.739)

Cumulative PVA Assessment Excluding Berwick Bank

Breeding Season

11.12.136 When considering the cumulative impact during the breeding season on the regional population, the PVA predicted that the CPGR was 0.998 to 0.997 for the low and high impact scenario for both Option 1 and Option 2 respectively (Table 11.92), which translates to a decrease of 0.2% to 0.3% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.937 to 0.916 and 0.936 to 0.914 for the low and high impact scenario for Option 1 and Option 2 respectively (Table 11.92), which is equivalent to an 6.3% to 8.4% and 6.4% to 8.6% decrease in population size. The results of the PVA suggest that the magnitude of impact during the breeding season will be low.

Non-breeding Season

11.12.137 When considering the cumulative impact during the non-breeding season on the regional population, the PVA predicted that the CPGR was 0.996 and 0.995 for the low and high impact scenario for both Option 1 and Option 2 respectively (Table 11.92 which translates to a decrease of 0.4% to 0.5% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.895 to 0.849 and 0.894 to 0.849 for the low and high impact scenario for Option 1 and Option 2 respectively (Table 11.92), which is equivalent to a 10.5% to 15.1% and 10.7% to 15.1% decrease in population size. The results of the PVA suggest that the magnitude of impact during the non-breeding season will be low.

Annual

11.12.138 When considering the annual cumulative impact during the non-breeding season on the regional population, the PVA predicted that the CPGR was 0.994 and 0.992 for the low and high impact scenario for both Option 1 and Option 2 respectively (Table 11.92) which translates to a decrease of 0.6% to 0.8% in the growth rate after 30 years compared to the unimpacted population. The CPS was 0.840 to 0.780 and 0.838 to 0.779 for the low and high impact scenario for Option 1 and Option 2 respectively (Table 11.92), which is equivalent to a 16.0% to 22.0% and 16.2% to 22.1% decrease in population size. The results of the PVA suggest that the magnitude of impact annually will be low.

Table 11.92: Outputs of PVA for Cumulative Assessment of Combined Collision and Displacement Impacts for Kittiwake Excluding Berwick Bank for the Operational Life of the Proposed Development (up to 30 years). CI = Confidence Intervals Around Counterfactual Ratio Metrics Given in Parentheses

Bio-season	Impact Scenario	Simulated Population Size	Median Growth Rate (CI)	Median Counterfactual (CI)	
				Growth Rate	Population Size
Option 1					
Breeding Season	Baseline	1,041,157	1.014 (0.987 to 1.040)	-	-
	Impacted: Low	976,550	1.012 (0.984 to 1.037)	0.998 (0.998 to 0.998)	0.938 (0.928 to 0.947)
	Impacted: High	953,424	1.011 (0.984 to 1.037)	0.997 (0.997 to 0.997)	0.917 (0.907 to 0.926)
Non-breeding Season	Baseline	1,198,546	1.013 (0.986 to 1.038)	-	-
	Impacted: Low	1,071,302	1.009 (0.982 to 1.034)	0.996 (0.996 to 0.997)	0.895 (0.885 to 0.904)
	Impacted: High	1,016,629	1.008 (0.980 to 1.033)	0.995 (0.994 to 0.995)	0.849 (0.839 to 0.859)
Annual	Baseline	1,198,546	1.013 (0.986 to 1.038)	-	-
	Impacted: Low	1,006,614	1.007 (0.980 to 1.032)	0.994 (0.994 to 0.995)	0.840 (0.831 to 0.850)
	Impacted: High	934,154	1.005 (0.978 to 1.030)	0.992 (0.992 to 0.992)	0.780 (0.771 to 0.789)
Option 2					
Breeding Season	Baseline	1,041,157	1.014 (0.987 to 1.040)	-	-
	Impacted: Low	973,636	1.011 (0.984 to 1.037)	0.998 (0.998 to 0.998)	0.936 (0.926 to 0.945)
	Impacted: High	952,567	1.011 (0.984 to 1.037)	0.997 (0.997 to 0.997)	0.915 (0.905 to 0.924)
Non-breeding Season	Baseline	1,198,546	1.013 (0.986 to 1.038)	-	-
	Impacted: Low	1,068,899	1.009 (0.982 to 1.034)	0.996 (0.996 to 0.997)	0.894 (0.884 to 0.904)
	Impacted: High	1,014,701	1.008 (0.9810 to 1.033)	0.995 (0.994 to 0.995)	0.849 (0.839 to 0.858)
Annual	Baseline	1,198,546	1.013 (0.986 to 1.038)	-	-
	Impacted: Low	1,003,814	1.007 (0.980 to 1.032)	0.994 (0.994 to 0.995)	0.838 (0.829 to 0.848)
	Impacted: High	932,366	1.005 (0.978 to 1.030)	0.992 (0.992 to 0.992)	0.779 (0.768 to 0.788)

Magnitude of Impact

11.12.139 From the results of the PVA, it is predicted that the maximum annual impact on growth rate is 1.0% for the annual scenario for both Option 1 and Option 2, which equivalent to a 26.8% and 27.0% decrease in population size for Option 1 and Option 2 respectively. Therefore, it can be determined that the is medium.

11.12.140 Although only the scenario with the highest impact has been taken forward to determine significance, it is noted that the results excluding Berwick Bank would result in no change to the magnitude of the impact.

Significance of the Effect

11.12.141 The magnitude of impact is considered to be medium and the sensitivity of the VOR is considered to be high. Following the matrix approach, as presented in Table 11.13, the cumulative impact of combined collision risk and displacement on kittiwake is therefore considered to be moderate or major. However, as the impact to the growth rate is within the lower range of those considered to be medium, the significance of the effect is considered to be **Moderate** adverse, which is significant in EIA terms.

Summary of the Effects

11.12.142 The assessment of the cumulative inter-related effect of collision risk and displacement during the O&M phase for gannet and kittiwake found that the effect is expected to be significant in EIA terms for kittiwake only (Table 11.93).

11.12.143 It should be noted that the assessment of the inter-related effect of collision risk and distributional responses was carried out before the Applicant received a response from MD-LOT regarding the treatment of consented projects (Table 11.3). Within this response it was advised that Berwick Bank, Green Volt, Salamander and West of Orkney OWFs mortalities could be excluded from the cumulative assessment, meaning the assessment presented can be considered precautionary.

11.12.144 The removal of the four OWFs from the CEA would result in a notable change to the impact of collision risk and distributional responses for both kittiwake and gannet. The reduction of mortalities (compared to the collision risk and high displacement, including Berwick Bank scenario) and updated change in survival for each species assessed are:

- Kittiwake: the number of mortalities is reduced by 1,227.69 (23.00%), resulting in an annual change in survival of 0.665 percentage points.
- Gannet: the number of mortalities is reduced by 399.47 (13.68%), resulting in an annual change in survival of 0.296 percentage points.

Table 11.93: Summary of Significant Effect of Cumulative Distributional Responses During the O&M Phase

Species	Significance of Effect
Gannet	There would not be a likely significant effect on gannet arising from the cumulative inter-related effects of collision risk and displacement.
Kittiwake	There would be a likely significant effect on kittiwake arising from the cumulative inter-related effects of collision risk and displacement.

Summary of Significance of Cumulative Effects

11.12.145 From the CEA, it was concluded that the cumulative impact of the Proposed Development and other projects (Table 11.55) will result in significant impacts, in EIA terms, for great black-backed gull and herring gull due to collision risk, guillemot and razorbill due to distributional responses, and kittiwake due to the inter-related effects of collision risk and distributional responses.

11.12.146 The impacts to puffin due to distributional responses and gannet due to the inter-related effect of collision risk and distributional responses were found to not be significant in EIA terms.

11.12.147 This was demonstrated by a cumulative PVA assessment, which was conducted for each species during the breeding season, non-breeding season and annually, and conducted with and without Berwick Bank impacts where appropriate. A summary of the significance of cumulative assessment is provided in Table 11.94.

11.12.148 No Additional Mitigation has been proposed, with further details presented in Section 11.3.

11.12.149 It should be noted that following consultation with MD-LOT (Table 11.3), it was advised that Berwick Bank, Green Volt, Salamander and West of Orkney OWFs mortalities could be removed from cumulative totals. Although the CEA had already been carried out at the time of receiving this advice the effect of removing these projects for collision risk, distributional responses and the inter-related effects of collision risk and distributional responses are discussed in paragraph 11.12.59, 11.12.117 and 11.12.144 for each impact respectively.

Table 11.94: Summary of Significant Effect of Cumulative Effects Assessment

Species	Significance of Cumulative Effect
Collision Risk Impacts	
Great black-backed gull	Major significant effect on great black-backed gull arising from cumulative collision risk.
Herring gull	Moderate significant effect on great black-backed gull arising from cumulative collision risk.
Displacement Impacts	
Guillemot	Moderate significant effect on guillemot arising from cumulative distributional responses.
Razorbill	Moderate significant effect on razorbill arising from cumulative distributional responses.

Species	Significance of Cumulative Effect
Puffin	No significant effect on puffin arising from cumulative distributional responses.
Combined Collision Risk and Displacement Impacts	
Gannet	No significant effect on gannet arising from the cumulative inter-related effects of collision risk and distributional responses.
Kittiwake	Moderate significant effect on kittiwake arising from the cumulative inter-related effects of collision risk and distributional responses.

11.13 Additional Mitigation and Proposed Monitoring

11.13.1 It was found that the Proposed Development alone did not result in any significant effects, with the highest significance recorded being **Minor** adverse. Due to this, no Additional Mitigation has been presented or proposed within Section 11.10.

11.13.2 Within the CEA (see Section 11.12), it was concluded that moderate effects will occur to herring gull due to collision risk only, guillemot and razorbill due to distributional responses only, and to kittiwake due to the inter-related effect of collision risk and distributional responses. Major effects were also concluded for great black-backed gull due to collision risk only. However, it should be noted that the contribution of the Proposed Development alone to the annual impacts (using the high displacement scenario and including Berwick Bank where relevant) was minimal. It was found that the Proposed Development alone contributed less than 2.50% of the total annual mortalities, for great black-backed gull (0.23%), razorbill (2.30%) and kittiwake (1.26%). Thus, for these species any significant effects are likely a result of the additive nature of this assessment with the presence of the Proposed Development unlikely to alter the outcomes.

11.13.3 In addition to the results of the Proposed Development alone assessment, the Applicant can only propose measures to reduce impacts arising from the Proposed Development itself. Therefore, if the conclusion of adverse effects on site integrity is determined for any SPAs assessed within the RIAA, the applicant has provided a HRA without prejudice Derogation Case, including a Compensation Roadmap (Derogation Case, Compensation Roadmap, TWP-BOW-RPS-ENV-RPT-00042) to demonstrate how these potential impacts will be compensated for.

Monitoring

11.13.4 In light of the findings of current monitoring at operational OWFs, and prior to construction of the Proposed Development starting, a strong, statistically robust and strategic bird monitoring programme will be devised and agreed in liaison with NatureScot and the Marine Directorate, considering foraging patterns, population trends and productivity for guillemot, razorbill, puffin, great-black-backed gulls and kittiwake at the key colonies on the east coast of Scotland.

11.14 Transboundary Effects

11.14.1 A screening of transboundary effects has been carried out and any potential for significant transboundary effects regarding offshore ornithology from the Proposed Development alone upon the interests of European Economic Area (EEA) states has been assessed as part of this Offshore EIA Report (see Volume 3, Technical Appendix 4.5: Transboundary Effects – Screening). The potential transboundary effects are summarised below:

- Collision risk mortality due to collision with rotor blades; and
- Distributional responses, displacement and barrier effects from Offshore Infrastructure.

Collision Risk Mortality Due to Collision with Rotor Blades

11.14.2 For all species assessed, collision with Wind Turbines was determined to result in negligible or minor adverse effect. As such, transboundary effects, which encompass wider populations and those more distant from the Proposed Development, are not expected to occur. Therefore, transboundary effects from collision with Wind Turbines are determined to be **Negligible** or **Minor** adverse, which is not significant in EIA terms.

Distributional Responses, Displacement and Barrier Effects from Offshore Infrastructure

11.14.3 For all species, disturbance and displacement were determined to result in negligible or minor adverse effect. As such, transboundary effects, which encompass wider populations and those more distant from the Proposed Development, are not expected to occur. Therefore, transboundary effects from disturbance and displacement from the physical presence of Offshore Infrastructure during construction, O&M and decommissioning activities are determined to be **Negligible** or **Minor** adverse, which is not significant in EIA terms.

Combined Impacts – Displacement and Collision with Wind Turbines

11.14.4 For both kittiwake and gannet, the combined impact of collision with Wind Turbines, and disturbance and displacement from the physical presence of Offshore Infrastructure and construction, O&M and decommissioning activities, were determined to be not significant in EIA terms. As such, transboundary effects, which encompass wider populations and those more distant from the Proposed Development, are not expected to occur. Therefore, transboundary effects from the combined effect of collision with Wind Turbines, and disturbance and displacement from the physical presence of Offshore Infrastructure during construction, O&M and decommissioning activities, are determined to be **Minor** adverse, which is not significant in EIA terms.

11.15 Summary of Impacts, Mitigation, Likely Significant Environmental Effects and Monitoring

11.15.1 Information on offshore ornithology within the Offshore Ornithology Study Area was collected through a desktop review of existing studies and datasets and a suite of site-specific surveys, including DAS, LiDAR, and intertidal bird surveys. This information is summarised in Table 11.4 and Table 11.5.

11.15.2 A summary of the potential impacts, Embedded Mitigation and the conclusion of likely significant effects in respect to offshore ornithology are available in Table 11.95 to

11.15.3 Table 11.97. The impacts assessed were:

- collision risk mortality due to collision with rotor blades;
- distributional responses, displacement and barrier effects from Offshore Infrastructure;
- disturbance and displacement from vessel movements;
- disturbance to prey species and their habitats;
- temporary habitat loss and/or habitat disturbance;
- attraction to light;
- direct impact from UXO clearance; and
- indirect impacts from construction/decommissioning noise

11.15.4 Overall, it is concluded that there will be no likely significant effects in respect to offshore ornithology arising from the Proposed Development alone during the construction, O&M or decommissioning phases.

11.15.5 Table 11.98 presents a summary of the potential cumulative impacts, Embedded Mitigation and the conclusion of likely significant effects on offshore ornithology. The cumulative effects assessed include:

- collision risk mortality due to collision with rotor blades;
- distributional responses, displacement and barrier effects from Offshore Infrastructure; and
- the inter-related effect of collision risk and distributional responses.

11.15.6 Although there will be no likely significant effects in respect of offshore ornithology arising from the Proposed Development alone, there is a significant effect cumulatively with other OWFs for herring gull and great black-backed gull in relation to collision risk, razorbill and guillemot in relation to distributional responses and for kittiwake for the inter-related effect of collision risk and distributional responses.

11.15.7 No likely significant transboundary effects were identified in respect of offshore ornithology.

11.15.8 In addition to the results of the Proposed Development alone assessment, the Applicant can only propose measures to reduce impacts arising from the

Proposed Development itself. As the in-combination assessment within the RIAA (RIAA, Part 3: Special Protection Areas and Ramsar Sites TWP-BOW-RPS-ENV-RPT-00015) has concluded adverse effects on site integrity for a number of SPAs, the Applicant has provided a Compensation Roadmap (Derogation Case, Compensation Roadmap, TWP-BOW-RPS-ENV-RPT-00042 to demonstrate how these potential impacts will be compensated for.

11.15.9 No further Additional Mitigation beyond the Embedded Mitigation stated within this chapter is considered.

Table 11.95: Embedded Mitigation for Potential Impacts of the Proposed Development

Impact	Relevant Embedded Mitigation (Mitigation ID)[1]	Phase*		
		C	O	D
Collision mortality risk due to collision with rotor blades	21 and 54		✓	
Distributional responses, displacement and barrier effects from Offshore Infrastructure	7, 8, 24 and 54	✓	✓	✓
	43	✓		
Disturbance and displacement to birds from vessel movements	5 and 9	✓	✓	✓
Disturbance to prey species and their habitats	5, 7, 8, 24 and 54	✓	✓	✓
Temporary habitat loss and/or habitat disturbance	7, 8 and 54	✓		✓
	43	✓		
Attraction to light	N/A			
Direct impacts from Unexploded Ordnance (UXO) clearance	7, 8, 36, 53 and 54	✓		
Indirect impacts from construction/decommissioning noise	7, 8, 9 and 54	✓		✓
	43	✓		

[1] For more details on the Embedded Mitigation, see Table 11.15

*Proposed Development phase: C = Construction phase, O = Operation and Maintenance phase, and D = Decommissioning phase

Table 11.96: Summary of the Quantitative Assessment of Significance for Collision Risk and Displacement

Impact	Species	Sensitivity of Receptor	Magnitude of Impact	PVA Scenario(s) Required for Assessment	Significance of Effect	Proposed Monitoring
Construction Phase						
Distributional responses, displacement and barrier effects from Offshore Infrastructure	Fulmar	Low	Negligible	-	Negligible	-
	Gannet	Low	Negligible	-	Negligible	-
	Kittiwake	Low	Negligible	-	Negligible	-
	Guillemot	Medium	Low[1]	Breeding Non-breeding Annual	Negligible	-
	Razorbill	Medium	Negligible[1]	Breeding Annual	Minor	-
	Puffin	Medium	Negligible	-	Negligible	-
O&M Phase						
Collision mortality risk due to collision with rotor blades	Gannet	High	Negligible	-	Minor	-
	Kittiwake	High	Negligible	-	Minor	-
	Great black-backed gull	Very High	Negligible	-	Minor	-
	Herring gull	Very High	Negligible	Breeding season Annual	Minor	-
	Arctic tern	Low	Negligible	Breeding season	Negligible	-
	Migratory birds	High	Negligible	-	Minor	-
Distributional responses, displacement and barrier effects from Offshore Infrastructure	Fulmar	Low	Negligible	-	Negligible	-
	Gannet	Low	Negligible	-	Negligible	-
	Kittiwake	Low	Negligible	-	Negligible	-
	Guillemot	Medium	Low	Breeding season Non-breeding season Annual	Minor	-

Impact	Species	Sensitivity of Receptor	Magnitude of Impact	PVA Scenario(s) Required for Assessment	Significance of Effect	Proposed Monitoring
	Razorbill	Medium	Negligible	Breeding season Annual	Negligible	-
	Puffin	Medium	Negligible	-	Negligible	-
Inter-related: Distributional responses, displacement and barrier effects from Offshore Infrastructure; and Collision mortality risk due to collision with rotor blades.	Gannet	High	Negligible	-	Minor	-
	Kittiwake	High	Negligible	-	Minor	-
Decommissioning Phase						
Distributional responses, displacement and barrier effects from Offshore Infrastructure	Fulmar	Low	Negligible	-	Negligible	-
	Gannet	Low	Negligible	-	Negligible	-
	Kittiwake	Low	Negligible	-	Negligible	-
	Guillemot	Medium	Low[1]	Breeding Annual	Negligible	-
	Razorbill	Medium	Negligible[1]	Breeding Annual	Minor	-
	Puffin	Medium	Negligible	-	Negligible	-

[1] PVA was only carried out for the O&M phase as the impact due to distributional responses is expected to be highest during this period. The results of the PVA have been used to determine the magnitude for both construction and decommissioning phases, which is considered precautionary.

Table 11.97: Summary of Assessment of Significance for Impacts with a Qualitative Assessment

Impact	Species	Sensitivity of Receptor	Magnitude of Impact	Significance of Effect	Proposed Monitoring
Construction					
Distributional responses, displacement and barrier effects from Offshore Infrastructure	Oystercatcher	Low	Negligible	Negligible	-
	Lapwing	High	Negligible	Minor	-
	Curlew	High	Negligible	Minor	-
	Common gull	Medium	Negligible	Negligible	-
	Black-headed gull	Low	Negligible	Negligible	-
Disturbance and displacment to birds from vessel movements	Fulmar	Very Low	Negligible	Negligible	-
	Gannet	Low	Negligible	Negligible	-
	Kittiwake	Low	Negligible	Negligible	-
	Guillemot	Medium	Negligible	Negligible	-
	Razorbill	Medium	Negligible	Negligible	-
	Puffin	Medium	Negligible	Negligible	-
	Oystercatcher	Medium	Negligible	Negligible	-
	Lapwing	Medium	Negligible	Negligible	-
	Curlew	High	Negligible	Minor	-
	Common gull	Low	Negligible	Negligible	-
	Black-headed gull	Low	Negligible	Negligible	-
	Common eider	High	Negligible	Minor	-
	Common scoter	High	Negligible	Minor	-
	Goldeneye	High	Negligible	Minor	-
	Great northern diver	High	Negligible	Minor	-
	Long-tailed duck	Medium	Negligible	Negligible	-
	Red-breasted merganser	Medium	Negligible	Negligible	-

Impact	Species	Sensitivity of Receptor	Magnitude of Impact	Significance of Effect	Proposed Monitoring
	Red-throated diver	Very high	Negligible	Minor	-
	Scaup	Medium	Negligible	Negligible	-
	Shag	High	Negligible	Minor	-
	Slavonian grebe	Medium	Negligible	Negligible	-
	Velvet scoter	Medium	Negligible	Negligible	-
	Sandwich tern	High	Negligible	Minor	-
	Common tern	Low	Negligible	Negligible	-
	Little tern	Low	Negligible	Negligible	-
	Pink footed goose	High	Negligible	Minor	-
	Redshank	Low	Negligible	Negligible	-
Disturbance to prey species and their habitats	Fulmar	Low	Negligible	Negligible	-
	Gannet	Low	Negligible	Negligible	-
	Kittiwake	Medium	Negligible	Minor	-
	Great black-backed gull	Medium	Negligible	Minor	-
	Herring gull	Medium	Negligible	Minor	-
	Arctic tern	Medium	Negligible	Minor	-
	Guillemot	Medium	Negligible	Minor	-
	Razorbill	Medium	Negligible	Minor	-
	Puffin	Medium	Negligible	Minor	-
	Manx shearwater	Low	Negligible	Negligible	-
	European storm petrel	Medium	Negligible	Minor	-
	Oystercatcher	Medium	Negligible	Minor	-
	Lapwing	Medium	Negligible	Minor	-
	Curlew	Medium	Negligible	Minor	-

Impact	Species	Sensitivity of Receptor	Magnitude of Impact	Significance of Effect	Proposed Monitoring
	Common gull	Medium	Negligible	Minor	-
	Black-headed gull	Medium	Negligible	Minor	-
Temporary habitat loss and/or habitat disturbance	Kittiwake	High	Negligible	Minor	-
	Guillemot	Medium	Negligible	Negligible	-
	Razorbill	High	Negligible	Minor	-
	Puffin	High	Negligible	Minor	-
	Fulmar	Low	Negligible	Negligible	-
	Gannet	Low	Negligible	Negligible	-
	Manx shearwater	Low	Negligible	Negligible	-
	European storm petrel	Low	Negligible	Negligible	-
	Oystercatcher	Low	Negligible	Negligible	-
	Lapwing	High	Negligible	Minor	-
	Curlew	High	Negligible	Minor	-
	Common gull	Medium	Negligible	Negligible	-
	Black-headed gull	High	Negligible	Minor	-
Direct impacts from UXO clearance	Gannet	Very high	Negligible	Minor	-
	Guillemot	Very high	Negligible	Minor	-
	Razorbill	Very high	Negligible	Minor	-
	Puffin	Very high	Negligible	Minor	-
Indirect impacts from construction/ decommissioning noise	Fulmar	High	Negligible	Minor	-
	Gannet	High	Negligible	Minor	-
	Kittiwake	High	Negligible	Minor	-
	Great black-backed gull	High	Negligible	Minor	-
	Herring gull	High	Negligible	Minor	-

Impact	Species	Sensitivity of Receptor	Magnitude of Impact	Significance of Effect	Proposed Monitoring
	Arctic tern	High	Negligible	Minor	-
	Guillemot	High	Negligible	Minor	-
	Razorbill	High	Negligible	Minor	-
	Puffin	High	Negligible	Minor	-
	Manx shearwater	High	Negligible	Minor	-
	European storm petrel	High	Negligible	Minor	-
	Oystercatcher	High	Negligible	Minor	-
	Lapwing	High	Negligible	Minor	-
	Curlew	High	Negligible	Minor	-
	Common gull	High	Negligible	Minor	-
	Black-headed gull	High	Negligible	Minor	-
O&M					
Distributional responses, barrier effects and displacement	Oystercatcher	Low	Negligible	Negligible	-
	Lapwing	High	Negligible	Minor	-
	Curlew	High	Negligible	Minor	-
	Common gull	Medium	Negligible	Negligible	-
	Black-headed gull	Low	Negligible	Negligible	-
Disturbance to birds from vessel movements	Fulmar	Very Low	Negligible	Negligible	-
	Gannet	Low	Negligible	Negligible	-
	Kittiwake	Low	Negligible	Negligible	-
	Guillemot	Medium	Negligible	Negligible	-
	Razorbill	Medium	Negligible	Negligible	-
	Puffin	Medium	Negligible	Negligible	-
	Oystercatcher	Medium	Negligible	Negligible	-

Impact	Species	Sensitivity of Receptor	Magnitude of Impact	Significance of Effect	Proposed Monitoring
	Lapwing	Medium	Negligible	Negligible	-
	Curlew	High	Negligible	Minor	-
	Common gull	Low	Negligible	Negligible	-
	Black-headed gull	Low	Negligible	Negligible	-
	Common eider	High	Negligible	Minor	-
	Common scoter	High	Negligible	Minor	-
	Goldeneye	High	Negligible	Minor	-
	Great northern diver	High	Negligible	Minor	-
	Long-tailed duck	Medium	Negligible	Negligible	-
	Red-breasted merganser	Medium	Negligible	Negligible	-
	Red-throated diver	Very high	Negligible	Minor	-
	Scaup	Medium	Negligible	Negligible	-
	Shag	High	Negligible	Minor	-
	Slavonian grebe	Medium	Negligible	Negligible	-
	Velvet scoter	Medium	Negligible	Negligible	-
	Sandwich tern	High	Negligible	Minor	-
	Common tern	Low	Negligible	Negligible	-
	Little tern	Low	Negligible	Negligible	-
	Pink footed goose	High	Negligible	Minor	-
	Redshank	Low	Negligible	Negligible	-
Disturbance to prey species and their habitats	Fulmar	Low	Negligible	Negligible	-
	Gannet	Low	Negligible	Negligible	-
	Kittiwake	Medium	Negligible	Minor	-
	Great black-backed gull	Medium	Negligible	Minor	-

Impact	Species	Sensitivity of Receptor	Magnitude of Impact	Significance of Effect	Proposed Monitoring
	Herring gull	Medium	Negligible	Minor	-
	Arctic tern	Medium	Negligible	Minor	-
	Guillemot	Medium	Negligible	Minor	-
	Razorbill	Medium	Negligible	Minor	-
	Puffin	Medium	Negligible	Minor	-
	Manx shearwater	Low	Negligible	Negligible	-
	European storm petrel	Medium	Negligible	Minor	-
	Oystercatcher	Medium	Negligible	Minor	-
	Lapwing	Medium	Negligible	Minor	-
	Curlew	Medium	Negligible	Minor	-
	Common gull	Medium	Negligible	Minor	-
	Black-headed gull	Medium	Negligible	Minor	-
Attraction to light	Manx shearwater	Medium	Negligible	Negligible	-
	European storm petrel	Medium	Negligible	Negligible	-
Decommissioning					
Distributional responses, displacement and barrier effects from Offshore Infrastructure	Oystercatcher	Low	Negligible	Negligible	-
	Lapwing	High	Negligible	Minor	-
	Curlew	High	Negligible	Minor	-
	Common gull	Medium	Negligible	Negligible	-
	Black-headed gull	Low	Negligible	Negligible	-
Disturbance and displacementt to birds from vessel movements	Fulmar	Very Low	Negligible	Negligible	
	Gannet	Low	Negligible	Negligible	-
	Kittiwake	Low	Negligible	Negligible	-
	Guillemot	Medium	Negligible	Negligible	-

Impact	Species	Sensitivity of Receptor	Magnitude of Impact	Significance of Effect	Proposed Monitoring
	Razorbill	Medium	Negligible	Negligible	-
	Puffin	Medium	Negligible	Negligible	-
	Oystercatcher	Medium	Negligible	Negligible	-
	Lapwing	Medium	Negligible	Negligible	-
	Curlew	High	Negligible	Minor	-
	Common gull	Low	Negligible	Negligible	-
	Black-headed gull	Low	Negligible	Negligible	-
	Common eider	High	Negligible	Minor	-
	Common scoter	High	Negligible	Minor	-
	Goldeneye	High	Negligible	Minor	-
	Great northern diver	High	Negligible	Minor	-
	Long-tailed duck	Medium	Negligible	Negligible	-
	Red-breasted merganser	Medium	Negligible	Negligible	-
	Red-throated diver	Very high	Negligible	Minor	-
	Scaup	Medium	Negligible	Negligible	-
	Shag	High	Negligible	Minor	-
	Slavonian grebe	Medium	Negligible	Negligible	-
	Velvet scoter	Medium	Negligible	Negligible	-
	Sandwich tern	High	Negligible	Minor	-
	Common tern	Low	Negligible	Negligible	-
	Little tern	Low	Negligible	Negligible	-
	Pink footed goose	High	Negligible	Minor	-
	Redshank	Low	Negligible	Negligible	-
	Fulmar	Low	Negligible	Negligible	-

Impact	Species	Sensitivity of Receptor	Magnitude of Impact	Significance of Effect	Proposed Monitoring
Disturbance to prey species and their habitats	Gannet	Low	Negligible	Negligible	-
	Kittiwake	Medium	Negligible	Minor	-
	Great black-backed gull	Medium	Negligible	Minor	-
	Herring gull	Medium	Negligible	Minor	-
	Arctic tern	Medium	Negligible	Minor	-
	Guillemot	Medium	Negligible	Minor	-
	Razorbill	Medium	Negligible	Minor	-
	Puffin	Medium	Negligible	Minor	-
	Manx shearwater	Low	Negligible	Negligible	-
	European storm petrel	Medium	Negligible	Minor	-
	Oystercatcher	Medium	Negligible	Minor	-
	Lapwing	Medium	Negligible	Minor	-
	Curlew	Medium	Negligible	Minor	-
	Common gull	Medium	Negligible	Minor	-
	Black-headed gull	Medium	Negligible	Minor	-
Temporary habitat loss and/or habitat disturbance	Kittiwake	High	Negligible	Minor	-
	Guillemot	Medium	Negligible	Negligible	-
	Razorbill	High	Negligible	Minor	-
	Puffin	High	Negligible	Minor	-
	Fulmar	Low	Negligible	Negligible	-
	Gannet	Low	Negligible	Negligible	-
	Manx shearwater	Low	Negligible	Negligible	-
	European storm petrel	Low	Negligible	Negligible	-
	Oystercatcher	Low	Negligible	Negligible	-

Impact	Species	Sensitivity of Receptor	Magnitude of Impact	Significance of Effect	Proposed Monitoring
	Lapwing	High	Negligible	Minor	-
	Curlew	High	Negligible	Minor	-
	Common gull	Medium	Negligible	Negligible	-
	Black-headed gull	High	Negligible	Minor	-
Indirect impacts from construction/ decommissioning noise	Fulmar	High	Negligible	Minor	-
	Gannet	High	Negligible	Minor	-
	Kittiwake	High	Negligible	Minor	-
	Great black-backed gull	High	Negligible	Minor	-
	Herring gull	High	Negligible	Minor	-
	Arctic tern	High	Negligible	Minor	-
	Guillemot	High	Negligible	Minor	-
	Razorbill	High	Negligible	Minor	-
	Puffin	High	Negligible	Minor	-
	Manx shearwater	High	Negligible	Minor	-
	European storm petrel	High	Negligible	Minor	-
	Oystercatcher	High	Negligible	Minor	-
	Lapwing	High	Negligible	Minor	-
	Curlew	High	Negligible	Minor	-
	Common gull	High	Negligible	Minor	-
	Black-headed gull	High	Negligible	Minor	-

Table 11.98: Summary of Cumulative Effects Assessment

Impact	Species	Sensitivity of Receptor	Magnitude of Impact	Significance of Impact	PVA	Significance of Residual Effect	Proposed Monitoring
O&M Phase							
Collision mortality risk due to collision with rotor blades	Gannet	High	NA	Significant	See inter-related effect below		
	Kittiwake	High	NA	Significant	See inter-related effect below		
	Great black-backed gull	Very High	Medium	Significant	For breeding, non-breeding and annually	Major, significant in EIA terms	Yes – see Paragraph 11.13.4
	Herring gull	Very high	Low	Significant	For breeding, non-breeding and annually for both Berwick Bank included and excluded	Moderate, significant in EIA terms	Yes – see Paragraph 11.13.4
Distributional responses, displacement and barrier effects from Offshore Infrastructure	Gannet	Low	NA	Significant	See inter-related effect below		
	Kittiwake	Low	NA	Significant	See inter-related effect below		
	Guillemot	Medium	Medium	Significant	For breeding, non-breeding and annually for both Berwick Bank included and excluded	Moderate, significant in EIA terms	Yes – see Paragraph 11.13.4
	Razorbill	Medium	Medium	Significant	For breeding, non-breeding and annually for both Berwick Bank included and excluded	Moderate, significant in EIA terms	Yes – see Paragraph 11.13.4
	Puffin	Medium	Low	Significant	For breeding, non-breeding and annually for both	Minor, not significant in EIA terms	Although not significant, this species will be

Impact	Species	Sensitivity of Receptor	Magnitude of Impact	Significance of Impact	PVA	Significance of Residual Effect	Proposed Monitoring
					Berwick Bank included and excluded		included within the proposed monitoring – see Paragraph 11.13.4
Inter-related effect: Distributional responses, displacement and barrier effects from Offshore Infrastructure; and Collision mortality risk due to collision with rotor blades.	Gannet	High	Low	Not significant	For breeding, non-breeding and annually for both Berwick Bank included and excluded	Minor, not significant in EIA terms	Although not significant, this species will be included within the proposed monitoring – see Paragraph 11.13.4
	Kittiwake	High	Medium	Significant	For breeding, non-breeding and annually for both Berwick Bank included and excluded	Moderate, significant in EIA terms	Yes – see Paragraph 11.13.4

References

Albores-Barajas, Y.V., Riccato, F., Fiorin, R., Massa, B., Torricelli, P. and Soldatini, C. (2011). Diet and diving behaviour of European Storm Petrels Hydrobates pelagicus in the Mediterranean (ssp. melitensis). *Bird Study*, *58*(2), pp.208-212.

AOWFL (2025). *Ayre Offshore Wind Farm, Offshore EIA Report*: *Volume 2, Chapter 11: Offshore Ornithology.* Thistle Wind Partners. Available at: Ayre Offshore Wind Farm, Offshore EIA Report. Accessed on: 20 April 2026.

APHA (2023). Confirmed cases of wild birds with highly pathogenic avian influenza (bird flu) in Great Britain. Animal and Plant Health Agency. Available at: Bird flu (avian influenza): cases in wild birds - GOV.UK. Accessed on: 20 April 2026.

Ardersier Port (Scotland) Limited (2024). Ardersier Energy Transition Facility. Available at: Ardersier Energy Transition Facility - Haventus. Accessed on: 20 April 2026.

Aspen (2025). Volume 2, Chapter 12: Offshore and Intertidal Ornithology. Available at: https://marine.gov.scot/sites/default/files/aspen_owf_chapter_12_offshore_and_intertidal_ornithology_final.pdf. Accessed on: 20 April 2026.

Atkinson, P. W. and Baillie, S. R. (2025). Jumping species and seasons–the spread and impact of highly pathogenic avian influenza on seabirds and waterbirds. Bird Study, 71(4), 289-292.

Atchoi, E., Mitkus, M. and Rodríguez, A., (2020). Is seabird light-induced mortality explained by the visual system development?. Conservation Science and Practice, 2(6), p.e195.

Ausden, M., Rowlands, A., Sutherland, W.J. and James, R. (2003). Diet of breeding lapwing *Vanellus vanellus* and redshank *Tringa totanus* on coastal grazing marsh and implications for habitat management. *Bird Study*, *50*(3), pp.285-293.

Band, W. (2012). Using a collision risk model to assess bird collision risks for offshore wind farms – with extended method. Report to the Crown Estate Strategic Ornithological Support Services (SOSS).

Bolton, M., Sheehan, D., Bolton, S.E., Bolton, J.A. and Bolton, J.R. (2017). Resurvey reveals arrested population growth of the largest UK colony of European Storm-petrels Hydrobates pelagicus, Mousa, Shetland.

BOWFL (2024). Offshore Scoping Report. Bowdun Offshore Wind Farm Limited. Available at: Scoping Report - Bowdun Offshore Wind Farm - SCOP-0056 | marine.gov.scot. Accessed on: 20 April 2026.

Bradbury, G., Trinder, M., Furness, B., Banks, A. N., Caldow, R. W. G. and Hume, D. (2014). Mapping Seabird Sensitivity to Offshore Wind Farms. PLoS ONE, 9(9). DOI: 10.1371/journal.pone.0106366. Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0106366. Accessed on: 20 April 2026.

Brighton, C.H., Clarke, J.A. and Boersch-Supan, P.H. (2025). Scientific support to the trial of Spoor AI at the European Offshore Wind Deployment Centre. *BTO Research Report*, *781*.BTO (2025). Seabird Monitoring Programme Database. British Trust for Ornithology. Available at: Seabird Monitoring Programme | JNCC. Accessed on: 20 April 2026.

Buchan Offshore Wind (2025a). Appendix 9.2 Offshore Ornithology Collision Risk Modelling (CRM). Available at: bow_eia_volume_3_appendix_09.2_offshore_ornithology_collision_risk_modelling_crm.pdf. Accessed on: 20 April 2026.

Buchan Offshore Wind (2025b). Appendix 9.3 Ornithology Distributional Responses Report. Available at: bow_eia_volume_3_appendix_09.3_distributional_responses_report.pdf. Accessed on: 20 April 2026.

Buckingham, L., Bogdanova, M. I., Green, J. A., Dunn, R. E., Wanless, S., Bennett, S., Bevan, R. M., Call, A., Canham, M., Corse, C. J., Harris, M. P., Heward, C. J., Jardine, D. C., Lennon, J., Parnaby, D., Redfern, C. P. F., Scott, L., Swann, R. L., Ward, R. M., Weston, E. D., Furness, R. W. and Daunt, F. (2022). Interspecific variation in non-breeding aggregation: a multi-colony tracking study of two sympatric seabirds. Marine Ecology Progress Series, 684: 181-197.

Burnell, D., Perkins, A., Newton, S., Bolton, M., Tierney, T. and Dunn, T. (2023). Seabirds count: a census of breeding seabirds in Britain and Ireland (2015-2021). Lynx Nature Books, Barcelona.

Caledonia North (2024). Volume 3 Caledonia North: Chapter 6 Offshore Ornithology. Available at: https://marine.gov.scot/sites/default/files/241115_-_caledonia_-_eia_application_-_volume_3_chapter_6_-_offshore_ornithology_-_caledonia_north.pdf. Accessed on: 20 April 2026.

Caneco, B. (2024). sCRM Shiny App. DMP Statistical Solutions UK Limited

Caneco, B., Humphries, G., Cook, A.S. and Masden, E. (2022). Estimating bird collisions at offshore windfarms with stochLAB. Available at: Estimating bird collisions at offshore windfarms with stochLAB - University of the Highlands and Islands. Accessed on: 20 April 2026.

Carless, S. (2005). Effect of human disturbance on the foraging behaviour of the oystercatcher Haematopus ostralegus on the rocky shore.

CIEEM (2024). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Version 1.3 updated September 2024. Chartered Institute of Ecology and Environmental Management, Winchester. Available at: ECIA-Guidelines-2018-Terrestrial-Freshwater-Coastal-and-Marine-V1.2-April-22-Compressed.pdf (cieem.net). Accessed on: 20 April 2026.

Collop, C. (2017). Impact of human disturbance on coastal birds: population consequences derived from behavioural responses. Doctoral dissertation, Bournemouth University. Available at: Collop, Catherine Helen_Ph.D._2016.pdf. Accessed on: 20 April 2026.

Cook, A.S.C.P & Robinson, R.A. (2016). Testing sensitivity of metrics of seabird population response to offshore wind farm effects. *Joint Nature Conservation Committee.* Available at: Testing sensitivity of metrics of seabird population response to offshore wind farm effects. Accessed on: 20 April 2026.

Danil, K. and St Leger, J. A. (2011). Seabird and dolphin mortality associated with underwater detonation exercises. Marine Technology Society Journal, 45(6): 89-95.

Deakin, Z., Cook, A., Daunt, F., McCluskie, A., Morley, N., Witcutt, E., Wright, L. and Bolton, M. (2022). A review to inform the assessment of the risk of collision and displacement in petrels and shearwaters from offshore wind developments in Scotland.

DEFRA (2024). Consultation on spatial management measures for industrial sandeel fishing. Government response. Department for Environment, Food and Rural Affairs. Available at: Government response - GOV.UK (www.gov.uk). Accessed on: 20 April 2026.

Delany, S., Veen, J. and Clark, J. A., Eds. (2006). Urgent preliminary assessment of ornithological data relevant to the spread of Avian Influenza in Europe. Report to the European Commission. EU-DG Environment, Brussels. Available at: https://www.wetlands.org/publication/urgent-preliminary-assessment-of-ornithological-data-relevant-to-the-spread-of-avian-influenza-in-europe-phase-1-2/. Accessed on: 20 April 2026.

d'Elbée, J. and Hemery, G. (1998). Diet and foraging behaviour of the British Storm Petrel Hydrobates pelagicus in the Bay of Biscay during summer. Ardea, 86(1), pp.1-10.

Del Hoyo, J., Elliott, A., Sargatal, J. and Christie, J. (Eds.) (1992). Handbook of the Birds of the World. Lynx Edicions: Barcelona, Spain.

DESNZ (2026). UK Greenhouse Gas Emissions: Final, Available at: https://www.data.gov.uk/dataset/9568363e-57e5-4c33-9e00-31dc528fcc5a/final-uk-greenhouse-gas-emissions-national-statistics. Accessed on: 20 April 2026.

Dias, M. P., Martin, R., Pearmain, E. J., Burfield, I. J., Small, C., Phillips, R. A, Yates, O., Lascelles, B., Borboroglu, P. G. and Croxall, J. P. (2019). Threats to seabirds: A global assessment. Biological Conservation, 237: 525-537.

Dunn, R. E., Duckworth, J., O'Brien, S., Furness, R.W., Buckingham, L., Daunt F., Bogdanova, M., & Green, J. A. (2024). Temporal and spatial variability in availability bias has consequences for marine bird abundance estimates during the non-breeding season. Ecological Solutions and Evidence, 5. Available at: Temporal and spatial variability in availability bias has consequences for marine bird abundance estimates during the non-breeding season. Accessed on: 20 April 2026.

Duriez, O., Sæther, S.A., Ens, B.J., Choquet, R., Pradel, R., Lambeck, R.H. and Klaassen, M. (2009). Estimating survival and movements using both live and dead recoveries: a case study of oystercatchers confronted with habitat change. *Journal of Applied Ecology*, *46*(1), pp.144-153.

Falchieri, M., Reid, S. M., Ross, C. S., James, J., Byrne, A. M., Zamfir, M., Brown, I. H., Banyard, A. C., Tyler, G., Philip, E. and Miles, W. (2022). Shift in HPAI infection dynamics causes significant losses in seabird populations across Great Britain. Veterinary Record, 191(7): 294-296.

Fayet, A. L., Clucas, G. V., Anker-Nilssen, T., Syposz, M. and Hansen, E. S. (2021). Local prey shortages drive foraging costs and breeding success in a declining seabird, the Atlantic puffin. Journal of Animal Ecology, 90(5): 1152-1164.

Frederiksen, M., Furness, R. W. and Wanless, S. (2007). Regional variation in the role of bottom-up and top-down processes in controlling sandeel abundance in the North Sea. Marine Ecology Progress Series, 337: 279-286.

Frederiksen, M., Anker-Nilssen, T., Beaugrand, G. and Wanless, S. (2013). Climate, copepods and seabirds in the Boreal Northeast Atlantic – Current state and future outlook. Global Change Biology, 19: 364-372.

Furness, R.W. and Tasker, M.L. (2000). Seabird-fishery interactions: quantifying the sensitivity of seabirds to reductions in sandeel abundance, and identification of key areas for sensitive seabirds in the North Sea. *Marine Ecology Progress Series*, *202*, pp.253-264.

Furness, R. W., Wade, H. M., Robbins, A. M. and Masden, E. A. (2012). Assessing the sensitivity of seabird populations to adverse effects from tidal stream turbines and wave energy devices. ICES Journal of Marine Science, 69(8): 1466-1479.

Furness, R. W., Wade, H. M. and Masden, E. A. (2013). Assessing vulnerability of marine bird populations to offshore wind farms. Journal of Environmental Management, 119: 56-66. DOI: 10.1016/j.jenvman.2013.01.025.

Furness, R. W. (2015). Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS). Natural England Commissioned Reports, Number 164. Available at: Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS) - NECR164 (naturalengland.org.uk). Accessed on: 20 April 2026.

Furness, R. W. (2018). Dogger Bank South Offshore Windfarm Ornithology Technical Appendix 12.8 - Consequences for birds of obstruction lighting on offshore wind turbines. Available at:

DBS+PEIR+TA12.8+Review+of+turbine+lighting+-+Furness+2018.pdf. Accessed on: 20 April 2026.

Garthe, S. and Hüppop, O. (2004). Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index. Journal of Applied Ecology, 41(4): 724-734.

Gehring, J. L., Kerlinger, P. & Manville, A. M. (2009). Communication towers, lights, and birds: successful methods of reducing the frequency of avian collisions. Ecological Applications, 19, 505-514.

Gineste, B., Souquet, M., Couzi, F.X., Giloux, Y., Philippe, J.S., Hoarau, C., Tourmetz, J., Potin, G. and Le Corre, M., (2017). Tropical Shearwater population stability at Reunion Island, despite light pollution. Journal of Ornithology, 158(2), pp.385-394.

Goodship, N.M. and Furness, R.W. (2022). NatureScot Research Report 1283-Disturbance Distances Review: An updated literature review of disturbance distances of selected bird species.

Grant (2025). In-combination and Cumulative Totals for Seabird Species of Key Importance to Northeast and East ScotWind Projects. Royal Haskoning DHV

Green, E. (2017). Tern diet in the UK and Ireland: a review of key prey species and potential impacts of climate change. *RSPB Report*.

Guilford, T., Padget, O., Bond, S. and Syposz, M., (2018). Light pollution causes object collisions during local nocturnal manoeuvring flight by adult Manx Shearwaters Puffinus puffinus. Seabird, 31.

Hamer, K.C., Phillips, R.A., Wanless, S., Harris, M.P. and Wood, A.G. (2000). Foraging ranges, diets and feeding locations of gannets Morus bassanus in the North Sea: evidence from satellite telemetry. *Marine ecology progress series*, *200*, pp.257-264.

Harris, S. J., Baker, H., Balmer, D. E., Bolton, M., Burton, N. H. K., Caulfield, E., Clarke, J. A. E., Dunn, T. E., Evans, T. J., Hereward, H. R .F., Humphreys, E. M., Money, S. and O'Hanlon, N. J. (2024). Seabird Population Trends and Causes of Change: 1986–2023, the annual report of the Seabird Monitoring Programme. BTO Research Report 771. British Trust for Ornithology, Thetford.

HiDef Aerial Surveying Limited. (2025). mCRM: Avian Migration Collision Risk Model. R package version 1.0.0.

Horswill, C. and Robinson, R. (2015). Review of seabird demographic rates and density dependence. JNCC Report, 552. Joint Nature Conservation Committee, Peterborough.

Hötker, H., Thomsen, K.-M. & H. Jeromin (2006). Impacts on biodiversity of exploitation of renewable energy sources: the example of birds and bats - facts, gaps in knowledge, demands for further research, and ornithological guidelines for the development of renewable energy exploitation. Michael-Otto-Institut im NABU, Bergenhusen. Available at: Hotker_et_al_Renewable_Energy_on_Biodiversity-libre.pdf. Accessed on: 20 April 2026.

HM Government (2011). *Statutory guidance UK marine policy statement. Department for Environment, Food & Rural Affairs*. Available at: https://www.gov.uk/government/publications/uk-marine-policy-statement. Accessed on: 20 April 2026.

Inorite Limited (2024). Welcom to Wind Table: The Wind Farm Performance Tracker. Available at: Wind Table - GB Wind Farm Performance Data and Analysis. Accessed on: 20 April 2026.

Isaksson, N., Masden, E. A., Williamson, B. J., Costagliola-Ray, M. M., Slingsby, J., Houghton, J. D. and Wilson, J. (2020). Assessing the effects of tidal stream marine renewable energy on seabirds: A conceptual framework. Marine Pollution Bulletin, 157: 111314.

Jarrett, D., Cook, A.S.C.P., Woodward, I., Ross, K., Horswill C., Dadam, D and Humphreys, E.M. (2018) Short-term behavioural responses of wintering waterbirds to marine activity. *Scottish Marine and Freshwater Science,* 9(7), pp.12096-1.

JNCC (2020). Seabird Population Trends and Causes of Change: 1986-2018 Report. Joint Nature Conservation Committee. Available at: SMP Report 1986–2019 | JNCC - Adviser to Government on Nature Conservation. Accessed on: 20 April 2026.

JNCC (2021). Seabird Population Trends and Causes of Change: 1986–2019 Report. Joint Nature Conservation Committee, Peterborough. Available at: SMP Report 1986–2019 | JNCC - Adviser to Government on Nature Conservation. Accessed on: 20 April 2026.

JNCC (2022a). Joint SNCB Interim Displacement Advice Note. Joint Nature Conservation Committee. Available at: Joint SNCB Interim Displacement Advice Note (jncc.gov.uk). Accessed on: 20 April 2026.

JNCC (2022b). Joint SNCB Interim Displacement Advice Note. Joint Nature Conservation Committee. Available at: Joint SNCB Interim Displacement Advice Note (jncc.gov.uk). Accessed on: 20 April 2026.

JNCC, Natural England, Natural Resources Wales, NatureScot. (2024). Joint advice note from the Statutory Nature Conservation Bodies (SNCBs) regarding bird collision risk modelling for offshore wind developments. JNCC, Peterborough. Available at: Joint advice note from the Statutory Nature Conservation Bodies (SNCBs) regarding bird collision risk modelling for offshore wind developments. Accessed on: 20 April 2026.

Johnston, A., Cook, A. S. C. P., Wright, L. J., Humphreys, E. M. and Burton, N. (2014). Modelling flight heights of marine birds to more accurately assess collision risk with offshore wind turbines. Journal of Applied Ecology, 51(1): 31-41.

King, S., Maclean, I. M. D., Norman, T., & Prior, A. (2009). Developing guidance on ornithological Cumulative Impact Assessment for offshore wind farm developers.

Kingston, A., Northridge, S., Paxton, C. G., & Buratti, J. P. F. (2023). Improving understanding of seabird bycatch in Scottish longline fisheries and exploring potential solutions.

Kerlinger, P., Gehring, J. L., Erickson, W. P., Curry, R., Jain, A. and Guarnaccia, J. (2010). Night migrant fatalities and obstruction lighting at wind turbines in North America. The Wilson Journal of Ornithology, 122(4): 744-754.

Kober, K., Clarke, E., Kingston, A., Ribeiro Santos, A., Balestri, E., Coull, K., Anderson, O., Parsons, M. (2024). Gap analysis on the monitoring of marine bird bycatch by British vessels – Report to the Department for Environment, Food & Rural Affairs. JNCC Report 761. JNCC, Peterborough, ISSN 0963-8091.

Kubetzki, U., Garthe, S. and Hüppop, O. (1999). The diet of common gulls Larus canus breeding on the German North Sea coast. *Atlantic Seabirds*, *1*(2), pp.57-70.

Lepper, P. A., Robinson, S. P., Cheong, S. H., Wang, L., Tougaard, J., Griffiths, E. T. and Hartley, J. (2024). Deflagration: A Method for Lowering Noise from Underwater Unexploded Ordnance (UXO) Clearance Operations. In The Effects of Noise on Aquatic Life: Principles and Practical Considerations (pp. 1949-1966). Cham: Springer International Publishing.

MacArthur Green (2023). Beatrice Offshore Wind Farm: Year 2 Post-construction Ornithological Monitoring Report. Available at: bowl_2021_post_construction_ornithology_monitoring_report_25_07_2023.pdf. Accessed on: 20 April 2026.

MacArthur Green (2024). *West of Orkney Windfarm: Offshore Ornithology Additional Information – Addendum to the Offshore EIA Report –Offshore Ornithology EIA Report Chapter*. Available

at: 12 addendum to the offshore eia report - ornithology - redacted.pdf. Accessed on: 20 April 2026.

Masden, E.A. (2015). Developing an avian collision risk model to incorporate variability and uncertainty. Scottish Marine and Freshwater Science. Available at: Scottish Marine and Freshwater Science Vol 6 No 14: Developing an avian collision risk model to incorporate variability and uncertainty - gov.scot. Accessed on: 20 April 2026.

McGregor, R. M., King, S., Donovan, C. R., Caneco, B. and Webb, A. (2018). A Stochastic Collision Risk Model for Seabirds in Flight. Marine Scotland Science report. HC0010–400–001.

Marine Directorate (2025). Derogation Case Assessment - West of Orkney Windfarm. Available at: https://marine.gov.scot/sites/default/files/west_of_orkney_windfarm_-_derogation_assessment_-_annex_g_-_final_-_redacted.pdf. Accessed on: 20 April 2026.

Marine Scotland (2026). maps.marine.gov.scot: NMPi part of Scotland's Environment. Available at: Marine Scotland - National Marine Plan Interactive. Accessed on: 20 April 2026.

MD-LOT (2024). *Scoping Opinion – Bowdun Offshore Wind Farm.* Available at: Marine Scotland - Aberdeen.dot. Accessed on: 20 April 2026.

MD-LOT (2025a). *Caledonia Offshore Wind Farms – Representations.* Marine Directorate – Licensing and Operations Team. Available at: Caledonia North and South Offshore Wind Farms – Moray Firth - Representations | marine.gov.scot. Accessed on: 20 April 2026.

MD-LOT (2025b). *Cenos Offshore Windfarm – Representations.* Marine Directorate – Licensing and Operations Team. Available at: Representations - Cenos Offshore Windfarm - 200 km East of Aberdeen - S.36 and Marine Licence Applications | marine.gov.scot. Accessed on: 20 April 2026.

Medina-Franco, R.A., Sangiorgi, P. and Valdés-Velásquez, A., (2025). Lost in the glow: understanding the impact of light pollution on storm-petrels. Avian Conservation and Ecology, 20(1).

Melvin, E.F., Wolfaardt, A., Crawford, R., Gilman, E. and Suazo, C.G. (2023). Bycatch reduction. *Conservation of marine birds*, pp.457-496.

Miles, W., Money, S., Luxmoore, R. and Furness, R. W. (2010). Effects of artificial lights and moonlight on petrels at St Kilda. Bird Study, 57: 244–251.

Mitchell, I., Daunt, F., Frederiksen, M. and Wade, K. (2020). Impacts of climate change on seabirds, relevant to the coastal and marine environment around the UK. In book: MCCIP Science Review 2020: 382-399.8.

Mitkus, M., Nevitt, G.A. and Kelber, A., (2018). Development of the visual system in a burrow-nesting seabird: Leach's storm petrel. Brain, Behavior and Evolution, 91(1), pp.4-16.

Mooney, T. A., Smith, A., Hansen, K. A., Larsen, O. N., Wahlberg, M. and Rasmussen, M. (2019). Birds of a feather: hearing and potential noise impacts in puffins (Fratercula arctica). In Proceedings of Meetings on Acoustics (Vol. 37, No. 1). AIP Publishing.

Nadara (2016). Environmental Impact Assessment, Volume II: Chapter 10: Offshore Ornithology. Available at: https://marine.gov.scot/sites/default/files/bellrock_eia_-_volume_2_-_chapter_10_-_offshore_ornithology_0.pdf. Accessed on: 20 April 2026.

NatureScot. (2018). Interim Guidance on apportioning impacts from marine renewable developments to breeding seabird populations in SPAs. Available at: https://www.nature.scot/doc/interim-guidance-apportioning-impacts-marine-renewable-developments-breeding-seabird-populations. Accessed on: 20 April 2026.

NatureScot. (2020). Guidance Note 9: Guidance to support Offshore Wind Applications: Marine ornithology advice for seasonal definitions for birds in the Scottish marine environment.

Available at: https://www.nature.scot/doc/guidance-note-9-guidance-support-offshore-wind-applications-seasonal-periods-birds-scottish-marine. Accessed on: 20 April 2026.

NatureScot. (2023a). Guidance Note 8: Guidance to support Offshore Wind Applications: Marine ornithology advice for assessing the distributional responses, displacement and barrier impacts of marine birds. Available at: https://www.nature.scot/doc/guidance-note-8-guidance-support-offshore-wind-applications-marine-ornithology-advice-assessing. Accessed on: 20 April 2026.

NatureScot. (2023b). Guidance Note 3: Guidance to support Offshore Wind Applications: Marine Birds – Identifying theoretical connectivity with breeding site Special Protection Areas using breeding season foraging ranges. Available at: https://www.nature.scot/doc/guidance-note-3-guidance-support-offshore-wind-applications-marine-birds-identifying-theoretical. Accessed on: 20 April 2026.

NatureScot. (2023c). Guidance Note 2: Guidance to support Offshore Wind Applications: Advice for marine ornithology baseline characterisation surveys and reporting. Available at: https://www.nature.scot/doc/guidance-note-2-guidance-support-offshore-wind-applications-advice-marine-ornithology-baseline. Accessed on: 20 April 2026.

NatureScot. (2023d). Guidance Note 4: Guidance to support Offshore Wind Applications: Ornithology – Determining connectivity of marine birds with Marine Special Protection Areas and breeding seabirds from colony SPAs in the non-breeding season. Available at: https://www.nature.scot/doc/guidance-note-4-guidance-support-offshore-wind-applications-ornithology-determining-connectivity. Accessed on: 20 April 2026.

NatureScot. (2023e). Guidance Note 5: Guidance to support Offshore Wind Applications: Recommendations for marine bird population estimates. Available at: https://www.nature.scot/doc/guidance-note-5-guidance-support-offshore-wind-applications-recommendations-marine-bird-population. Accessed on: 20 April 2026.

NatureScot. (2023f). Guidance Note 6: Guidance to support Offshore Wind Applications: Marine ornithology impact pathways for offshore wind developments. Available at: https://www.nature.scot/doc/guidance-note-6-guidance-support-offshore-wind-applications-marine-ornithology-impact-pathways. Accessed on: 20 April 2026.

NatureScot. (2023g). Guidance Note 11: Guidance to support Offshore Wind Applications: Marine Ornithology Overview; Marine ornithology – Recommendations for seabird Population Viability Analysis (PVA). Available at: https://www.nature.scot/doc/guidance-note-11-guidance-support-offshore-wind-applications-marine-ornithology-recommendations. Accessed on: 20 April 2026.

NatureScot (2023h). NatureScot Scientific Advisory Committee Sub-Group on Avian Influenza Report on the H5N1 outbreak in wild birds 2020-2023. Available at: NatureScot Scientific Advisory Committee Sub-Group on Avian Influenza Report on the H5N1 outbreak in wild birds 2020-2023 | NatureScot. Accessed on: 20 April 2026.

NatureScot. (2025a). Guidance Note 1: Guidance to support Offshore Wind Applications: Marine ornithology overview. Available at: https://www.nature.scot/doc/guidance-note-1-guidance-support-offshore-wind-applications-marine-ornithology-overview. Accessed on: 20 April 2026.

NatureScot. (2025b). Guidance Note 7: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing collision risk of marine birds. Available at: https://www.nature.scot/doc/guidance-note-7-guidance-support-offshore-wind-applications-marine-ornithology-advice-assessing. Accessed on: 20 April 2026.

Navedo, J.G., Gutiérrez, J.S., Salmón, P., Arranz, D., Novo, M., Díaz-Cosín, D.J., Herrera, A.G. and Masero, J.A. (2020). Food supply, prey selection and estimated consumption of wintering Eurasian Curlews feeding on earthworms at coastal pastures. *Ardea*, *107*(3), pp.263-274.

Northridge, S., Kingston, A. & Coram, A. (2020) Preliminary estimates of seabird bycatch by UK vessels in UK and adjacent waters. Defra report ME6024. October 2020.

Offshore Wind Power Limited (2024). West of Orkney Windfarm Offshore Ornithology Additional Information: Addendum to the Report to Inform Appropriate Assessment: HRA Stage 2 – SPA Appropriate Assessment. Available at: https://www.westoforkney.com/application/files/6917/2795/5171/Addendum-to-the-Report-to-Inform-Appropriate-Assessment-HRA-Stage-2-SPA-Appropriate-Assessment.pdf. Accessed on: 20 April 2026.

Ossian Offshore Wind Farm (2024). *Environmental Impact Assessment Report. SSE Renewables*. Available at: Ossian Offshore Wind Farm | marine.gov.scot. Accessed on: 20 April 2026.

Ordtek. (2018). *Technical Note 01 Strategic Unexploded Ordnance (UXO) Risk Management – Seabed Effects During Explosive Ordnance Disposal (EOD).* Norfolk Vanguard Limited. pp.11.

Ouwehand, J., F Leopold, M. and Kees, C.J. (2004). A comparative study of the diet of Guillemots Uria aalge and Razorbills Alca torda killed during the Tricolor oil incident in the south-eastern North Sea in January 2003. *Atlantic Seabirds*, *6*(3), pp.147-164.

Ozsanlav-Harris, L., Inger, R. and Sherley, R. (2023). Review of data used to calculate avoidance rates for collision risk modelling of seabirds. JNCC Report 732 (Research and Review Report), JNCC, Peterborough, ISSN 0963-8091.

Pavat, D., Harker, A.J., Humphries, G., Keogan, K., Webb, A. and Macleod, K.. (2023). *Consideration of avoidance behaviour of northern gannet (Morus bassanus) in collision risk modelling for offshore wind farm impact assessments. NECR490. Natural England*. Available at: NECR512 Consideration of avoidance behaviour of northern gannet (Morus bassanus) in collision risk modelling for offshore wind farm impact assessments - NECR512. Accessed on: 20 April 2026.

Pearce-Higgins, J. W, Humphreys, E. M., Burton, N. H., Atkinson, P. W., Pollock, C., Clewley, G. D. and Baker, H. (2023). Highly pathogenic avian influenza in wild birds in the United Kingdom in 2022: impacts, planning for future outbreaks, and conservation and research priorities. Report on virtual workshops held in November 2022. BTO research Report, 752.

Phillips, R.A., Petersen, M.K., Lilliendahl, K., Solmundsson, J., Hamer, K.C., Camphuysen, C.J. and Zonfrillo, B. (1999). Diet of the northern fulmar Fulmarus glacialis: reliance on commercial fisheries?. *Marine Biology*, *135*(1), pp.159-170.

Port of Cromarty Firth (2026). Port of Cromarty Firth – The Natural Choice for Renewables. Available at: Renewables - Port of Cromarty Firth. Accessed on: 20 April 2026.

Rich, C. and Longcore, T. eds., (2013). Ecological consequences of artificial night lighting. Island Press. Available at: Ecological Consequences of Artificial Night Lighting - Google Books. Accessed on: 20 April 2026.

Rodrigues, P., Aubrecht, C., Gil, A., Longcore, T. and Elvidge, C., (2012). Remote sensing to map influence of light pollution on Cory's shearwater in São Miguel Island, Azores Archipelago. European Journal of Wildlife Research, 58(1), pp.147-155.

Rodríguez, A., Burgan, G., Dann, P., Jessop, R., Negro, J.J. and Chiaradia, A., (2014). Fatal attraction of short-tailed shearwaters to artificial lights. PLoS One, 9(10), p.e110114.

Rodríguez, A., García, D., Rodríguez, B., Cardona, E., Parpal, L. and Pons, P., (2015a). Artificial lights and seabirds: is light pollution a threat for the threatened Balearic petrels?. Journal of Ornithology, 156(4), pp.893-902.

Rodríguez, A., Rodríguez, B. and Negro, J.J., (2015b). GPS tracking for mapping seabird mortality induced by light pollution. Scientific reports, 5(1), p.10670.

Rodríguez, A., Holmes, N.D., Ryan, P.G., Wilson, K.J., Faulquier, L., Murillo, Y., Raine, A.F., Penniman, J.F., Neves, V., Rodríguez, B. and Negro, J.J., (2017). Seabird mortality induced by land-based artificial lights. Conservation Biology, 31(5), pp.986-1001.

Rojek, N. A., Parker, M. W., Carter, H. R. and McChesney, G. J. (2007). Aircraft and vessel disturbances to Common Murres Uria aalge at breeding colonies in central California, 1997-1999. Marine Ornithology: 35, 61-69.

Scottish Government (2015). *Scotland's national marine plan. Marine Scotland, Edinburgh (UK)*. Available at: Scotland's National Marine Plan - gov.scot (www.gov.scot). Accessed on: 20 April 2026.

Scottish Government (2020). *Sectoral marine plan for offshore wind energy. Marine Scotland, Edinburgh (UK).* Available at: Sectoral marine plan for offshore wind energy - gov.scot (www.gov.scot). Accessed on: 20 April 2026.

Scottish Government (2024). The Sandeel (Prohibition of Fishing) (Scotland) Order 2024: business and regulatory impact assessment – final. Available at: The Sandeel (Prohibition Of Fishing) (Scotland) Order 2024: business and regulatory impact assessment - final - gov.scot (www.gov.scot). Accessed on: 20 April 2026.

Scottish Ministers (2025). Berwick Bank Wind Farm Public Notice of Determination. Available at: https://marine.gov.scot/sites/default/files/berwick_bank_wind_farm_-_public_notice_of_decision_-_redacted.pdf. Accessed on: 20 April 2026.

Schwemmer, P., Mendel, B., Sonntag, N., Dierschke, V. and Garthe, S. (2011). Effects of ship traffic on seabirds in offshore waters: implications for marine conservation and spatial planning. *Ecological Applications*, *21*(5), pp.1851-1860.

Sexton, C. (2017). Influence of the disturbance on shorebird behaviour. Cork: Community-Academic Research Links, University College Cork.

Siddiqi-Davies, K., Fisher-Reeves, L., Morford, J., Clucas, G. and Guilford, T. (2025). First description of Manx Shearwater Puffinus puffinus diet using DNA metabarcoding. *Seabird Journal*, *37*.

Souchay, G. and Schaub, M. (2016). Investigating rates of hunting and survival in declining European lapwing populations. *PLoS One*, *11*(9), p.e0163850.

Spiorad na Mara Limited (2026). Environmental Impact Assessment Report. Chapter 14: Marine and Nearshore Ornithology, Volume 2a. Available at: https://marine.gov.scot/sites/default/files/chapter_14_-_marine_and_nearshore_ornithology.pdf (Accessed on: 17/04/2026).

SSE Renewables (2024). Chapter 11: Offshore Ornithology, Array EIA Report. Ossian Offshore Windfarm. Available at: volume_2_-_technical_assessments_-_chapter_11_-_offshore_ornithology.pdf. Accessed on: 20 April 2026.

Stanbury, A., Eaton, M., Aebischer, N., Balmer, D., Brown, A., Douse, A., Lindley, P., McCulloch, N., Noble, D. and Win, I. (2021). The status of our bird populations. British Birds, 114(2021): 723-747. Available at: https://britishbirds.co.uk/journal/article/status-our-bird-populations. Accessed on: 20 April 2026.

Steenweg, R.J., Ronconi, R.A. and Leonard, M.L. (2011). Seasonal and age-dependent dietary partitioning between the great black-backed and herring gulls. *The Condor*, *113*(4), pp.795-805.

Stone, C. J., Webb, A., Barton, C., Ratcliffe, N., Reed, T. C., Tasker, M. L., Camphuysen, C. J. and Pienkowski, M. W. (1995). An atlas of seabird distribution in north-west European waters. Joint Nature Conservatio n Committee, Peterborough. Available at: https://hub.jncc.gov.uk/assets/c132752f-827c-41fc-b617-e681db21eaf5. Accessed on: 20 April 2026.

Syposz, M., Gonçalves, F., Carty, M., Hoppitt, W. and Manco, F., (2018). Factors influencing Manx Shearwater grounding on the west coast of Scotland. Ibis, 160(4), pp.846-854.

Syposz, M., Padget, O., Willis, J., Van Doren, B.M., Gillies, N., Fayet, A.L., Wood, M.J., Alejo, A. and Guilford, T., (2021). Avoidance of different durations, colours and intensities of artificial light by adult seabirds. Scientific Reports, 11(1), p.18941.

Thomas, R., J Medeiros, R. and L Pollard, A., (2006). Evidence for nocturnal inter-tidal foraging by European Storm-petrels Hydrobates pelagicus during migration. Atlantic seabirds, 8(1/2), pp.87-96.

Tremlett, C. J, Morley, N. and Wilson, L. J. (2024). UK seabird colony counts in 2023 following the 2021-22 outbreak of Highly Pathogenic Avian Influenza. RSPB Research Report 76.

UK Government, Department for Environment, Food & Rural Affairs, Natural Resources Wales, Department for Business, Energy & Industrial Strategy, Marine Management Organisation, JNCC, Department of Agriculture, Environment and Rural Affairs (Northern Ireland), Offshore Petroleum Regulator for Environment & Decommissioning, Department for Energy Security & Net Zero, Natural England and Scottish Government (2025). *Marine environment: unexploded ordnance clearance Joint Position Statement [online]*. Available at: Marine environment: unexploded ordnance clearance Joint Position Statement - GOV.UK. Accessed on: 20 April 2026.

UK Government, Department for Environment, Food & Rural Affairs (2025). *Supporting minimising environmental impacts from unexploded ordnance clearance [online]*. Available at: https://www.gov.uk/government/publications/supporting-minimising-environmental-impacts-from-unexploded-ordnance-clearance. Accessed on: 20 April 2026.

Van De Pol, M., Brouwer, L., Ens, B.J., Oosterbeek, K. and Tinbergen, J.M. (2010). Fluctuating selection and the maintenance of individual and sex-specific diet specialization in free-living oystercatchers. *Evolution*, *64*(3), pp.836-851.

Viana, D.S., Santoro, S., Soriguer, R.C. and Figuerola, J. (2023). A synthesis of Eurasian Curlew (Numenius arquata arquata) demography and population viability to inform its management. *Ibis*, *165*(3), pp.767-780.

Votier, S. C., Furness, R. W., Bearhop, S., Crane, J. E., Caldow, R. W. G., Catry, P., Ensor, K., Hamer, K. C., Hudson, A. V., Kalmback, E., Klomp, N. I., Pfeiffer, S., Phillips, R. A., Prieto, I. and Thompson, D. R. (2004). Changes in fisheries discard rates and seabird communities. Nature, 427(6976): 727-730.

Wade, H. M., Masden, E. A., Jackson, A. C. and Furness, R. W. (2016). Incorporating data uncertainty when estimating potential vulnerability of Scottish seabirds to marine renewable energy developments. Marine Policy, 70: 108–113. doi:10.1016/j.marpol.2016.04.045.

Waggitt, J., Evans, P., Andrade, J., Banks, A., Boisseau, O., Bolton, M., Bradbury, G., Brereton, T., Camphuysen, K., Durinck, J., Felce, T., Fijn, R., Garcia-Baron, I., Garthe, S., Geelhoed, S., Gilles, A., Goodall, M., Haelters, J., Hamilton, S., Hartny-Mills, L.,, Hodgins, N., James, K., Jessopp, M., Kavanagh, A. S., Leopold, M., Lohrengel, K., Louzao, M., Markones, N., Martínez-Cedeira, J., Cadhla, O., Perry, S. L.,, Pierce, G. J., Ridoux, V., Robinson, K. P., Santos, M. B, Saavedra, C., Skov, H., Stienen, E. W. M., Sveegaard, S., Thompson, P., Vanermen, N., Wall, D., Webb, A., Wilson, J., Wanless, S., Hiddink, J. G. (2019). Distribution maps of cetacean and seabird populations in the North-East Atlantic. Journal of Applied Ecology, 57(2), 253-269. DOI:10.1111/1365-2664.13525. Available at:

https://besjournals.onlinelibrary.wiley.com/doi/10.1111/1365-2664.13525. Accessed on: 20 April 2026.

Waggitt, J. (2019). Data from: Distribution maps of cetacean and seabird populations in the North-East Atlantic [Dataset]. Dryad. Available at: https://datadryad.org/stash/dataset/doi:10.5061/dryad.mw6m905sz. Accessed on: 20 April 2026.

Warham, J., (1996). The behaviour, population biology and physiology of the petrels. Academic Press.

Westerberg, K., Brown, R., Eagle, G. and Votier, S.C. (2019). Intra-population variation in the diet of an avian top predator: generalist and specialist foraging in great black-backed gulls Larus marinus. *Bird Study*, *66*(3), pp.390-397.

Wilhelm, S.I., Dooley, S.M., Corbett, E.P., Fitzsimmons, M.G., Ryan, P.C. and Robertson, G.J., (2021). Effects of land-based light pollution on two species of burrow-nesting seabirds in Newfoundland and Labrador, Canada. Avian Conservation & Ecology, 16(1).

Woodward, I., Thaxter, C. B., Owen, E. and Cook, A. S. C. P. (2019). Desk-based revision of seabird foraging ranges used for HRA screening. BTO Research Report No. 724. The British Trust for Ornithology, Thetford.

Woodward, I., Franks, S., Bowgen, K., Davies, J., Green, R., Griffin, L., Mitchell, C., O'Hanlon, N., Pollock, C., Rees, E., Tremlett, C., Wright, L. and Cook, C. (2023). Strategic study of collision risk for birds on migration and further development of the stochastic collision risk modelling tool. Work Package 1: Strategic review of birds on migration in Scottish waters. Report by British Trust for Ornithology, Royal Society for the Protection of Birds and ECO-LG to The Scottish Government, Crown Estate Scotland and The Crown Estate. Available at: strategic-study-collision-risk-birds-migration-further-development-stochastic-collision-risk-modelling-tool-work-package-1-strategic-review-birds-migration-scottish-waters.pdf. Accessed on: 20 April 2026.

Wright, L.J., Ross-Smith, V.H., Massimino, D., Dadam, D., Cook, A.S.C.P. and Burton, N.H.K. (2012). Assessing the risk of offshore wind farm development to migratory birds designated as features of UK Special Protection Areas (and other Annex I species). Strategic Ornithological Support Services. Project SOSS-05. BTO Research Report No. 592.

Xodus (2023). *West of Orkney EIA Report. Volume 2, Supporting Study 12: Offshore Ornithology Technical Supporting Study.* Available at: https://marine.gov.scot/sites/default/files/supporting_study_12_-_offshore_ornithology_technical_supporting_study.pdf#page=210&zoom=100,92,132. Accessed on: 20 April 2026.

Young, L. and VanderWerf, E. (2023). Conservation of Marine Birds. London: Academic Press.

Yelverton, J.T., Richmond, D.R., Fletcher, E.R. and Jones, R.K. (1973). *Safe distances from underwater explosions for mammals and birds* (No. DNA3114T).