Cenos Offshore Windfarm Limited

Cenos EIA

EIAR Chapter 12 – Ornithology

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Revisions & Approvals

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Contents

ACRONYMS

ACRONYM	DEFINITION
AC	Alternating Current
AEoSI	Adverse Effects on Site Integrity
ALDFG	Abandoned, Lost or Discarded Fishing Gear
AOB	Apparently Occupied Burrow
AON	Apparently Occupied Nest
AOS	Apparently Occupied Site
BDMPS	Biologically Defined Minimum Population Scales
CBD	Convention on Biological Diversity
CFP	Common Fisheries Policy
CES	Crown Estate Scotland
cm	Centimetre
CMS	Construction Method Statement
CRM	Collision Risk Modelling
DAS	Digital Aerial Survey
DC	Direct Current
EEA	European Economic Area
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EICB	Export / Import Cable Bundle
EICC	Export / Import Cable Corridor
EMF	Electro-magnetic Field
EMP	Environmental Management Plan
EOWDC	European Offshore Wind Deployment Centre
EPS	European Protected Species
FAD	Fish Aggregation Device
FLO	Fisheries Liaison Officer
FPSOs	Floating Production Storage and Offloading vessels
FTU	Floating Turbine Unit
GSD	Ground Sample Distance
HDD	Horizontal Directional Drilling
HPAI	Highly Pathogenic Avian Influenza

ACRONYM	DEFINITION
HRA	Habitat's Regulation Assessment
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IAC	Inter-Array Cable
IND	Individuals
INNSMP	INNS Management Plan
INTOG	Innovation and Targeted Oil and Gas
km	Kilometre
LMP	Lighting and Marking Plan
MARPOL	Marine Pollution
mCRM	migratory CRM
MD-LOT	Marine Directorate – Licensing Operations Team
MHWS	Mean High Water Springs
MLA	Marine Licence Applications
MLS	Most Likely Scenario
MLWS	Mean Low Water Springs
MMDR	Mean Maximum Foraging Range
MMO	Marine Mammal Observer
MPA	Marine Protected Area
MPCP	Marine Pollution Contingency Plan
MPI	Multi-Purpose Connector
MSP	Mean Seasonal Peak
MW	Megawatts
NAO	North Atlantic Oscillation
NCMPA	Nature Conservation Marine Protected Area
NLB	Northern Lighthouse Board
NM	Nautical Mile
NNR	National Nature Reserve
OSCPs	Offshore Substation Converter Platforms
OWF	Offshore Windfarm
PEMP	Project Environmental Monitoring Programme
PINS	Planning Inspectorate
PVA	Population Viability Analysis

ACRONYM	DEFINITION
RIAA	Report to Inform the Appropriate Assessment
RLB	Red Line Boundary
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SD	Standard Deviation
SMP	Seabird Monitoring Programme
SNCBs	Statutory Nature Conservation Bodies
SOPEP	Shipboard Oil Pollution Emergency Plans
SOSSMAT	Strategic Ornithological Support Services Migration Assessment Tool
SOV	Service Operations Vessel
SPA	Special Protection Area
SPL	Sound Pressure Level
SSSI	Site of Special Scientific Interest
SST	Sea Surface Temperature
TLP	Tension Leg Platform
TTS	Temporary Threshold Shift
TTTCC	Through the Tidal Cycle Counts
UKBAP	UK Biodiversity Action Plan
UN	United Nations
UXO	Unexploded Ordnances
VMP	Vessel Management Plan
VP	Vantage Point
WCS	Worst-case Scenario
WTG	Wind Turbine Generator
ZOI	Zone of Influence

GLOSSARY

TERM	DEFINITION
2023 Scoping Opinion	Scoping Opinion received in June 2023, superseded by the 2024 Scoping Opinion.
2023 Scoping Report	Environmental Impact Assessment (EIA) Scoping Report submitted in 2023, superseded by the 2024 Scoping Report.
2024 Scoping Opinion	Scoping Opinion received in September 2024, superseding the 2023 Scoping Opinion.
2024 Scoping Report	EIA Scoping Report submitted in April 2024, superseding the 2023 Scoping Report.
Area of Opportunity	The area in which the limits of electricity transmission via High Voltage Alternating Current (HVAC) cables can reach oil and gas assets for decarbonisation. This area is based on assets within a 100 kilometre (km) radius of the Array Area.
Array Area	The area within which the Wind Turbine Generators (WTGs), floating substructures, moorings and anchors, Offshore Substation Converter Platforms (OSCPs) and Inter-Array Cables (IAC) will be present.
Cenos Offshore Windfarm ('the Project')	'The Project' is the term used to describe Cenos Offshore Windfarm. The Project is a floating offshore windfarm located in the North Sea, with a generating capacity of up to 1,350 Megawatts (MW). The Project which defines the Red Line Boundary (RLB) for the Section 36 Consent and Marine Licence Applications (MLA), includes all offshore components seaward of Mean High Water Springs (MHWS) (WTGs, OSCPs, cables, floating substructures moorings and anchors and all other associated infrastructure). The Project is the focus of this Environmental Impact Assessment Report (EIAR).
Cenos Offshore Windfarm Ltd. (The Applicant)	The Applicant for the Section 36 Consent and associated marine licences.

TERM	DEFINITION
Cumulative Assessment	The consideration of potential impacts that could occur cumulatively with other relevant projects, plans, and activities that could result in a cumulative effect on receptors.
Developer	Cenos Offshore Windfarm Ltd., a Joint Venture between Flotation Energy and Vårgrønn As (Vårgrønn).
Environmental Impact Assessment (EIA)	The statutory process of evaluating the likely significant environmental effects of a proposed project or development. Assessment of the potential impact of the proposed Project on the physical, biological and human environment during construction, operation and maintenance and decommissioning.
Environmental Impact Assessment Regulations	This term is used to refer to the Environmental Impact Assessment Regulations which are of relevance to the Project. This includes the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended); and the Marine Works (Environmental Impact Assessment) Regulations 2007.
Environmental Impact Assessment Report	A report documenting the findings of the EIA for the Project in accordance with relevant EIA Regulations.
Export / Import Cable	High voltage cable used to export / import power between the OSCPs and Landfall.
Export / Import Cable Bundle (EICB)	Comprising two Export / Import Cables and one fibre-optic cable bundled in a single trench.
Export / Import Cable Corridor (EICC)	The area within which the Export/Import Cable Route will be planned and the Export / Import Cable will be laid, from the perimeter of the Array Area to MHWS.
Export / Import Cable Route	The area within the Export / Import Export Corridor (EICC) within which the Export / Import Cable Bundle (EICB) is laid, from the perimeter of the Array Area to MHWS.

TERM	DEFINITION
Floating Turbine Unit (FTU)	The equipment associated with electricity generation comprising the WTG, the floating substructure which supports the WTG, mooring system and the dynamic section of the IAC.
Flotation Energy	Joint venture partner in Cenos Offshore Windfarm Ltd.
Habitats Regulations	The Habitats Directive (Directive 92/43/ECC) and the Wild Birds Directive (Directive 2009/147/EC) were transposed into Scottish Law by the Conservation (Natural Habitats &c) Regulations 1994 ('Habitats Regulations') (up to 12 NM); by the Conservation of Offshore Marine Habitats and Species Regulations 2017 ('Offshore Marine Regulations') (beyond 12 NM); the Conservation of Habitats and Species Regulations 2017 (of relevance to consents under Section 36 of the Electricity Act 1989); the Offshore Petroleum Activities (Conservation of Habitats) Regulatlons 2001; and the Wildlife and Countryside Act 1981. The Habitats Regulations set out the stages of the Habitats Regulations Appraisal (HRA) process required to assess the potential impacts of a proposed project on European Sites (Special Areas of Conservation, Special Protection Areas, candidate SACs and SPAs and Ramsar Sites).
Habitats Regulations Appraisal	The assessment of the impacts of implementing a plan or policy on a European Site, the purpose being to consider the impacts of a project against conservation objectives of the site and to ascertain whether it would adversely affect the integrity of the site.
High Voltage Alternating Current (HVAC)	Refers to high voltage electricity in Alternating Current (AC) form which is produced by the WTGs and flows through the IAC system to the OSCPs. HVAC may also be used for onward power transmission from the OSCPs to assets or to shore over shorter distances.
High Voltage Direct Current (HVDC)	Refers to high voltage electricity in Direct Current (DC) form which is converted from HVAC to HVDC at the OSCPs and transmitted to shore over longer distances.
Horizontal Directional Drilling (HDD)	An engineering technique for laying cables that avoids open trenches by drilling between two locations beneath the ground's surface.

TERM	DEFINITION
Innovation & Targeted Oil and Gas (INTOG)	In November 2022, the Crown Estate Scotland (CES) announced the Innovation & Targeted Oil and Gas (INTOG) Leasing Round, to help enable this sector-wide commitment to decarbonisation. INTOG allowed developers to apply for seabed rights to develop offshore windfarms for the purpose of providing low carbon electricity to power oil and gas installations and help to decarbonise the sector. Cenos is an INTOG project and in November 2023 secured an Exclusivity Agreement as part of the INTOG leasing round.
Inter-Array Cable (IAC)	The cables which connect the WTGs to the OSCPs. WTGs may be connected with IACs into a hub or in series as a 'string' or a 'loop' such that power from the connected WTGs is gathered to the OSCPs via a single cable.
Joint Venture	The commercial partnership between Flotation Energy and Vårgrønn, the shareholders which hold the Exclusivity Agreement with CES to develop the Cenos site as an INTOG project.
Landfall	The area where the Export / Import Cable from the Array Area will be brought ashore. The interface between the offshore and onshore environments.
Marine Licence	Licence required for certain activities in the marine environment and granted under the Marine and Coastal Access Act 2009 and / or the Marine (Scotland) Act 2010.
Marine Protected Area (MPA)	Marine sites protected at the national level under the Marine (Scotland) Act 2010 out to 12 NM, and the Marine and Coastal Access Act 2009 between 12-200 NM. In Scotland MPAs are areas of sea and seabed defined so as to protect habitats, wildlife, geology, underseas landforms, historic shipwrecks and to demonstrate sustainable management of the sea.
Marine Protected Area (MPA) Assessment	A three-step process for determining whether there is a significant risk that a proposed development could hinder the achievement of the conservation objectives of an MPA.
Mean High Water Springs (MHWS)	The height of Mean High Water Springs is the average throughout the year, of two successive high waters, during a 24-hour period in each month when the range of the tide is at its greatest.

<table>
<tr><th>TERM</th><th>DEFINITION</th></tr>
<tr><td>Mean Low Water Springs (MLWS)</td><td>The height of Mean Low Water Springs is the average throughout a year of the heights of two successive low waters during periods of 24 hours (approximately once a fortnight).</td></tr>
<tr><td>Mitigation Measures</td><td>Measures considered within the topic-specific chapters in order to avoid impacts or reduce them to acceptable levels.
Primary mitigation – measures that are an inherent part of the design of the Project which reduce or avoid the likelihood or magnitude of an adverse environmental effect, including location or design;
Secondary mitigation – additional measures implemented to further reduce environmental effects to ‘not significant’ levels (where appropriate) and do not form part of the fundamental design of the Project; and
Tertiary mitigation – measures that are implemented in accordance with industry standard practice or to meet legislative requirements and are independent of the EIA (i.e. they would be implemented regardless of the findings of the EIA).
Primary and tertiary mitigation are referred to as embedded mitigation. Secondary mitigation is referred to as additional mitigation.</td></tr>
<tr><td>Mooring System</td><td>Comprising the mooring lines and anchors, the mooring system connects the floating substructure to the seabed, provides station-keeping capability for the floating substructure and contributes to the stability of the floating substructure and WTG.</td></tr>
<tr><td>Nature Conservation Marine Protected Area (NCMPA)</td><td>MPA designated by Scottish Ministers in the interests of nature conservation under the Marine (Scotland) Act 2010.</td></tr>
<tr><td>Offshore Substation Converter Platforms (OSCPs)</td><td>An offshore platform on a fixed jacket substructure, containing electrical equipment to aggregate the power from the WTGs and convert power between HVAC and HVDC for export / import via the export / import cable to / from the shore. The OSCPs will also act as power distribution stations for the Oil & Gas platforms.</td></tr>
<tr><td>Onward Development</td><td>Transmission projects which are anticipated to be brought forward for development by 3rd party oil and gas operators to enable electrification of assets via electricity generated by the Project. All Onward Development will subject to separate marine licensing and permitting requirements.</td></tr>
<tr><td>Onward Development Area</td><td>The area within which oil and gas assets would have the potential to be electrified by the Project.</td></tr>
</table>

TERM	DEFINITION
Onward Development Connections	Oil and gas assets located in the waters surrounding the Array Area will be electrified via transmission infrastructure which will connect to the Project's OSCPs. These transmission cables are referred to as Onward Development Connections.
Project Area	The area that encompasses both the Array Area and EICC.
Project Design Envelope	A description of the range of possible elements that make up the Project design options under consideration and that are assessed as part of the EIA for the Project.
Study Area	Receptor specific area where potential impacts from the Project could occur.
Transboundary Assessment	The consideration of impacts from the Project which have the potential to have a significant effect on another European Economic Area (EEA) state's environment. Where there is a potential for a transboundary effect, as a result of the Project, these are assessed within the relevant EIA chapter.
Transmission Infrastructure	The infrastructure responsible for moving electricity from generating stations to substations, load areas, assets and the electrical grid, comprising the OSCPs, and associated substructure, and the Export / Import Cable.
Vårgrønn As (Vårgrønn)	Joint venture partner in Cenos Offshore Windfarm Ltd.
Wind Turbine Generator (WTG)	The equipment associated with electricity generation from available wind resource, comprising the surface components located above the supporting substructure (e.g., tower, nacelle, hub, blades, and any necessary power transformation equipment, generators, and switchgears).
Worst-Case Scenario	The worst-case scenario based on the Project Design Envelope which varies by receptor and / or impact pathway identified.

12 ORNITHOLOGY

12.1 Introduction

This Chapter of the Environmental Impact Assessment Report (EIAR) presents the ornithology receptors of relevance to the Project and assesses the potential effects from the construction, operation and maintenance and decommissioning of the Project on these receptors. Where required, mitigation is proposed, and the residual effects and their significance are assessed. Potential cumulative and transboundary effects are also considered.

This EIAR Chapter has been prepared by HiDef predominantly using site-specific Digital Aerial Survey (DAS) data, also collected by HiDef, to characterise the baseline environment, alongside additional desk-based data sources. Surveys were conducted over the Innovation and Targeted Oil and Gas (INTOG) Lease Area plus a 4 kilometre (km) buffer. Site-specific data pertaining to ornithological receptors is outlined in Section 12.4.3 and in EIAR Vol. 4, Appendix A19: Ornithology Baseline Report and EIAR Vol. 4, Appendix A20: Intertidal & Nearshore Bird Surveys. The DAS report can be found in Annex 4 of EIAR Vol. 4, Appendix A16: Marine Mammal Baseline Report.

Table 12-1 below provides a list of all the supporting studies which relate to and should be read in conjunction with the ornithology impact assessment. All supporting studies are appended to this EIAR.

Table 12-1 : Details of supporting studies and location (where relevant)

NAME OF STUDY	SUMMARY
Annex 4 - EIAR Vol. 4, Appendix 16: Marine Mammal Baseline Report	Site-specific DAS report from surveys conducted between April 2023 and March 2023.
EIAR Vol. 4, Appendix 19: Ornithology Baseline Report	Presentation of information from site-specific DAS between April 2021 and March 2023, including calculated density and abundance estimates. Provision of additional data sources of relevance to the EIA.
EIAR Vol. 4, Appendix 20: Intertidal and Nearshore Bird Surveys	Presents the results from intertidal and nearshore surveys undertaken between April and August 2024 at the potential Export / Import Cable Landfall site
EIAR Vol. 4, Appendix 21: Collision Risk Modelling Report	Presents the species-specific mortalities from collision risk
EIAR Vol. 4, Appendix 22: Distributional Responses Report	Presents the species-specific mortalities from distributional responses under each scenario Annex 2 provides assessment of distributional responses during the chick rearing period using SeabORD.
EIAR Vol. 4, Appendix 23: Regional Populations and Associated Colony Counts	Explains the methodology behind determining regional populations of each species in the breeding and non-breeding seasons used within EIA

NAME OF STUDY	SUMMARY
EIAR Vol. 4, Appendix 24: Apportioning Report	Describes the seasonal apportioning of seabirds at the Array Area to colonies within and out with SPAs. Annex 2 provides apportioned seabird mortality to SPAs.
EIAR Vol. 4, Appendix 25: Population Viability Analysis Report	Presents the results of PVA modelling for the project alone, cumulatively (regional) and in-combination (SPA)

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

- EIAR Vol. 3, Chapter 10: Benthic Ecology – assesses potential effects associated with the Project on the benthic environment;
- EIAR Vol. 3, Chapter 13: Fish and Shellfish Ecology – assesses the effect of the Project on fish and shellfish species within the Array Area and surrounding waters; and
- EIAR Vol. 3, Chapter 15: Shipping and Navigation – describes vessel activities within the Array Area during the construction, operation and maintenance and decommissioning phases.

Where information is used to inform the impact assessment, reference to the relevant EIAR chapter is given.

The following specialists have contributed to the assessment:

- Jaz Harker, HiDef
- Laura Rudd, HiDef
- Mairi Semple, HiDef; and
- Catriona Gall, HiDef

12.2 Legislation, policy, and guidance

The wider marine planning, legislation, policy and guidance is discussed in EIAR Vol. 2, Chapter 3: Policy and Legislative Context. The following legislation, policy, and guidance are relevant to the assessment of effects from the Project on ornithology:

- Legislation:
  - The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) for Scottish territorial (<12NM) waters ('the Habitats Regulations 1994');
  - Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019;
  - The Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) in offshore (>12 Nautical Mile (NM)) waters;
  - Marine (Scotland) Act 2010;
  - Marine and Coastal Access Act 2009;
  - European Protected Species (EPS) listed under Schedule 2 of the Habitats Regulations 1994 (as amended in Scotland);
  - Wildlife and Natural Environment (Scotland) Act 2011;
  - Nature Conservation (Scotland) Act 2004;
  - Wildlife and Countryside Act 1981 (as amended);
  - The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention);
  - The Convention for the Protection of the Marine Environment of the North-East Atlantic (The Convention for the Protection of the Marine environment of the North-East Atlantic (OSPAR) Convention); and
  - UK Post-2010 Biodiversity Framework, superseding the UK Biodiversity Action Plan (UKBAP), the UK Government's response to the Convention on Biological Diversity (CBD) 1992.

- Policy:
  - Scotland's National Marine Plan: A Single Framework for Managing Our Seas (Scottish Government, 2015):
    - Renewables 5: Renewable energy projects must demonstrate compliance with EIA and HRA legislative requirements.
    - Renewables 6: Cable and network owners and marine users should ensure a co-ordinated and strategic approach to development and activities to minimise impacts on the marine natural environment.
    - Renewables 9: Marine planners and decision makers should support the development of joint research and monitoring programmes for offshore wind and marine renewables energy development.
  - Scottish Biodiversity Strategy to 2045;
  - GEN 1 General planning principle: There is a presumption in favour of sustainable development and use of the marine environment when consistent with the policies and objectives of this Plan;
  - GEN 9 Natural heritage: Development and use of the marine environment must: (a) Comply with legal requirements for protected areas and protected species. (b) Not result in significant impact on the national status of Priority Marine Features. (c) Protect and, where appropriate, enhance the health of the marine area;
  - GEN 19 Sound evidence: Decision making in the marine environment will be based on sound scientific and socio-economic evidence;
  - UK Post-2010 Biodiversity Framework, superseding the UK Biodiversity Action Plan (UKBAP), the UK Government's response to the Convention on Biological Diversity (CBD) 1992;
  - The United Nations' (UN) Convention on Biological Diversity (1992); including the 'Aichi' biodiversity targets;

- The Convention for the Protection of the Marine Environment of the North-East Atlantic (the OSPAR Convention 1992);
- The Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention 1971);
- The Bonn Convention (1979); and
- The Bern Convention (1979).

- Guidance:
  - Band (2012): Guidance on using a collision risk model to estimate bird collisions for offshore wind farm developments;
  - Bradbury *et al.*, (2014): Mapping seabird sensitivity to offshore wind farms;
  - CIEEM (2022): Guidelines for Ecological Impact Assessment in the UK and Ireland;
  - Furness *et al.* (2013): Analysis of seabird sensitivity to offshore wind farm developments;
  - Furness (2015): Report on Biologically Defined Minimum Population Scales (BDMPS), used to define non-breeding season populations;
  - Garthe and Hüppop, (2004): Scaling possible adverse effects of marine wind farms on seabirds: developing and applying vulnerability index;
  - Horswill and Robinson, (2015): Review of seabird demographic rates and density dependence;
  - JNCC *et al.* (2022): Advice note from the joint Statutory Nature Conservation Bodies (SNCBs) on undertaking displacement assessment. Used to consider the risk that birds will be displaced from an operational wind farm development and to estimate the mortality that may arise as a result;
  - JNCC *et al.* (2024): Joint Advice note from the Statutory Nature Conservation Bodies (SNCBs) regarding bird collision risk modelling for offshore wind developments;
  - NatureScot (2018): Environmental Impact Assessment Handbook: Guidance for competent authorities, consultees and others involved in the Environmental Impact Assessment process in Scotland;
  - NatureScot (2020a): The effect of aviation obstruction lighting on birds at wind turbines, communication towers and other structures;
  - NatureScot (2020b): Guidance on seasonal periods for birds in the Scottish marine environment, used to define breeding seasons for the species of concern in assessment;
  - NatureScot. (2023a): Guidance Note 1: Guidance to support Offshore Wind Applications: Marine ornithology overview;
  - NatureScot. (2023b): Guidance Note 2: Guidance to support Offshore Wind Applications: Advice for marine ornithology baseline characterisation surveys and reporting;
  - NatureScot. (2023c): 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;
  - 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;
  - NatureScot. (2023e): Guidance Note 5: Guidance to support Offshore Wind Applications: Recommendations for marine bird population estimates;
  - NatureScot. (2023f): Guidance Note 6: Guidance to support Offshore Wind Applications: Marine ornithology impact pathways for offshore wind developments;

- NatureScot. (2023g): Guidance Note 7: Guidance to support Offshore Wind Applications: Marine Ornithology – Advice for assessing collision risk of marine birds;
- NatureScot. (2023h): Guidance Note 8: Guidance to support Offshore Wind Applications: Marine ornithology advice for assessing the distributional responses, displacement and barrier impacts of marine birds;
- NatureScot. (2023i): Guidance Note 9: Guidance to support Offshore Wind Applications: Marine ornithology advice for seasonal definitions for birds in the Scottish marine environment;
- NatureScot. (2023j): Guidance Note 10: Guidance to support Offshore Wind Applications: Marine ornithology advice for apportioning impacts to breeding colonies;
- NatureScot. (2023k): Guidance Note 11: Guidance to support Offshore Wind Applications: Marine Ornithology Overview; Marine ornithology – Recommendations for seabird Population Viability Analysis (PVA);
- Searle *et al.* (2014; 2018): Guidance on use of SeabORD for displacement modelling;
- Searle *et al.* (2019): Natural England guidance on population modelling; and
- Woodward *et al.* (2019): Defines the seabird foraging ranges used for screening designated sites into apportioning calculations.

12.3 Scoping and consultation

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

The 2024 Scoping Report was submitted to Marine Directorate – Licensing Operations Team (MD-LOT) in April 2024, relevant stakeholders were consulted by MD-LOT. The Scoping Opinion was received in September 2024. The 2024 Scoping Report and Scoping Opinion supersedes the 2023 Scoping Report and Scoping Opinion for the Project. Relevant comments from the Scoping Opinion and Scoping Workshop to ornithology are provided in Table 12-3 below, which provides a high-level response on how these comments have been addressed within the EIAR.

A Scoping Workshop was held on the 29th February 2024 (as detailed in EIAR Vol. 2, Chapter 1: Introduction). Relevant points specific to ornithology are provided in Table 12-2 below, which sets out how these points have been addressed within the EIAR. Further consultation has been undertaken throughout the pre-application phase. Table 12-2 summarises the consultation activities carried out relevant to ornithology.

Table 12-2 Consultation activities for ornithology

CONSULTEE	TYPE OF CONSULTATION	DATE	SUMMARY
NatureScot	Written consultation	2nd April 2024	Following the Scoping Workshop NatureScot provided further advice in response to posed during the Scoping Workshop on approach to EIA and HRA.
NatureScot	Written consultation	13th June 2024	Specific advice regarding the interpretation of NatureScot Guidance Note 11: Guidance to support offshore wind applications: Marine ornithology – recommendations for seabird Population Viability Analysis (PVA).
NatureScot	Consultation meeting	7th August 2024	To update NatureScot on the status of intertidal surveys and further discuss the approach to assessment for ornithological receptors, namely apportioning, discussion of guillemot abundance in site-specific DAS, incorporation of macro-avoidance for northern gannet (*Morus bassanus*, hereafter 'gannet') in CRM during the non-breeding season, Population Viability Analysis (PVA), and cumulative and in-combination assessment.
NatureScot	Written consultation	10th September 2024	Following the Ornithology Catch Up on 7th August further questions were posed to NatureScot surrounding the approach to gannet non-breeding apportioning and how to interpret NatureScot advice for running PVA.
NatureScot	Consultation meeting	21st October 2024	To further discuss the approach to apportioning in addition to further consultation relating to HRA and compensation aspects.
NatureScot	Written consultation	7th November 2024.	Following the consultation meeting on 21st October 2024, NatureScot provided written advice via email pertaining to the assessment of guillemot under HRA, the preferred method to apportioning, the inclusion of compensated impacts within PVA and the approach to assessment for gannet at Forth Islands SPA.
NatureScot	Cumulative Effects Long List response	2nd December 2024	Written response received on the Cumulative Effects Assessment Long List for Ornithology.

Table 12-3 Summary of consultation responses specific to ornithology

REGULATOR/CONSULTEE	COMMENT	RESPONSE
Scoping Workshop		
NatureScot	Have you considered wet storage? Understand ports and harbours agreements are not in place, so will be difficult to define, but would like to see this considered in the EIAR.	The Applicant understands the concerns raised by NatureScot regarding wet storage. At present, the temporary assembly and storage of non-generating floating wind turbines, or parts thereof, is not a licensable activity, as these assets are classified and insured as vessels in the context of port operations. Rather, the temporary storage of these assets within the bounds of the port authority forms part of the suite of vessel-related activities associated with port marshalling to support construction activities offshore, as it would for the oil and gas industry (e.g. through the temporary mooring of drill rigs, floating production storage and offloading units etc.). As such, the environmental impact assessment will be complete without consideration of turbine storage and assembly associated with port marshalling, in that it will cover all of the licensable activities for which the Applicant seeks consent.
NatureScot	Helpful to understand work done around entanglement. If narrative brought forward to scoping report to justify aspects scoped in/out that would be helpful.	Secondary entanglement from subsea mooring systems is scoped into the assessment and provided within Section 12.1.1.1.
Scoping Opinion		
Scottish Ministers	The Developer considers the impacts on ornithological receptors in chapter 11 of the Scoping Report. The Scottish Ministers are content with the study area as described in Section 11.3 of the Scoping Report, however, direct the Developer to NatureScot's Guidance Note 3 in relation to foraging ranges for guillemot, razorbill and gannet and advise that this is applied in the EIA.	Noted, NatureScot Guidance Note 3 has been followed in relation to seabird foraging ranges and applied within the EIA.

REGULATOR/CONSULTEE	COMMENT	RESPONSE
Scottish Ministers	The Scottish Ministers direct the Developer to Annex I of the NatureScot representation in relation to the DAS, specifically in relation to the significantly lower numbers of guillemot presented in the 2021 survey results which may not provide representative data. The Developer is advised to engage with NatureScot in relation to addressing this issue and provide an outcome to this in the EIAR.	NatureScot provided four potential options to address this, which were discussed and agreed upon during consultation on 7th August 2024: Option 1: *Undertake additional digital aerial surveys at the same time of year following the same methodology used in the previous surveys and, if possible, similar dates. This could help establish more reliable baseline data for auks in the dispersal period;* Option 2: *Carry out a review of data available, or being collected, from east coast offshore wind farm sites on auk numbers and dispersal, during this period. As well as data from other site-specific bird surveys and monitoring, the study could include the regional DAS surveys being undertaken by the East Developer Collaboration;* Option 3: *It may also be useful to review any recent guillemot productivity data from the region, if available, to clarify chick fledging dates. This could provide useful data to help inform how the post-breeding dispersal period is considered within the assessment in general and for understanding the low numbers in 2021; and* Option 4: *Use the 2022 August-November guillemot numbers for this period in 2021.* As agreed with NatureScot in the Ornithology Catch Up on 7th August 2024, the Applicant has used a combination of both Option 2 and Option 3 to address their concerns, which is provided in Section 12.4.4.3.

REGULATOR/CONSULTEE	COMMENT	RESPONSE
Scottish Ministers	The Scottish Ministers are satisfied that the species scoped in for assessment reflect the species found most abundantly in the DAS. Furthermore, the Scottish Ministers are broadly content with the potential impacts proposed to be scoped in and out of the EIAR as described in Table 11-8 of the Scoping Report. However, the Scottish Ministers advise that temporary disturbance and displacement during construction of the HDD should be scoped into the EIAR as insufficient information has been provided to enable the impact to be scoped out at this stage. Secondary entanglement from subsea mooring systems must also be scoped in for assessment due to the high uncertainty of the potential impact. The Developer is directed to the NatureScot representation in this regard and advised that it is fully considered in the EIAR.	Noted, temporary disturbance and displacement during construction of the HDD and secondary entanglement from subsea mooring systems are scoped into the assessment and provided within Section 12.6.1.2 and Section 12.1.1.1 respectively.
Scottish Ministers	The Scottish Ministers are content that the assessment methodology presented in the Scoping Report is appropriate. The Scottish Ministers advise that the Developer utilise NatureScot's guidance note on Collision Risk Modelling ("CRM") to develop the CRM approach. Whilst the guidance is awaiting update, the Scottish Ministers direct the Developer to the NatureScot representation for the key changes to be implemented and advise that this is taken into consideration in the EIAR. Additionally, the Scottish Ministers direct the Developer to the recently published Strategic Review of Birds on Migration in Scottish Waters to assist in informing the decision process in relation to species to be included in the	Guidance presented within the August 2024 publication "*Joint advice note from the Statutory Nature Conservation Bodies (SNCBs) regarding bird collision risk modelling for offshore wind developments*" has been closely followed and incorporated into assessment. The updated guidance incorporates the advice given as part of the Scoping Opinion and any advice previously received from NatureScot after the Scoping Workshop on 2nd April 2024. No assessment of collision risk for fulmar has been undertaken due to a flight height that is unlikely to result in collisions.

REGULATOR/CONSULTEE	COMMENT	RESPONSE
	assessment. Furthermore, the Scottish Ministers are content, in line with the NatureScot representation that collision risk modelling is not undertaken for fulmar.	
Scottish Ministers	In relation to addressing impacts of Highly Pathogenic Avian Influenza ("HPAI"), the Developer, in undertaking the EIA, must consider the impact of HPAI on colonies as detailed in the NatureScot and RSPB representations.	Noted. The approach to incorporating HPAI in assessment was discussed with NatureScot during the Scoping Workshop on 29th February 2024. The Applicant has incorporated the outcomes of that discussion and the NatureScot and RSPB response to the Scoping Report within Section 12.4.5.3.
Scottish Ministers	The Scottish Ministers advise that the Developer should use Option 2 (as described in Section 11.11.2.10 of the Scoping Report) to derive guillemot non-breeding season breeding populations, using the UK North Sea and Channel Waters Biologically Defined Minimum Population Scales ("BDMPS") population as the main approach taken in the assessment and should be used for Population Viability Analysis.	Noted. The BDMPS population for guillemot for the UK North Sea and Channel Waters has been used as the non-breeding season regional population within EIA.
Scottish Ministers	In relation to non-breeding season apportioning, the Scottish Ministers advise use of colony counts from the BDMPS in line with the NatureScot representation.	Noted. Colony counts from the BDMPS (Furness, 2015) have been used in non-breeding apportioning and are presented in EIAR Vol. 4, Appendix 24: Apportioning Report.
Scottish Ministers	With regard to mitigation, the Scottish Ministers acknowledge the embedded mitigations measures as outlined in Section 11.7 of the Scoping Report and agree that this is suitable for managing and mitigating effects of the Proposed Development on ornithological receptors. However, further mitigation may be required dependent on the outcome of the assessment in the EIAR. This is in line with the NatureScot representation.	Noted. This information is presented in Section 12.12.

REGULATOR/CONSULTEE	COMMENT	RESPONSE
Scottish Ministers	The Scottish Ministers agree with the Developer's proposal as set out in Section 11.9 of the Scoping Report to scope in distributional responses and collision risk during operation as part of the cumulative impact assessment.	Thank you. Quantitative analysis of distributional responses and collision risk cumulatively with other offshore wind farm projects is presented within Section 12.7.
Scottish Ministers	The Scottish Ministers agree with the Developer's proposal as set out in Section 11.10 of the Scoping Report to scope in transboundary effects.	Noted, thank you.
NatureScot	The study area is described in Section 11.3 of the Scoping Report. The Regional Study Area has been defined as species-specific and derived from breeding season foraging ranges from Woodward *et al*. (2019) and non-breeding season Biologically Defined Minimum Population Scales (BDMPS) regions as defined in Furness (2015). We agree with this but highlight that there are some exceptions to the standard foraging ranges for guillemot, razorbill and gannet for particular SPAs. These can be found in our Guidance Note 3. For the site-specific Digital Aerial Surveys (DAS), the surveys were conducted over the lease area plus a 4 km buffer. We agree with the survey area employed for the DAS.	NatureScot Ornithology Guidance Note 3 has been followed when determining seabird connectivity to the Project and exceptions to standard foraging ranges for guillemot, razorbill and gannet accounted for. The DAS report can be found in Annex 4 of EIAR Vol. 4, Appendix 16: Marine Mammal Baseline Report.
NatureScot	Designated Sites Table 11-6 shows the SPAs likely to have connectivity with the Project and designated qualifying features. We note the provisional list of SPAs and qualifying features in this table and that this list is purely indicative with no screening or connectivity analysis carried out. We would expect our Guidance Notes 3 and 4 to be followed when	NatureScot Ornithology Guidance Notes 3 and 4 are referenced within the RIAA, Appendix A: HRA Stage One Screening Report to determine connectivity to Designated Sites.

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	determining connectivity and await submission of the Stage 1 LSE Screening report.	
NatureScot	There is not any new legislation or policy documents that the Project should be aware of.	Noted, thank you.
NatureScot	Our CRM guidance note is currently being revised and an updated version will be published shortly. We recommend using the revised guidance to develop the CRM approach. At this stage we can share the following key changes to our guidance: • We have taken account of Ozsanlev-Harris *et al.* (2023) updated avoidance rates; • When running CRM we only require: - Most likely scenario (MLS) – option 2 (using the generic flight height dataset) – Worst-case scenario (WCS) – option 2 (using the generic flight height dataset). Please note that we require both stochastic and deterministic CRM outputs and these should be presented using the 2022 update to the sCRM tool shiny app (Caneco, 2022) The sCRM tool provides three approaches for estimating the variability for monthly density data. We advise that 1,000 samples from a distribution of mean densities (e.g. from a bootstrapped sample) is used. Where stochastic models have been used we require a clear statement as to which variability approach has been chosen and should the first or second approach be used, this will require justification. The bootstrapped data should be	Guidance presented within the August 2024 publication "*Joint advice note from the Statutory Nature Conservation Bodies (SNCBs) regarding bird collision risk modelling for offshore wind developments*" have been followed within the EIA application. The updated guidance incorporates the advice given as part of the Scoping Opinion and any advice previously received from NatureScot after the Scoping Workshop on 2nd April 2024.

REGULATOR/CONSULTEE	COMMENT	RESPONSE
	provided to enable the modelling to be re-run and the outputs checked	
NatureScot	A report has recently been published which presents new availability bias correction factors for auks and red-throated diver (Dunn *et al.*, 2024). We are currently reviewing this and will update our guidance shortly if appropriate.	NatureScot informed the Applicant in the Ornithology Catch Up on 7th August 2024 that the NatureScot advice on the application of Dunn *et al.* (2024) correction factors was not yet available. In lieu of this guidance, the Applicant has agreed with NatureScot to use correction factors which have previously been accepted on other Scottish offshore windfarm projects.
NatureScot	The species scoped in are those that were most abundant in the DAS and therefore should be considered for assessment. Please see Annex 1 below for our advice on the DAS Survey Report.	Noted, thank you. The DAS report can be found in Annex 4 of EIAR Vol. 4, Appendix 16: Marine Mammal Baseline Report.
NatureScot	The wording of this question does not exactly match what is stated in Table 11-8. In Table 11-8, direct disturbance and displacement is correctly included in all three life-cycle phases. We agree that distributional responses during the operational phase, collision risk during the operational phase and changes to prey resources (all life-cycle phases) should be scoped in for further assessment.	The Applicant proposes to follow the information presented in Table 11-8 of the Scoping Report, in accordance with the impacts which are requested to be Scoped In within this response from NatureScot. I.e. distributional responses during the operational phase, collision risk during the operational phase and changes to prey resources (all life-cycle phases), in addition to temporary disturbance and displacement (construction phase) and secondary entanglement (operational phase) (Section 12.6)
NatureScot	It is stated in Table 11-8 that "there may be temporary disturbance and displacement effects to ornithological receptors during the construction of the HDD. However, these are expected to be localised and temporary in nature and fully mitigated. This impact is therefore scoped out of the EIA". We are unable to comment on whether this pathway should be scoped out as it is not made clear how this impact is to be fully mitigated. We also highlight that if	To address NatureScot's concerns that there was not enough information available to Scope Out impacts from disturbance and / or displacement effects to ornithological receptors during construction of the HDD, the Applicant has Scoped In this potential impact and it is discussed in Section 12.6.1.2

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	the ornithological receptors in question are features of an SPA then this impact will need to be considered under HRA, noting that mitigation cannot be considered when assessing likely significant effects (LSE).	
NatureScot	"Subsea mooring systems may cause entanglement resulting in injury and/or mortality" is proposed to be scoped out for birds. The information presented in Appendix 5G (Approach to secondary entanglement as a potential impact) is helpful and indicates that risk of secondary entanglement is likely to be low. However, we advise that this impact pathway (secondary entanglement) should be scoped into the EIA for birds, due to the high uncertainty around this potential impact, the lack of monitoring to date, and the scale of the development which is greater than previous infrastructure projects in the area. We would not expect to see a quantitative assessment, rather the information provided in the Scoping Report could be used in the EIA to support qualitative assessment of sensitivity and magnitude of impacts.	Noted, secondary entanglement during the operational phase has been Scoped In within Section 12.6 and is considered qualitatively, aligning with the NatureScot advice received.
NatureScot	Wet storage could also be a significant impact pathway for ornithological receptors depending on the nature and location of activities associated with the construction assembly and maintenance of floating turbines. Agreement will be needed as to how this aspect is dealt with and assessed.	The Applicant understands the concerns raised by NatureScot regarding wet storage. At present, the temporary assembly and storage of non-generating floating wind turbines, or parts thereof, is not a licensable activity, as these assets are classified and insured as vessels in the context of port operations. Rather, the temporary storage of these assets within the bounds of the port authority forms part of the suite of vessel-related activities associated with port marshalling to support construction activities offshore, as it would for the oil and gas industry (e.g. through the temporary mooring of drill rigs, FPSOs, etc.). As such, the environmental impact assessment will be complete without

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		consideration of turbine storage and assembly associated with port marshalling, in that it will cover all of the licensable activities for which the Applicant seeks consent.
NatureScot	The approach to the collision risk assessment is discussed in Section 11.11.2.18-22. This Section states that the ornithological receptors which will be assessed for collision risk will be: kittiwake, gannet, and fulmar. However, fulmar is not considered to be at high risk of collision impacts. NatureScot is the operating name of Scottish Natural Heritage flight height is generally close to the sea surface and below potential collision height. It is standard practice that collision risk modelling is not undertaken for this species.	Noted. Collision risk modelling will not be undertaken for fulmar within the EIA.
NatureScot	Migratory birds are discussed in Section 11.11.2.22. We note that a qualitative assessment of migratory birds will be undertaken if the migratory CRM tool continues to be unavailable. The recently published Strategic Review of Birds on Migration in Scottish Waters (Woodward, *et al.*, 2023) will help inform decisions about which species need to be scoped in.	At the time of writing (December 2024), the migratory collision risk model is not available for use, which has been confirmed to HiDef by MD-LOT. Therefore, qualitative assessment of migratory species using Woodward *et al.* (2023) has been completed as presented in Section 0
NatureScot	There is a need for ongoing engagement in relation to the impacts of Highly Pathogenic Avian Influenza (HPAI) and how to incorporate these impacts within assessments. Work is continuing within NatureScot to provide further information, which we will provide when we can. In the meantime, we expect the impact of HPAI on colonies to be considered qualitatively especially when reviewing	Noted. The approach to incorporating HPAI in assessment was discussed with NatureScot during the Scoping Workshop on 29th February 2024. The Applicant has incorporated the outcomes of that discussion and the NatureScot and RSPB response to the Scoping Report within Section 12.4.5.3. Recent information presented by JNCC (2022), Tremlett *et al.* (2024) and Jeglinski *et al.* (2024) has been utilised.

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	Population Viability Analysis (PVA) outputs. As the DAS survey work straddles the HPAI outbreak, it will be important for assessment purposes to consider the current status of seabird populations at SPA colonies. Surveys have been undertaken at a number of key seabird colonies in 2023, coordinated by RSPB, and some will be repeated in 2024. Recent data for key species at some sites can already be found on the Seabird Monitoring Programme (SMP) database18. RSPB have just published a report on HPAI effects which will provide helpful context (Tremlett *et al.*, 2024).	
NatureScot	As above, we are currently revising our Collision Risk Modelling Guidance Note and the revised guidance note recommends using Ozsanlav-Harris *et al.* (2023) avoidance rates in assessments.	The Applicant acknowledges the new joint SNCB CRM guidance published in August 2024 "*Joint advice note from the Statutory Nature Conservation Bodies (SNCBs) regarding bird collision risk modelling for offshore wind developments*" and has utilised this when running collision analysis. Further information can be found in EIAR Vol. 4, Appendix 21: Collision Risk Modelling Report and Section 0.
NatureScot	Deriving a guillemot non-breeding season regional population We have already provided advice (letter sent by email on 2nd April 2024) that Option 2, using the BDMPS population, should be the main approach taken in assessments for this site and it should be used for PVAs. The relevant BDMPS population would be UK North Sea & Channel Waters. We are aware of ongoing tagging work on auks in the non-breeding season, building on Buckingham *et al.* (2022), including the new Scottish Government's Offshore Wind	Noted. The BDMPS population for guillemot for the UK North Sea and Channel Waters will be used as the non-breeding season regional population within the EIA.

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	Directorate's funded project 'Auk Foraging Ecology in the Non-Breeding Season' on the over-wintering ecology of guillemots and razorbills called Aukestra (AUKs: ESTimating Risk of displacement At sea). This project requires the deployment of GLS / TDR loggers in 2024 and 2025. Once this work is complete and published, we will review it and update our guidance if required.	
NatureScot	Deriving a guillemot non-breeding season regional population With respect to the colonies used for Option 1, this is not our preferred option. However, we note that the list provided above by HiDef is very limited and excludes a number of potentially relevant sites on the east coast of mainland Scotland, Orkney and Shetland. These include Fowlsheugh, West Westray, Calf of Eday, Rousay, Marwick Head, Hoy, Copinsay, Noss, Sumburgh Head and St Abbs Head to Fast Castle SPAs.	Noted. The BDMPS population for guillemot for the UK North Sea and Channel Waters will be used as the non-breeding season regional population within the EIA.
NatureScot	Deriving a guillemot non-breeding season regional population The Applicant is welcome to present their Option 1 as well, as an alternative approach, but our assessment of the project will be based on Option 2. An explanation of the rationale for including Option 1 and justification for its use would be required.	Noted. The BDMPS population for guillemot for the UK North Sea and Channel Waters will be used as the non-breeding season regional population within the EIA.

REGULATOR/CONSULTEE	COMMENT	RESPONSE
NatureScot	Deriving a guillemot non-breeding season regional population We advise that Option 2 is used to derive guillemot non-breeding season regional populations to be use within PVAs.	Noted. The BDMPS population for guillemot for the UK North Sea and Channel Waters will be used as the non-breeding season regional population within the EIA.
NatureScot	Deriving a breeding season regional population for fulmar Initially, we would expect all designated sites with theoretical connectivity to the development for each relevant qualifying species to be included based on mean-max + 1SD foraging ranges in the breeding season and taking account of by sea distances. This should define the maximum extent of the offshore ornithology regional study area and the regional population for a species.	As fulmar is no longer quantitatively assessed for collision risk within EIA, there is no need for a regional population to be derived for which to assign impacts to in the EIA. As such, no regional populations for fulmar will be presented.
NatureScot	Colony counts used in apportioning We advise that colony counts from the BDMPS should be used for non-breeding season apportioning.	Noted. Colony counts from the BDMPS will be used within non-breeding season apportioning.
NatureScot	We agree that the methods presented are appropriate and follow our guidance for the project alone assessment.	Noted.
NatureScot	Cumulative effects are considered in Section 11.9 of the Scoping Report. We agree with the proposed approach for the assessment of cumulative effects on ornithology receptors.	Noted. Additionally, the list of projects to be included in the ornithology cumulative assessment was provided to NatureScot on 28th October 2024. The response received from NatureScot on 5th December 2024 confirmed that NatureScot were content with the proposed developments included in cumulative assessment. This includes the use of the UK North Sea region used to screen in projects for guillemot during the non-breeding season, due to the

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		species being outside of breeding season mean-max foraging range + 1SD as presented in Woodward *et al.* (2019).
NatureScot	The embedded mitigation measures are detailed in Section 11.7 of the Scoping Report. In principle, we agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of the Project on ornithology receptors. However, we note that most proposed mitigation measures are based around future plans rather than specific measures. In addition, further mitigation and monitoring may be needed if impacts are predicted.	As presented in Section 12.12 no further mitigation is required above the embedded mitigation measures proposed in the Scoping Report and Section 12.5.4.
NatureScot	Potential transboundary effects on ornithology are considered in Section 11.10 of the Scoping Report and Appendix 5D: Transboundary Screening Matrix. We agree that ornithology should be scoped in for the assessment of transboundary effects and we agree with the proposed approach to the assessment. We do not currently have specific guidance for transboundary and inter-related effects.	Noted.
NatureScot	Section 2.1 of the DAS Report details the survey flight methodology. In summary, the following methodology was used: • 24 months of surveys, April 2021 – March 2023 • 2.5 km spaced transects • 2 cm Ground Sample Distance (GSD) • 550 m flying height • 10% site coverage. This is standard methodology for HiDef surveys, which we generally accept. Further, the 4 km buffer is acceptable for this development. It is noted that no information on environmental conditions,	Noted. Details on environmental conditions are presented within the Ornithology Baseline Appendix (EIAR Vol. 4, Appendix 19: Ornithology Baseline Report). The DAS report can be found in Annex 4 of EIAR Vol. 4, Appendix 16: Marine Mammal Baseline Report.

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	e.g. weather, sea state, etc. are provided in the report. This is something we would expect to see.	
NatureScot	The data analysis is described in Section 2.5 of the DAS Report and is as would be expected and standard practice for HiDef. We note that availability bias has been addressed appropriately for auks.	Noted, thank you.
NatureScot	Survey effort is discussed in Section 3.1 of the DAS Report. No surveys were carried out in July 2021 and December 2022 due to weather constraints. Two surveys were carried out in August 2021, one on 4 August to make up for lack of survey in July, the other on 20 August. It was a relatively long gap between the June survey on 10th June and the 4th August survey. In 2022 there were no months missed and surveys over the summer months were quite regular, including a survey on 21st July. Whilst it is surprising that weather prevented survey for a whole month in July, we can accept this as an additional survey was carried out to fill the gap and there was sufficient coverage the following year. A missed survey in December 2022 is of less concern as bird numbers tend to be low at this time of year, plus an additional survey was carried out early in January 2023.	Noted. Information pertaining to site-specific DAS is presented within Section 12.4.3.1 and in more detail in Annex 4 of EIAR Vol. 4, Appendix A16: Marine Mammal Baseline Report and EIAR Vol. 4, Appendix 19: Ornithology Baseline Report.
NatureScot	Identification rates are explained in Section 3.2 of the DAS Report. We note that each animal was assigned to a species group, and where possible these were also assigned a species identification with confidence levels of 'Possible', 'Probable' or 'Definite'. The analysis of data to species level uses all levels of identification confidence. Table 3 in the	The levels of identification confidence should not be taken into consideration when interpreting data as all levels of confidence are used within analysis. Even species which are identified down to a confidence of 'probable' have a high enough certainty to be included within further assessment. More information is provided within Annex 4 of EIAR Vol. 4, Appendix 16: Marine Mammal Baseline Report and EIAR Vol. 4, Appendix 19: Ornithology Baseline Report.

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	DAS Report presents identification rates that range from 94 - 100%. This appears to be excellent, but it should be qualified by the fact that it is based on all confidence levels including 'possible' and 'probable,' but does not show the number of identifications that fall into the different confidence categories. This makes the percentage identification rates rather misleading and further explanation is required.	
NatureScot	The results are as would be expected for a project so far offshore – 185 km from the coast by Peterhead. Specific comments for two species are provided below.	Noted.
NatureScot	We note in Plate 11-1 in the Scoping Report that overall bird numbers in 2022 were considerably higher than in 2021, particularly in the period July / August to November. It is clear from the two-year DAS Report that this difference is driven by guillemot numbers. Guillemot numbers were significantly lower in 2021 (2,055) than in 2022 (4,502) overall, especially from July / August-November. Large peaks of guillemot regularly occur during this post-breeding dispersal period, with large aggregations of birds often appearing offshore during these months. So, the low numbers in 2021 are of concern and are likely to have been caused by the auk wreck of Autumn 2021, which began with initial strandings in August on the east coast of Britain. We advise undertaking two years of survey to allow for interannual variation and for when events such as this occur which depress numbers in a particular year. We consider that the 2021 results may not provide representative data.	The Applicant engaged with NatureScot on 7th August 2024 to discuss and agree an approach to address the issue of guillemot abundance in site-specific DAS. To address NatureScot concerns, the Applicant proposes to utilise a combination of Options 2 and 3 as per NatureScot advice to provide additional evidence which may be used to explain inter-annual variation in auk abundance; this was discussed and agreed with NatureScot at the Ornithology Catch Up Meeting on 7th August 2024 and is presented in Section 12.4.4.3.

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	We would be interested in any information the Applicant could provide that might help explain the significant differences in numbers. We suggest possible options for addressing this: 1. Undertake additional digital aerial surveys at the same time of year following the same methodology used in the previous surveys and, if possible, similar dates. This could help establish more reliable baseline data for auks in the dispersal period. 2. Carry out a review of data available, or being collected, from east coast offshore wind farm sites on auk numbers and dispersal, during this period. As well as data from other site-specific bird surveys and monitoring, the study could include the regional DAS surveys being undertaken by the East Developer Collaboration. 3. It may also be useful to review any recent guillemot productivity data from the region, if available, to clarify chick fledging dates. This could provide useful data to help inform how the post-breeding dispersal period is considered within the assessment in general and for understanding the low numbers in 2021. 4. Use the 2022 August-November guillemot numbers for this period in 2021. We would be happy to discuss these options further with the Applicant and agree an approach to address this.	
NatureScot	It is noted that the surveys span the HPAI outbreak which began in 2021 and remains ongoing. This is likely to have particularly affected gannet numbers and the report states that a total of 59 gannets were recorded deceased, with the highest number recorded dead in June 2022. It will be	Noted, HPAI has been addressed within the Ornithology Baseline Appendix (EIAR Vol. 4, Appendix 19: Ornithology Baseline Report) and the Ornithology EIAR Chapter in Section 12.4.5.3.

REGULATOR/CONSULTEE	COMMENT	RESPONSE
	important to consider the impact of HPAI in assessments, as we have explained in our advice above.	
NatureScot	As shown in Figure 7-4 of the Scoping Report, the ECC will make landfall within the Buchan Ness to Collieston Coast SPA and will also pass through the marine extension of the SPA. There is therefore potential for the works related to the ECC to impact on the qualifying seabird features, primarily through disturbance. We understand that the Applicant is coordinating with NorthConnect Limited regarding the inshore portion of the ECC (the 28 km Section of cable from the 12 NM territorial boundary to MHWS) and that this Section of the ECC has previously been assessed within the EIAR submitted for NorthConnect Limited. It is stated throughout the Scoping Report (e.g. Section 5.6.2.4) that previous EIA work for NorthConnect will be considered when assessing impacts from the Project's ECC from MHWS to 12 NM, updated by any other readily available information and surveys undertaken. We raised concerns about the age of the NorthConnect Project survey data at the Scoping Workshop in February 2024. Generally, we do not accept survey data that is older than 5 years, and we understand the NorthConnect Project data is from 2017.	Due to the age of data utilised in the NorthConnect application, the Applicant has commissioned a programme of site-specific surveys spanning from April – September 2024 to supplement those previously conducted. Information from these surveys is presented in EIAR Vol. 4, Appendix 20: Intertidal & Nearshore Bird Surveys and Section 12.1.1.1.

REGULATOR/CONSULTEE	COMMENT	RESPONSE
NatureScot	The Scoping Workshop meeting minutes include an action point for Cenos to provide NatureScot with an update on planned ornithology survey work related to this issue. We received an email from Cenos on 3rd May 2024 providing this information, which we have reviewed and provide the following advice on. Two types of survey are being undertaken to update the NorthConnect data, using the same methodologies as the previous surveys. Time lapse camera surveys, using two cameras at the same locations and with the same set ups as for the NorthConnect surveys in 2016/17, were deployed in April 2024. The aim is to collect comparable data, to help understand any changes in bird numbers. It is not clear how long the cameras will be deployed for. Vantage point surveys will also be undertaken on a monthly basis from April up to and including October, focusing on the cable landfall site and up to 2 km offshore. The survey design mirrors that previously employed by the NorthConnect Project to characterise the baseline of the Project's landfall zone whilst ensuring that birds utilising seaward areas out to 2 km are also recorded. We welcome the new surveys and the Applicant's intention to update the NorthConnect Project's data. The methodologies employed are acceptable and we are pleased to see that they cover the 2 km marine extension to the SPA. In addition to the survey work, it will be important to use up to date colony counts from the Seabird Monitoring Programme database for the Buchan	Noted. NorthConnect data are supplemented by further data collected by APEM Ltd in 2024 and presented in EIAR Vol. 4, Appendix 20: Intertidal & Nearshore Bird Surveys and Section 12.1.1.1.

REGULATOR/CONSULTEE	COMMENT	RESPONSE
	Ness to Collieston Coast SPA in assessments, and to utilise any other available recent data from this area.	
RSPB	RSPB Scotland supports the deployment of renewable energy projects, providing that they are sited in appropriate places and designed to avoid potential adverse impacts on wildlife. We advise that all assessments should follow appropriate NatureScot Guidance.	Noted. The Applicant has followed the NatureScot Guidance Notes as closely as possible to ensure potential adverse impacts on wildlife are accounted for and assessed appropriately.
RSPB	The UK is of outstanding international importance for its breeding seabirds and wintering marine birds. As with all Annex I and regularly migratory species, the UK has a particular responsibility under the Birds Directive to secure their conservation. Their survival and productivity rates can be impacted by offshore windfarms directly (i.e. collision) and indirectly (e.g. displacement from foraging areas, additional energy expenditure, potential impacts on forage fish and wider ecosystem impacts such as changes in stratification). As set out in Searle *et al*. (2023), assessing impacts of offshore windfarms and other renewables developments is inherently uncertain. This uncertainty is propagated throughout the impact assessments, as there are not only direct impacts but ecosystem wide impacts that can change, for example, the abundance and availability of prey. Multiple data sources and modelling techniques are used to capture a simplified version of reality. They do not fully capture the complexity of seabird behavioural or demographic processes in a dynamic marine environment.	Noted. The Applicant has followed the NatureScot Guidance Notes published in 2023 which provides a range of scenarios under which impacts to ornithology receptors can be predicted, to ensure that the suitable amount of precaution is presented and accounted for. The consideration of wider ecosystem effects is considered within Section 12.11.

REGULATOR/CONSULTEE	COMMENT	RESPONSE
	Not recognising these uncertainties risks poorly informed decisions being made. Furthermore, an underestimation of impacts will have repercussions when consenting later offshore wind development. If a precautionary approach is taken from the beginning, the likelihood of irreversible damage occurring is reduced even whilst our knowledge base is incomplete, and modelling improves. The precautionary principle requires the Applicant to demonstrate with scientific certainty that something would not be harmful. The concept of something being overly precautionary dismisses the inherent uncertainty in modelling and overlooks the simplistic version of reality that the modelling captures. RSPB Scotland would welcome an inclusion of consideration of the potential wider ecosystem impacts that may arise through the construction and operation of the wind farm. These could occur, for example, through changes in water column stratification arising from the presence of the wind farm ultimately altering the availability of prey to seabirds.	
RSPB	The current H5N1 strain of Highly Pathogenic Avian Influenza (HPAI) has affected UK wild bird populations on an unprecedented scale since it was first recorded in the country in Great skuas in summer 2021, with seabirds and waterfowl particularly affected. The extent of reported mortalities attributed to HPAI in the UK and across Europe	The Applicant's approach to HPAI within assessment was discussed and agreed with NatureScot during the Scoping Workshop on 29th February 2024 and together with this RSPB representation and the subsequent NatureScot advice received 2nd April 2024, has been considered qualitatively in Section 12.4.5.3 and **EIAR Vol. 4, Appendix 19: Ornithology Baseline Report**. Recent

REGULATOR/CONSULTEE	COMMENT	RESPONSE
	in 2022 demonstrated that HPAI had become one of the biggest immediate conservation threats faced by multiple seabird species, including some for which the UK population is of global importance. Many species impacted by HPAI are of conservation concern in the UK, and the outbreak comes on top of widespread declines reported by the latest seabird census. It is currently unclear what the population scale impacts of the outbreak will be, but it is likely that they will be severe. This scale of impact means that seabird populations will be much less robust to any additional mortality arising from offshore wind farm developments. It also means that there may need to be a reassessment of whether SPA populations are in Favourable Conservation Status. With such uncertainty as to the future of these populations, there is the need for a high level of precaution to be included in examination of impacts arising from the proposed development.	information presented by JNCC (2022), Tremlett *et al*. (2024) and Jeglinski *et al.* (2024) has been utilised. The Applicant has provided a range of precaution within assessment for each potential impact which is Scoped In, which is discussed in more detail in Section 12.6.
Advice following the Scoping Workshop received 2nd April 2024		
NatureScot	Please note that there are some exceptions to the standard foraging ranges for guillemot, razorbill and gannet for particular SPAs. These can be found in our Guidance Note 3.	Noted. Guidance Note 3 has been referred to when determining the foraging range of ornithological receptors to be used within assessment.
NatureScot	The species scoped in are those that were most abundant in the DAS and therefore should be considered for	Puffin has been Scoped In for assessment of distributional responses and fulmar Scoped Out for assessment of collision risk. The results of this can be

REGULATOR/CONSULTEE	COMMENT	RESPONSE
	assessment. Puffin should also be included. However, fulmar is not considered to be at high risk of collision impacts, as flight height is generally close to the sea surface and below potential collision height. It is standard practice that collision risk modelling is not undertaken for this species and fulmar is generally scoped out at the stage of considering impact pathways.	found in Section 12.6, EIAR Vol. 4, Appendix 21: Collision Risk Modelling Report and EIAR Vol. 4, Appendix 22: Distributional Responses Report.
NatureScot	There is a need for ongoing engagement in relation to the impacts of HPAI and how to incorporate these impacts within assessments. Work is continuing within NatureScot to provide further information which we will do when we can. In the meantime, we expect the impact of HPAI on colonies to be considered qualitatively especially when reviewing PVA outputs. As the DAS survey work straddles the HPAI outbreak it will be important for assessment purposes to consider the current status of seabird populations at SPA colonies. Surveys have been undertaken at a number of key seabird colonies in 2023, coordinated by RSPB, and some will be repeated in 2024. Recent data for key species at some sites can already be found on the SMP database. RSPB have just published a report on HPAI effects which will provide helpful context: UK seabird colony counts in 2023 following the 2021-22 outbreak of Highly Pathogenic Avian Influenza Research Report 76. RSPB Conservation Science.	Noted. The approach to incorporating HPAI in assessment was discussed with NatureScot during the Scoping Workshop on 29th February 2024. The Applicant has incorporated the outcomes of that discussion and the NatureScot and RSPB response to the Scoping Report within Section 12.4.5.3 and EIAR Vol. 4, Appendix 19: Ornithology Baseline Report. Recent information presented by JNCC (2022), Tremlett *et al.* (2024) and Jeglinkski *et al.* (2024) has been utilised.
NatureScot	We are currently revising our Collision Risk Modelling Guidance Note 7 and this should be available shortly. The revised guidance note recommends using Ozsanlav-Harris *et al.* avoidance rates.	Guidance presented within the August 2024 publication "*Joint advice note from the Statutory Nature Conservation Bodies (SNCBs) regarding bird collision risk modelling for offshore wind developments*" has been closely followed and incorporated into assessment. The updated guidance incorporates the advice

REGULATOR/CONSULTEE	COMMENT	RESPONSE
		given as part of the Scoping Opinion and any advice previously received from NatureScot after the Scoping Workshop on 2nd April 2024.
NatureScot	In terms of HRA, for guillemot in the non-breeding season we advise the use of breeding season populations within foraging range, rather than BDMPS populations, as they tend to stay in vicinity of breeding colonies. For this site there are no SPAs within foraging range so there is no need for an HRA assessment for guillemot in the non-breeding season. However, we recommend that a displacement assessment using the BDMPS regional population, without SPA apportionment, should be presented in the EIAR with justification for any conclusions.	Noted. The BDMPS population for guillemot for the UK North Sea and Channel Waters has been used as the non-breeding season regional population within EIA.
NatureScot	Initially, we would expect all designated sites with theoretical connectivity to the development for each relevant qualifying species to be included based on mean-max + 1SD foraging ranges in the breeding season. This should define the maximum extent of the offshore ornithology regional study area and the regional population for a species. However, please note our comments above regarding fulmar and impact pathways.	Noted. The regional study area for ornithological receptors during the breeding season has been based on the mean-max foraging range + 1 SD as presented in Woodward *et al.* (2019) and NatureScot Guidance Note 5.
NatureScot	Projects located in Scottish and English waters should be scoped in / out of the cumulative assessment for breeding birds based on the mean-maximum foraging ranges from Woodward *et al.* (2019). The non-breeding season cumulative assessment, for species that migrate or disperse from their colonies, should include relevant developments within the BDMPS region (Furness, 2015).	This approach has been followed with the results of which presented in Section 12.7.

REGULATOR/CONSULTEE	COMMENT	RESPONSE
NatureScot	The approach described above for cumulative effects should also be used for wider transboundary effects. The inter-related effects are appropriate. We do not currently have any specific guidance on these topics.	Noted. The same approach for Scoping In cumulative projects has been used for wider transboundary effects (Section 12.10).
NatureScot	Disturbance and displacement also apply to the operational phase from maintenance activities and vessel movements. Please note that assessment of vessel movements should include potential impacts from vessels transiting between ports and the Array Area.	Noted. Disturbance and displacement during the operational phase due to maintenance activities and vessel movements have been Scoped In and are discussed within Section 12.6.2.1.
NatureScot	We advise that secondary entanglement (e.g. ghost nets entangled on subsea mooring lines) should be scoped in as a potential impact pathway during the operation and maintenance phase. Although there is limited evidence of secondary entanglement occurring, it's possible this is due to limited monitoring. Also, floating wind is a relatively new technology and the small demonstration inshore floating sites don't compare to the larger sites offshore. Further, fishing patterns may change once the proposed wind farm is operational through the displacement of fishers from other areas, which could lead to more lost equipment in the area that isn't perhaps currently seen. Lastly, the forthcoming scaling up of turbines in the ocean may result in a cumulative risk effect for secondary entanglement. That said, we are mindful that during the workshop there was discussion around potential evidence and experience from other floating offshore assets that could provide useful information and context with respect to this impact	Noted, secondary entanglement from subsea mooring systems is Scoped In for assessment and provided within Section 12.1.1.1.

REGULATOR/CONSULTEE	COMMENT	RESPONSE
	pathway. We would be happy to review this and advise further.	
NatureScot	Impact pathways associated with wet storage activities should be considered for ornithology. We appreciate that there are ongoing discussions regarding who has the responsibility for assessing impacts arising from wet storage and so we raise here just to highlight that it could represent a very significant impact pathway for ornithological receptors.	The Applicant understands the concerns raised by NatureScot regarding wet storage. At present, the temporary assembly and storage of non-generating floating wind turbines, or parts thereof, is not a licensable activity, as these assets are classified and insured as vessels in the context of port operations. Rather, the temporary storage of these assets within the bounds of the port authority forms part of the suite of vessel-related activities associated with port marshalling to support construction activities offshore, as it would for the oil and gas industry (e.g. through the temporary mooring of drill rigs, FPSOs, etc.). As such, the environmental impact assessment will be complete without consideration of turbine storage and assembly associated with port marshalling, in that it will cover all of the licensable activities for which the Applicant seeks consent.

12.4 Baseline characterisation

This Section outlines the current baseline for ornithology within the Study Area. The baseline characterisation and impact assessment are based on two years of site-specific DAS surveys which were carried out between April 2021 and March 2023, covering the DAS Area (INTOG Area + 4 km Buffer; Annex 4, EIAR Vol. 4, Appendix 16: Marine Mammal Baseline Report). In addition, land-based Vantage Point (VP) surveys of nearshore / intertidal bird activity in the area around the Project's proposed landfall site were also carried out between April and September 2024 (EIAR Vol. 4, Appendix 20: Intertidal and Nearshore Bird Surveys). All site-specific surveys are detailed in Section 12.4.3. Additionally, a desk-based study was undertaken to collate relevant information to the Project and surrounding areas. Data sources are presented in Table 12-4 and discussed in Section 12.4.2; more detail can be found EIAR Vol. 4, Appendix A19: Ornithology Baseline Report and EIAR Vol. 4, Appendix 20: Intertidal and Nearshore Bird Surveys.

12.4.1 Study area

Site-specific DAS covering the area shown in Figure 12-1 was used to characterise the baseline environment for ornithological receptors. Further detail on DAS coverage and data analysis is given in EIAR Vol. 4, Appendix A19: Ornithology Baseline Report; the DAS report which can be found in Annex 4 of EIAR Vol. 4, Appendix A16: Marine Mammal Baseline Report.

The Study Area for marine birds is derived from the foraging ranges presented in Woodward *et al*. (2019) in the breeding season and Biologically Defined Minimum Population Scales (BDMPS) regions as defined in Furness (2015) in the non-breeding season, as agreed with NatureScot at the Scoping Workshop on 29th February (Table 12-3). All phases of the Project are addressed in the assessment of ornithological receptors: construction, operation and maintenance and decommissioning. The Study Area covered by nearshore / intertidal surveys is presented in EIAR Vol. 4, Appendix 20: Intertidal and Nearshore Bird Surveys.

The ornithology temporal scope is defined as the entire lifetime of the Project including construction, operation and maintenance and decommissioning.

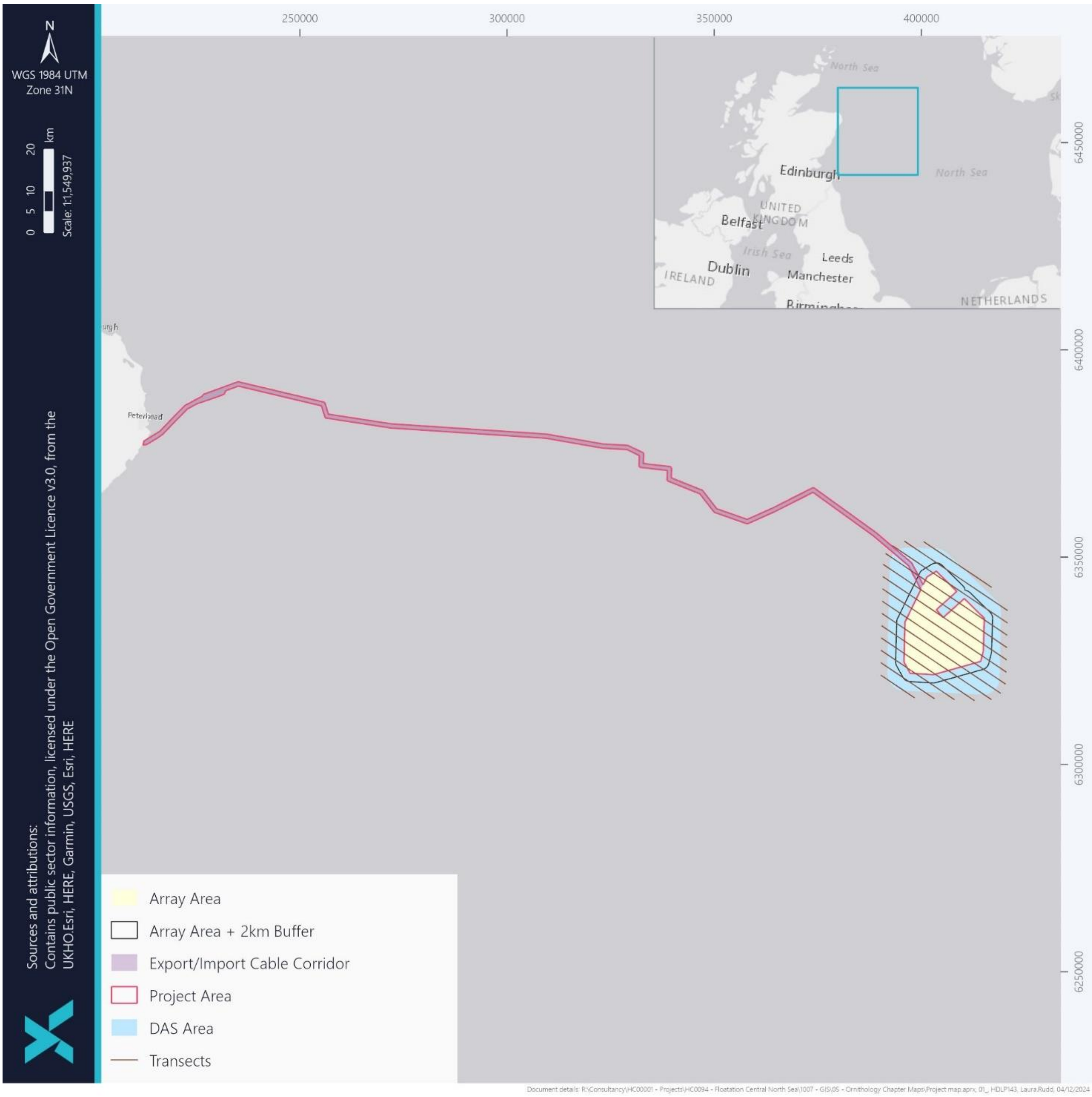

Figure 12-1 The Project including the Array Area, Export / Import Cable Corridor (EICC) and survey area covered by site-specific DAS

12.4.2 Data sources

The existing data sets and literature with relevant coverage to the Project, which have been used to inform the baseline characterisation for ornithology are outlined in Table 12-4. Project specific data obtained and used to inform this topic assessment are described in section 12.4.3.

Table 12-4 Summary of key datasets and reports

TITLE	SOURCE	YEAR	AUTHOR
Auk tagging project: final report, January 2023	Report available here: https://group.vattenfall.com/uk/contentassets/c65a13553f864f599431d69c8c6a57b4/auk-tagging-final-report-january-2023.pdf	2023	Vattenfall
Breeding density, fine-scale tracking, and large-scale modelling reveal the regional distribution of four seabird species	https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/eap.1591	2017	Wakefield *et al.*
Desk-based revision of seabird foraging ranges used for HRA screening	Referenced in NatureScot 2023c.	2019	Woodward *et al.*
Digital aerial seabird and cetacean surveys off the east coast of Scotland	https://www.gov.scot/publications/digital-aerial-seabird-cetacean-surveys-east-coast-scotland/	2021	APEM
Distribution maps of cetacean and seabird populations in the North-East Atlantic	https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/1365-2664.13525	2020	Waggitt *et al.*
Energy synchrony throughout the non-breeding season in common guillemots from four colonies	https://nsojournals.onlinelibrary.wiley.com/doi/10.1111/jav.03018?msockid=0372f55ba2056b970a86e71ca33d6a69	2023	Buckingham *et al.*
Green Volt Offshore Windfarm site-specific digital aerial surveys	https://marine.gov.scot/sites/default/files/2301261.pdf	2022	APEM

TITLE	SOURCE	YEAR	AUTHOR
Identifying important at-sea areas for seabirds using species distribution models and hotspot mapping	https://www.sciencedirect.com/science/article/pii/S0006320719310419	2020	Cleasby *et al.*
Interspecific variation in non-breeding aggregation: a multi-colony tracking study of two sympatric seabirds	https://www.int-res.com/articles/meps_oa/m684p181.pdf	2022	Buckingham *et al.*
JNCC Online SPA standard data forms for Natura2000 sites and SPA citations from NatureScot	https://sitelink.nature.scot/home	Various	JNCC & NatureScot
Mapping seabird sensitivity to offshore windfarms	https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0106366	2017	Bradbury *et al.*
Non-breeding season populations of seabirds in UK waters: Population sizes for Biological Defined Minimum Population Scales (BDMPS)	https://publications.naturalengland.org.uk/publication/6427568802627584	2015	Furness *et al.*
Ossian Offshore Wind Farm Limited site-specific DAS	https://marine.gov.scot/sites/default/files/volume_3_-_technical_reports_-_appendix_11.1_-_offshore_ornithology_baseline_report.pdf	2024	Ossian Offshore Wind Farm Limited (RPS)
Seabird Count: a census of breeding seabirds in Britain and Ireland	https://jncc.gov.uk/news/seabirds-count-publication/	2015 - 2021	Burnell *et al.*
Seabird Monitoring Programme (SMP) colony counts	https://app.bto.org/seabirds/public/data.jsp	Various	Seabird Monitoring Programme (SMP)
The identification of possible marine SPAs for seabirds in the UK: The application of Stage 1.1. – 1.4 of the SPA selection guidelines	https://hub.jncc.gov.uk/assets/6882ac8a-0f00-4abe-bc4b-88fc96dbc789	2012	Kober *et al.*

12.4.3 Project site-specific surveys

The surveys that have been undertaken and used to inform this ornithology assessment are summarised in Table 12-5. The area covered by site-specific DAS is presented in Figure 12-1, the area covered by NorthConnect VP surveys is presented in Figure 12-2. The most recent vantage point surveys are detailed in EIAR Vol. 4, Appendix 20: Intertidal & Nearshore Bird Surveys and summarised in Section 12.4.3.2.

Table 12-5 Summary of surveys

SURVEY TYPE	SCOPE OF SURVEY
Site-specific DAS	Site-specific DAS for ornithological receptors between April 2021 and March 2023
Intertidal and VP surveys	APEM Ltd monthly VP surveys between April and September 2024 NorthConnect monthly VP surveys between February 2016 and January 2017

12.4.3.1 Digital Aerial Surveys

In March 2021, HiDef were commissioned by the Applicant to undertake two years of high-resolution DAS of marine megafauna (including ornithological features). This EIAR Chapter only describes the ornithological activity recorded in site-specific DAS. Twenty-four surveys were flown roughly monthly (Section 12.4.3.4) between April 2021 and March 2023. Transects were spaced 2.5 km apart and orientated south-west and north-east, perpendicular to the depth contours along the coast, to reduce variation in ornithological abundance between transects.

The original DAS Area covered a total area of 835.97 km^2, covering the INTOG lease area plus a 4 km buffer (Figure 12-1). After the programme of DAS had been completed, the boundary for the Array Area for the Project, within the DAS Area was defined (the Array Area), with a total area of 333 km^2. The Array Area plus a 2 km buffer (an area relevant to impact assessment of ornithological receptors) is intersected by 12 transects and covers an area of 505.02 km^2.

Full details of the DAS methodology and the analysis of digital aerial video footage is presented in Annex 4 of EIAR Vol. 4, Appendix 16: Marine Mammal Baseline Report and EIAR Vol. 4, Appendix 19: Ornithology Baseline Report. In summary, the DAS were undertaken using four Gen II camera rigs with sensors set to a resolution of 2 centimetre (cm) ground sample distance (GSD) when flown at ~550 m above sea level. Each camera sampled a strip of ~125 m width, separated from the next camera by approximately 25 m, which provided a combined sampled width of 500 m within a 575 m overall strip. The total DAS Area measured 832.97 km^2 with a minimum sample coverage of 10% of the area achieved.

12.4.3.2 NorthConnect surveys

The Applicant has entered into a binding agreement to acquire NorthConnect Limited (the "Acquisition"). Completion of the Acquisition is subject to receipt of customary regulatory approvals. Once this acquisition is complete, the Applicant will hold the benefit of the Marine Licences granted in respect of the NorthConnect project as well as the planning permissions that have been granted for the onshore substation and cable infrastructure. Discussions remain ongoing as to whether the Applicant will utilise the full NorthConnect route to develop a multi-purpose interconnector (MPI) that connects the Project (as well as future oil and gas Onward Development Connections) to Scotland and Norway. The Applicant intends to utilise the shoreward part of the NorthConnect cable corridor for its offshore transmission infrastructure, although it is applying for new marine licenses to reflect the fact that its transmission infrastructure would not be part of an exempt interconnector cable and instead connected to an offshore generating station. For the avoidance of doubt, only one set of infrastructure will be placed within the consented cable corridor.

Between February 2016 and January 2017, ornithological surveys were conducted by Natural Research (Projects) Ltd at the NorthConnect survey area near Boddam, north-east Scotland, to characterise the surrounding area for a proposed landfall of an undersea cable route from Norway (NorthConnect, 2018b; Figure 12-2). The findings would enable an assessment of potential disturbance to seabird species with visual surveys undertaken within the preferred landfall site plus a 500 m buffer to either side. The area surveyed lies within the Buchan Ness to Collieston Coast SPA, which is designated for a breeding seabird assemblage. The specific area includes the Bullers of Buchan coast, which is also a Site of Special Scientific Interest (SSSI) for ornithological interest.

In addition, vantage point surveys from two different locations were undertaken to quantify the number and distribution of seabirds in waters out to 2 km from the coast. During each scan, individuals or groups of birds were identified, counted and their location and behaviour recorded. Surveys were also conducted along the proposed onshore cable corridor plus a 500 m buffer over four visits between April and July 2017, where location and activity of birds was recorded.

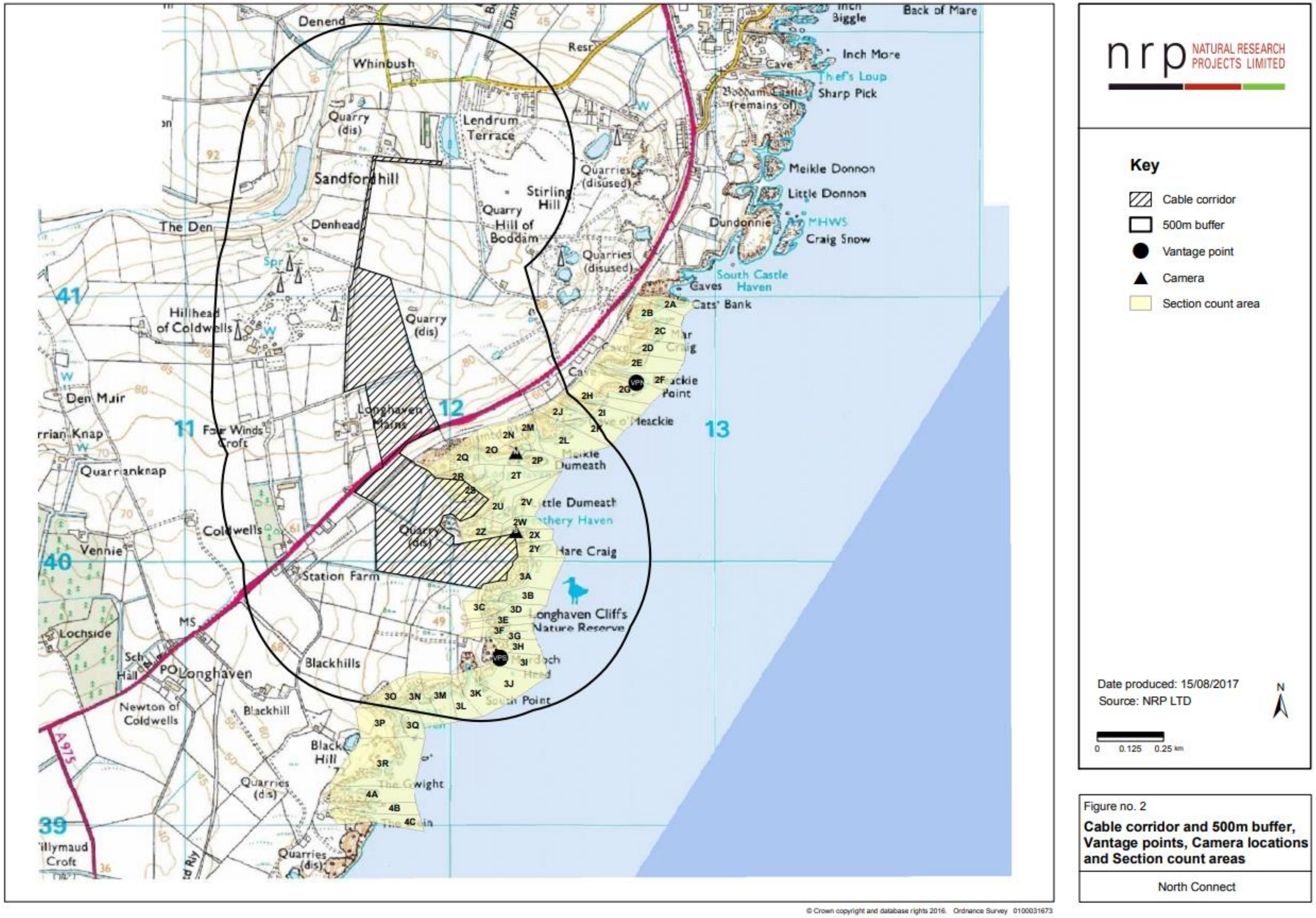

Figure 12-2 NorthConnect visual survey area (NorthConnect 2018b)

12.4.3.3 Intertidal and nearshore surveys

Between April and September 2024, six surveys were undertaken using the same methodology as those commissioned for NorthConnect, to provide updated information on seabird abundance and distribution around the landfall location. This followed the request from NatureScot for more recent data covering the landfall location in the Scoping Workshop held 29th February 2024; the approach to surveys was confirmed in the Ornithology Catch Up on 7th August 2024.

Vantage point surveys were conducted using the Through the Tidal Cycle Count (TTTCC) method as outlined by Gilbert *et al.* (1998) and were performed at different tidal states to ensure full coverage of the utilisation of the intertidal area during different stages of the tidal cycle. Surveys also included the area up to 2 km offshore and all areas within the Zone of Influence (ZOI) of the landfall site. Data for all waterbirds (including seabirds) were collected. Additional data on bird behaviour and disturbance events were recorded. More information is provided within EIAR Vol. 4, Appendix 20: Intertidal and Nearshore Bird Surveys.

12.4.3.4 Data limitations and assumptions

DAS provide a 'snapshot' of the baseline environment and, as with most other survey methods, they require suitable weather conditions and are limited in when they can be undertaken temporally (daylight hours). In July 2021 and December 2022, adverse weather conditions meant that DAS could not be conducted. In these instances, the surveys were flown the following month when a weather window was available. In the case of December 2022, NatureScot agreed this gap between surveys does not cause issues as seabird abundance tends to be low during winter (Table 12-3). For the missed July 2021 survey, as an additional survey was flown in August 2021 and there was sufficient coverage in the July 2022 survey, it was deemed by NatureScot in their response to the scoping report that there was sufficient representation of this season (Table 12-2).

Seabirds are highly mobile and widely distributed species, and thus some variation in abundance and density between surveys is to be expected. Currently there are limited methods able to account for the night activity of birds. Aside from this, the 24 site-specific DAS surveys are considered to provide a representative baseline of the Study Area for use in impact assessment. The desk-based studies also serve to supplement the site-specific surveys and provide further information ton contextualise predicted effects.

Project-specific DAS covered the Array Area plus a 4 km buffer however, it did not cover the Export / Import Cable Corridor (EICC). For the latter, therefore, a qualitative approach is taken to assessment of the potential effect pathways, with inferences made regarding the species potentially present in the EICC and their distribution, using information presented in EIAR Vol. 4, Appendix 20: Intertidal and Nearshore Bird Surveys as well as available SPA information and other published studies (Table 12-4).

Inherently, there will be limitations in using publicly available information to characterise the Study Area. Typically, data have not been collected to inform an EIA and therefore the temporal and spatial scales as well as the methodology applied may not be optimal for use in assessment. In addition, some of the sources may be older than desired and therefore may not be fully reflective of the current environment. As an example, the original NorthConnect surveys were carried out in 2017-2018 meaning these data are now over five years old; however, the addition of VP surveys in 2024 commissioned by the Applicant (EIAR Vol. 4, Appendix 20: Intertidal and Nearshore Bird Surveys) to supplement the original data, strengthen and provide confidence in results as well as highlight any changes since the previous surveys.

12.4.4 Existing baseline

A review of literature and available data sources (Table 12-3), augmented by consultation and Project site-specific surveys has been undertaken to describe the current baseline environment for ornithology.

12.4.4.1 Current baseline conditions

EIAR Vol. 4, Appendix 19: Ornithology Baseline Report and EIAR Vol. 4, Appendix 20: Intertidal and Nearshore Bird Surveys provide detailed characterisation of the baseline environment relating to ornithology which should be read in conjunction with this EIAR Chapter. Site-specific DAS recorded a total of 4,991 birds of 15 species (raw counts) within the Array Area plus 2 km buffer (Table 12-6). The most abundant species recorded was common guillemot (*Uria aalge*, hereafter 'guillemot'), followed by northern fulmar (*Fulmarus glacialis*, hereafter 'fulmar') and gannet. Intertidal vantage point surveys recorded a total of 3,931 birds of 22 species (Table 12-7). The most abundant species were black-legged kittiwake (*Rissa tridactyla*, hereafter 'kittiwake'); followed by guillemot. For intertidal and nearshore surveys, the peak count was taken as a proxy for abundance.

Table 12-6 Summary of species recorded during DAS of Array Area plus 2 km buffer (raw counts)

SPECIES	SCIENTIFIC NAME	ARRAY AREA		ARRAY AREA + 2 KM BUFFER		DAS AREA	
		YEAR 1	YEAR 2	YEAR 1	YEAR 2	YEAR 1	YEAR 2
Arctic skua	*Stercorarius parasiticus*	1	1	1	1	1	1
Arctic tern	*Sterna paradisaea*	5	0	13	0	13	0
Common gull	*Larus canus*	0	0	0	1	2	1
Common scoter	*Melanitta nigra*	0	0	0	0	0	4
Fulmar	*Fulmarus glacialis*	163	244	258	392	441	699
Gannet	*Morus bassanus*	48	86	64	115	115	154
Great black-backed gull	*Larus marinus*	7	21	9	24	17	41
Great skua	*Stercorarius skua*	1	0	1	0	2	0
Guillemot	*Uria aalge*	862	1,722	1,298	2,647	2,055	4,502
Herring gull	*Larus argentatus*	2	3	5	5	7	8
Kittiwake	*Rissa tridactyla*	25	33	38	47	73	96
Knot	*Calidris canutus*	8	0	8	0	8	0
Little auk	*Alle alle*	1	0	1	0	1	0
Little gull	*Hydrocoloeus minutus*	0	0	0	1	0	1
Puffin	*Fratercula arctica*	27	7	36	12	63	23
Razorbill	*Alca torda*	0	12	0	14	0	19
Total		1,152	2,129	1,732	3,259	2,798	5,549

Table 12-7 Summary of species recorded during nearshore and intertidal surveys (April to September 2024) EIAR Vol. 4, Appendix 20: Intertidal & Nearshore Bird Surveys. Peak count taken as proxy for abundance

SPECIES	MONTH						PEAK COUNT	PEAK MONTH
	APR	MAY	JUN	JUL	AUG	SEP		
Waterfowl and wader species								
Shelduck	15	0	0	0	0	0	15	April
Eider	16	8	3	2	2	3	16	April
Oystercatcher	0	0	0	2	0	5	5	September
Curlew	0	0	0	0	0	1	1	September
Redshank	0	0	0	0	0	2	2	September
Red-throated diver	0	0	0	0	0	1	1	September
Gull, tern and skua species								
Kittiwake	200	244	726	196	84	18	726	June
Black-headed gull	0	0	0	0	0	10	10	September
Common gull	0	0	0	0	0	31	31	September
Great black-backed gull	1	2	1	3	2	4	4	September
Herring gull	112	3	20	35	34	32	112	April
Sandwich tern	0	0	0	0	50	0	50	August
Great skua	0	0	1	1	1	0	1	June – August
Arctic skua	0	0	0	1	1	0	1	July and August
Other seabird species								
Guillemot	65	530	432	32	61	11	530	May
Razorbill	47	78	88	19	0	4	88	June
Puffin	0	21	28	76	0	0	76	July
Auk species	0	144	243	44	0	6	243	June
Fulmar	0	14	20	9	10	5	20	June
Gannet	0	0	0	0	5	1	5	August
Cormorant	0	3	5	5	1	2	5	June and July
Shag	5	5	7	9	13	10	13	August

The seabird species addressed in the assessment are those considered to be at potential risk due to their abundance in site-specific DAS, intertidal or nearshore surveys or their potential sensitivity to wind farm effects (Furness *et al.*, 2013; Wade *et al.*, 2016; Bradbury *et al.*, 2014), and were discussed with NatureScot during the Scoping Workshop on 29th February 2024 and agreed with the Scottish Ministers through the Scoping Opinion and the NatureScot response to the Scoping Report (Table 12-3). The species considered within assessment in this EIAR which were discussed and agreed through the Scoping Opinion and will be considered within quantitative assessment are:

- Kittiwake;
- Guillemot;
- Atlantic puffin (*Fratercula arctica*, hereafter 'puffin');
- Gannet; and
- Fulmar (scoped in for qualitative assessment of distributional responses only).

Additionally, intertidal and nearshore surveys (EIAR Vol. 4, Appendix 20: Intertidal and Nearshore Bird Surveys) recorded species in abundance which warrants their inclusion for assessment of disturbance and / or displacement of ornithology receptors during HDD during the construction phase and collision with WTGs during the operation and maintenance phase. The following species are assessed qualitatively:

- Waders and waterfowl (migratory species considered for collision with WTGs only);
- Herring gull (*Larus argentatus*; disturbance and / or displacement of ornithology receptors during HDD only);
- Razorbill (*Alca torda;* disturbance and / or displacement of ornithology receptors during HDD only); and
- Puffin (disturbance and / or displacement of ornithology receptors during HDD only).

Effects have been assessed in the context of relevant biological seasons, as defined by NatureScot (2020) and are presented in Table 12-8.

Table 12-8 Seasonal period used within ornithological impact assessment (NatureScot, 2020)

SPECIES	BREEDING SEASON	NON-BREEDING SEASON
Kittiwake	Mid Apr – Aug	Sep – mid Apr
Herring gull	Apr - Aug	Sep - Mar
Guillemot	Apr – mid Aug	Mid Aug - Mar
Razorbill	Apr – mid Aug	Mid Aug - Mar
Puffin	Apr – mid Aug	Mid Aug - Mar
Fulmar	Apr - mid Sep	Mid Sep – Mar
Gannet	Mid Mar - Sept	Oct – mid Mar

12.4.4.1.1 Key designated sites and seabird interests relevant to the Project

Seabirds are central-place foragers, leaving their coastal breeding colonies during the breeding season to hunt prey and primarily to provide for their chicks. For each of the species included in assessment, birds recorded within the DAS Area are likely to originate from breeding colonies located within the foraging range of each species. The breeding populations of seabirds at several colonies in the UK are protected and designated as SPAs.

The RIAA, Appendix A: HRA Stage One Screening Report, EIAR Vol. 4, Appendix 24: Apportioning Report and Report to Inform Appropriate Assessment (RIAA) provide the long list of SPAs screened in for assessment. These contain the designated sites for all qualifying breeding and seabird interests located within the foraging range of the Project. Designated sites important for seabirds are considered within the HRA process and are discussed within the RIAA. Key designated sites for ornithology are presented in Table 12-9. These sites are generally those which are located within the mean max foraging range + one standard deviation (mmfr + 1SD) to the Project which support important populations of breeding seabirds.

Table 12-9 Key designated sites for species scoped in for assessment

DESIGNATED SITE	RELEVANT QUALIFYING INTEREST FEATURES
Buchan Ness to Collieston Coast SPA	Kittiwake, herring gull
East Caithness Cliffs	Kittiwake
Fair Isle SPA	Gannet, puffin
Farne Islands SPA	Puffin
Flamborough and Filey Coast SPA	Gannet, kittiwake
Forth Islands SPA	Gannet, kittiwake, puffin
Foula SPA	Gannet, guillemot, kittiwake, puffin
Fowlsheugh SPA	Kittiwake, guillemot
Hermaness, Saxa Vord and Valla Field SPA	Gannet, puffin
Hoy	Puffin
North Caithness Cliffs SPA	Kittiwake
North Rona and Sule Sgeir SPA	Gannet
Noss SPA	Gannet
St Abb's Head to Fast Castle SPA and SSSI	Kittiwake
St Kilda SPA	Gannet
Sule Skerry & Sule Stack	Gannet
Troup, Pennan and Lion's Head SPA	Kittiwake
West Westray SPA	Kittiwake

12.4.4.1.2 Regional populations

Regional populations for the ornithological receptors quantitatively assessed within the EIAR were derived in order to determine the scale of potential effects (EIAR Vol. 4, Appendix 23: Regional Populations and Associated Colony Counts). For the breeding season, regional populations were derived using species-specific foraging ranges presented in Woodward *et al.* (2019), as described in the NatureScot guidance (NatureScot, 2023c), set out in the Scoping Report and agreed with NatureScot (Table 12-3). The Project is outside of foraging range for guillemot during the breeding season therefore this species is not assessed during this period, as agreed with NatureScot via written advice received (Table 12-3).

For kittiwake and puffin, the total number of breeding adult birds at each colony within the species-specific mmfr + 1SD of the Project were taken from the Seabird Monitoring Programme (SMP) and combined to create the breeding season regional populations. The mmfr +1SD was used for all gannet colonies without site-specific data and where site-specific data were available (i.e. for Grassholm, St Kilda and Forth Islands SPAs) maximum foraging range values were used to derive a breeding season regional population (Table 12-10).

A proportion of birds present in the breeding season will be non-breeding, known as 'sabbatical birds'. Within the regional population, a sabbatical rate of 10% has been applied for gannet and kittiwake and 7% for puffin, to adult birds during the breeding season, as per Berwick Bank (SSE Renewables, 2022) and Green Volt (Green Volt, 2023). The correction has been applied post analysis of assessment of distributional responses and collision risk, when determining whether the threshold for requirement for Population Viability Analysis (PVA) has been reached; more information is provided within EIAR Vol. 4, Appendix 25: Population Viability Analysis Report. No sabbatical rate is applied for guillemot as the species is only assessed during the non-breeding season.

For the non-breeding season, information presented in Furness (2015) was used to derive regional populations. Since guillemot is outside of foraging range, NatureScot requested that assessment during this season also be conducted on the non-breeding season regional population as presented in Furness (2015) (Table 12-3). For kittiwake and gannet, the autumn migration population from Furness (2015) was used as the non-breeding season regional population as mean seasonal peaks for both species occur in the autumn. For further detail on how the regional populations were derived in both the breeding and non-breeding seasons, refer to EIAR Vol. 4, Appendix 23: Regional Populations and Associated Colony Counts.

Fulmar regional populations have not been derived as only a qualitative assessment for distributional responses was required, following the NatureScot response to the RIAA, Appendix A: HRA Stage One Screening Report, as presented in the RIAA. The other species which are assessed qualitatively for disturbance and / or displacement of ornithology receptors during HDD only and collision with WTGs also did not require the calculation of regional populations.

Table 12-10 Foraging ranges used to calculate breeding season regional populations (NatureScot, 2023; Woodward et al., 2019)

SPECIES	FORAGING RANGE (KM)	ONE STANDARD DEVIATION (KM)	METRIC
Kittiwake	156.1	144.5	Mean-max plus 1SD
Guillemot	Not assessed during the breeding season - Project is outside foraging range		
Puffin	137.1	128.3	Mean-max plus 1SD
Gannet	315.2	194.2	Mean-max plus 1SD
	590	-	Max (Forth Islands)
	709	-	Max (St Kilda)

Table 12-11 Breeding and non-breeding regional populations used to assess effects

SPECIES	BREEDING SEASON REGIONAL POPULATION	NON-BREEDING SEASON REGIONAL POPULATION	BDMPS REGION (FURNESS, 2015)
Kittiwake	231,732	829,937	UK North Sea
Guillemot	NA	1,617,306	UK North Sea and Channel
Puffin	215,019	231,957	UK North Sea and Channel
Gannet	238,322	456,298	UK North Sea and Channel

12.4.4.2 Species Accounts

This Section provides a summary account for each of the focal seabird species in assessment, covering behavioural ecology, conservation value, context (from the range of data sources noted in Table 12-4) and key information about usage of the Array Area as derived from the DAS as reported in EIAR Vol. 4, Appendix A19: Ornithology Baseline Report and nearshore surveys as reported in EIAR Vol. 4, Appendix 20: Intertidal and Nearshore Bird Surveys. A summary of likely species occurrence specifically in relation to the EICC is included at the end of these species accounts. Density and abundance estimates are discussed in the context of the Array Area and the Array Area plus 2 km buffer, as these are the areas of relevance to quantitative impact assessment for collision risk and distributional responses respectively (Figure 12-1). The term 'distributional responses' refers specifically to displacement and barrier effects within the Array Area arising from the presence of wind turbine generators (WTGs). Effects of these individual effects are hard to separate out and are thus assessed together as per NatureScot guidance (NatureScot, 2023h).

For this assessment, sensitivity of the ornithological receptors to disturbance and collision was based on Furness *et al*. (2013) and Bradbury *et al.* (2014) and is summarised in Table 12-12.

Table 12-12 Species sensitivity scoring outlined in Furness et al. 2013 and Bradbury et al. 2014. Only applies to receptors considered in quantitative assessment of collision risk with WTGs and distributional responses from presence of FTUs

SPECIES	FURNESS *ET AL.*, 2013			BRADBURY *ET AL.*, 2014					
	HABITAT USE FLEXIBILITY	DISTURBANCE SPECIES CONCERN INDEX VALUE	COLLISION TOTAL RISK SCORE	DISTURBANCE SUSEPTIBILITY	HABITAT SPECIALISATION	SCORE OF POPULATION VULNERABILITY TO DISPLACEMENT AND CLASSIFICATION		SCORE OF POPULATION VULNERABILITY TO COLLISION RISK AND CLASSIFICATION	
Kittiwake	2	6	523	2	2	5	Very Low	420	High
Guillemot	3	14	37	3	3	13	Moderate	33	Very Low
Puffin	3	10	27	2	3	8	Low	12	Very Low
Gannet	1	3	725	2	2	3	Very Low	512	High
Fulmar	1	2	48	1	1	1	Very Low	39	Very Low

12.4.4.2.1 Kittiwake

Kittiwake are the most numerous gull species globally and are abundant around the UK (JNCC, 2021a; BTO, 2024). During the breeding season which runs from mid-April to August (NatureScot, 2020), kittiwake nest in coastal colonies on rocky cliff ledges or man-made vertical structures (Daunt, 2023). From these colonies kittiwake undertake foraging trips, within their mmfr + 1SD of 156.1 km ± 144.5 SD (Woodward *et al.,* 2019). Kittiwake prey on a wide variety of species but high-energy fish species such as sandeel (*Ammodytes spp.)* and sprat *(Sprattus sprattus)* are particularly important during the breeding season (BirdLife International, 2021a; JNCC, 2021a). Outside of the breeding season, kittiwake spend most of their time offshore.

It is estimated that the European kittiwake population is approximately 3,250,000 to 3,450,000 mature individuals (Birdlife International, 2021). There is evidence to suggest the species has declined in number over the last 20 years, due to a reduction in prey abundance (Evans and Waggitt, 2023). Kittiwake feeding strategy may make them more vulnerable to changes in food availability driven by climate change, and breeding success has been linked to sandeel abundance, particularly within the North Sea (Wanless *et al.*, 2007; BirdLife International, 2024a). This is also reflected in the most recent UK census which recorded 215,913 Apparently Occupied Nests (AONs), the lowest of the four census' completed in Britain and Ireland since 2000 and a decline of 42% (Daunt, 2023). The declines were most prominent in Scotland and along the western North Sea coastline and generally tended to increase with latitude. Exceptions to this were colonies in Aberdeen, Moray and Kirkcaldy (Daunt, 2023). There are also a small number of colonies which have recorded increases in recent years such as in Fowlsheugh SPA and Buchan Ness to Collieston Coast SPA on the north-east of Scotland (Daunt, 2023). Buchan Ness to Colliston Coast SPA is of particular interest to the Project as it is where the EICC is due to make landfall.

Density estimates from site-specific DAS during the breeding season for the Array Area plus 2 km buffer (for surveys in which kittiwake were recorded) ranged from 0.02 birds/km^2 (95% CI 0.00 – 0.06) in April 2021 to 0.66 birds/km^2 (95% CI 0.28 – 1.39) in May 2022, equating to 11 birds (95% CI 0 – 30) and 323 birds (95% CI 202 – 520) respectively. In the non-breeding season, density estimates ranged from 0.02 birds/km^2 (95% CI 0.00 – 0.06) in April 2022 to 0.6 birds/km^2 (95% CI 0.04 – 2.57) in October 2022, equating to 10 birds (95% CI 0 – 30) and 108 birds (95% CI 49 – 270) respectively. Mean seasonal peak (MSP) estimates were calculated as 208 birds and 97 birds in the breeding and non-breeding seasons respectively (EIAR Vol. 4, Appendix 19: Ornithology Baseline Report).

Waggitt *et al*. (2020) suggested kittiwake are likely to be within the vicinity of the Project in relatively high densities during the winter and in lower numbers during the summer (EIAR Vol. 4, Appendix 19: Ornithology Baseline Report). However, this contrasts with the Wakefield *et al.* (2017) paper which suggested overlap between the at-sea distribution of kittiwake and the Project during the breeding season. During site-specific DAS, kittiwake were recorded in higher abundance during the breeding season, aligning with results from Wakefield *et al.* (2017).

12.4.4.2.2 Herring gull

Herring gull breed in natural and urban habitats although there is thought to be a decline in the number of natural-nesting herring gull (Burnell, 2023a). The Firth of Forth is known to support one of the largest coastal roosting populations of herring gull in Scotland (NatureScot, 2020b). Many wintering herring gull present along the east coast of Scotland are migrants from further afield, such as Norway and north Russia, boosting local populations between September and February (Wernham *et al*., 2002; Furness, 2015). Herring gull are opportunistic feeders and have a mmfr of 58.8 ± 26.8 km (Woodward *et al*., 2019).

Both the Seabird2000 and Seabird count surveys indicated that around half of natural-nesting herring gull in Britain and Ireland bred in Scotland (Burnell, 2023a). In Scotland there was a 44% decrease in natural-nesting herring gull since Seabird2000, from 67,295 to 37,349 AON (Burnell, 2023a). Around 63% of the herring gull in Scotland are urban-nesting, however, the Seabird Census results show the overall population has decreased rather than just a change in proportion of those natural and urban-nesting (Burnell, 2023a).

During site-specific DAS, no herring gull were recorded during the breeding season, whereas they were recorded in three months during the non-breeding season. Density estimates for site-specific DAS during the non-breeding season in the Array Area plus 2 km buffer (for surveys in which herring gull were recorded) ranged between 0.02 birds/km^2 (95% CI 0.00 – 0.06) in December 2021 and 0.09 birds/km^2 (95% CI 0.03 – 0.14) in February 2023, equating to ten birds (95% CI 0 – 30) and 44 birds (95% CI 17 - 73) respectively. During the intertidal surveys, herring gull were recorded in all six months with an abundance (peak count) of 112 birds, recorded in April (Table 12-7).

12.4.4.2.3 Guillemot

Guillemot are one of the most abundant and widely distributed UK seabird species. During the breeding season, guillemot generally nest on cliff edges, where they lay one egg per year (Birdlife International, 2018a; Birdlife International, 2021b; BTO, 2024). Guillemot are pursuit divers, reaching average depths of 17 m at the Isle of May National Nature Reserve (NNR) (Dunn *et al.*, 2019) to catch prey which include high energy fish species such as sandeel (Anderson *et al.*, 2014; Bennet, 2023; BTO, 2024).

The feeding strategy exhibited by guillemot may offer the species a buffer to fluctuations in prey availability and abundance from pressures such as climate change or overfishing (Daunt *et al.*, 2013; Brander *et al*., 2016 Jonston *et al*., 2021). However, colonies may face additional challenges from climate change such as adverse weather conditions and variation in North Atlantic Oscillation (NAO) values, which can impact breeding success through productivity levels, mismatches in timing between prey spawning and seabird breeding periods, changes in hatching dates and reduced frequency of chick feeding (Birkhead, 1976 as referenced in Jonston *et al.*, 2021; Frederiksen *et al.*, 2004; Harris *et al*., 2006; Bennet, 2023 and further detailed in EIAR Vol. 4, Appendix 19: Ornithology Baseline Report).

The European guillemot breeding population is estimated at approximately 2,420,000 to 3,150,000 mature individuals (Birdlife International, 2021b) with a total of 1,265,888 individual birds counted at UK breeding colonies during the 2015 – 21 Seabird Count (Bennett, 2023). Bird census' have generally recorded an increase in guillemot numbers over the years however, the Seabirds Count between 2015 and 2021 estimated an 8% decline in numbers from the previous count in 2000 (Bennett, 2023). Despite the general decline, there is variation between sites along the east coast of Scotland; east Caithness Cliffs SPA saw a decrease of 6%, whereas the Calf of Eday SPA experienced a 5% increase in population size (Bennett, 2023; EIAR Vol. 4, Appendix 24: Apportioning Report).

Guillemot was the most abundant bird species recorded in site-specific DAS and was recorded at the Array Area in all surveys. Absolute density estimates in the breeding season for the Array Area plus 2 km buffer ranged from 0.17 birds/km^2 (95% CI 0.04 – 0.34) in April 2022 to 10.29 birds/km^2 (95% CI 7.6 – 13.71) in July 2022, equating to an estimated abundance of 61 birds (95% CI 26 – 160) and 4,613 birds (95% CI 4,094 – 4,813) respectively. In the non-breeding season absolute estimates ranged from 0.17 birds/km^2 (95% CI 0.3 – 0.55) in March 2023 to 22.08 birds/km^2 (95% CI 19.85 – 24.41) in November 2022. This equates to an abundance estimate for the Array Area plus 2 km buffer of 75 birds (95% CI 32 – 196) and 11,100 birds (95% CI 10,110 – 11,740) respectively. MSP estimates were calculated as

2,497 birds in the breeding season and 8,319 birds in the non-breeding season (EIAR Vol. 4, Appendix 19: Ornithology Baseline Report).

Buckingham *et al.* (2022) used data from geo-location loggers to map the distribution of guillemot from 11 key colonies in the UK between key periods of the non-breeding season. Results from the study suggested guillemot are likely to be within the Array Area throughout the non-breeding season, which is supported by data collected over this period by site-specific DAS. The conservation importance of guillemot is presented in Table 12-13.

12.4.4.2.4 Razorbill

Common around the UK, razorbill are distributed at coastal colonies between April and August during the breeding season, usually found in mixed species assemblages with other seabirds such as guillemot and kittiwake (Mitchell *et al.*, 2004). The northwest North Sea provides important habitat for razorbills year-round, especially between July and September during the flightless moult period (Stone *et al.*, 1995). Several large breeding colonies are present along the east coast of Scotland, such as the Isle of May, St Abb's Head and Fowlsheugh which respectively supported an estimated 4,867, 2,683 and 11,750 birds in 2018 (SMP, 2021). Razorbill typically feed on small fish including herring and sprat (Blake, 1983 and Ouwehand *et al*. 2004 as referenced in Buckingham, 2023) and have a mmfr of 88.7 ± 75.9 km (Woodward *et al.*, 2019).

There are estimated to be around 258,629 breeding razorbill in Britain and Ireland which is an 18% increase since Seabird2000 (Buckingham, 2023). Scotland has around 54% of the razorbill population in Britain and Ireland and while there has been and overall decline in Scotland by 2% this is mostly seen in the north and west. In contrast at Caithness and Kincardine and Deeside there were increases of 66% and 87% respectively (Buckingham, 2023).

During the two years of site-specific DAS, razorbill was only recorded in three surveys. Density estimates for site-specific DAS during the breeding season in the Array Area plus 2 km buffer (for surveys in which razorbill were recorded) ranged from 0.02 birds/km^2 (95% CI 0 – 0.07) in July 2022 to 0.05 birds/km^2 (95% CI 0 – 0.12) in June 2022, equating to 13 birds (95% CI 1 – 37) and 27 birds (95% CI 0 – 61) respectively. In the non-breeding season, density estimates ranged between 0.07 birds/km^2 (95% CI 0 – 0.18) in February 2023 and 0.2 birds/km^2 (95% CI 0.05 – 0.34) in November 2022, equating to 38 birds (95% CI 0 – 93) and 100 birds (95% CI 27 - 176) respectively. During the intertidal surveys, razorbill were recorded in five out of the six surveys with a peak abundance of 88 birds, recorded in June 2024 (Table 12-7).

12.4.4.2.5 Puffin

Puffin are widely distributed throughout the UK and Ireland and typically prey on small shoaling fish species such as sandeel (Owen *et al.*, 2023). They typically feed between zero and 60 m depth (Burger and Simpson, 1986), with average depths of 5 m recorded at the Isle of May NNR (Dunn *et al.*, 2019) and have a moderate mmfr + 1SD of 137.1 km ± 128.3 (Woodward *et al.*, 2019). One of the main threats to puffin populations is climate change, specifically related to changes in prey availability and composition. The species is primarily dependent on sandeel and so the decline in sandeel abundance and distribution is of concern for this species.

The breeding population in Europe is estimated at approximately 7,400,000 to 8,240,000 mature individuals (Birdlife International, 2021c). The most recent census (the Seabird Count) estimated the UK population at 474,679 apparently occupied burrows (AOBs), a decline of 14% since the previous census in 2000 (Owen *et al.*, 2023). In Scotland alone, numbers have fallen by 21% since Seabird 2000 with colony counts in Forth Islands SPA declining from 70,029 AOBs in 2000 to 41,906 AOBs in 2015, a decline of 40% (Owens *et al.*, 2023).

Site-specific DAS of the Array Area suggested puffin density varies between season. Absolute density estimates in the breeding season for Array Area plus 2 km buffer (when puffin were present) ranged from 0.03 birds/km^2 (95% CI 0.01 – 0.13) in July 2021 to 0.52 birds/km^2 (95% CI 0.26 – 0.90) in July 2022, equating to 13 birds (95% CI 4 – 65) and 252 birds (95% CI 132 – 417) respectively. This is a similar pattern to that observed within the Ossian Offshore Wind Farm Array Area where estimated puffin density was much higher in July 2022 (0.78 birds/km^2 95% CI 0.61 – 0.98) than in July 2021 (0.28 birds/km^2 95% CI 0.13 – 0.47; Ossian, 2024)). In the non-breeding season, absolute density estimates within the Array Area plus 2 km buffer ranged from 0.03 birds/km^2 (95% CI 0 – 0.08) in November 2022 to 0.25 birds/km^2 (95% CI 0.11 – 0.5) in November 2021, equating to 17 birds (95% CI 3 – 41) and 117 birds (95% CI 66 – 210) respectively. MSP estimates were calculated as 221 birds for the breeding season and 67 birds in the non-breeding season (EIAR Vol. 4, Appendix 19: Ornithology Baseline Report). Species sensitivity is outlined in Table 12-12 with conservation importance presented in Table 12-13.

12.4.4.2.6 Gannet

Gannet are endemic to the North Atlantic with the UK and Ireland supporting 56% of the global population (JNCC, 2020). Bass Rock which is part of the Forth Islands SPA in the east of Scotland holds the largest gannet colony in the world, with spillover from this single colony likely resulting in colonisation and population increases at other nearby colonies (Wanless *et al.*, 2023). When attending their colony, gannet lay a single egg which is incubated for around 44 days (Lane *et al.*, 2021; Wanless *et al.*, 2023).

With a wingspan of 2 m, gannet are able to travel large distances and have a mmfr + 1SD of 315.2 km ± 194.2 (Woodward *et al.*, 2019; BTO, 2024). They forage by plunge-diving up to 20 m and also scavenge around fishing vessels, targeting high-energy shoaling fish including immature herring and sprat (BirdLife International, 2021d; Wanless *et al.*, 2023). The opportunistic and varied nature of their foraging behaviour combined with their large foraging range have allowed gannet populations to exhibit some resilience against certain impacts of climate change however, changes in abundance and distribution of prey due to climate change may still impact gannet breeding productivity despite this foraging strategy (EIAR Vol. 4, Appendix 19: Ornithology Baseline Report; Montevecchi and Myers, 1997; Barrett *et al.*, 2017; Jonston *et al.*, 2021).

The European population of gannet is estimated at approximately 821,000 to 823,000 mature individuals (Birdlife International, 2021c) with the UK and Ireland population totalled at 360,748 apparently occupied site (AOS) dispersed across 28 colonies (Wanless *et al.*, 2023). In general, gannet populations have increased since the last census and additional areas have been colonised (Wanless *et al.*, 2023). However, gannet were strongly impacted by the H5N1 strain of Highly Pathogenic Avian Influenza (HPAI) in 2021 / 2022 (Lane *et al.*, 2023), with the number of occupied sites recorded declining by 25% compared to pre-HPAI baseline counts (Tremlett *et al.*, 2024). HPAI is discussed further in Section 12.4.5.3.

Gannet density was variable between seasons at the Array Area. Density estimates in the breeding season for the Array Area plus 2 km buffer ranged from 0.02 birds/km^2 (95% CI 0 – 0.06) in December 2021 to 0.53 birds/km^2 in May 2022 (95% CI 0.18 – 1.21), equating to 10 individuals (95% CI 0 – 30) and 244 individuals (95% CI 129 – 349) respectively. In the non-breeding season density estimates ranged from 0.02 birds/km^2 (95% CI 0.00 – 0.06) in December 2021 and 0.91 birds/km^2 (95% CI 0.47 – 1.65) in October 2022. This equates to 10 individuals (95% CI 0 –

30) and 453 individuals (95% CI 304 – 641) respectively. MSP estimates within the Array Area were calculated as 216 and 263 birds for the breeding and non-breeding seasons respectively (EIAR Vol.4, Appendix 19: Ornithology Baseline Report). The conservation importance of gannet is presented in Table 12-13.

12.4.4.2.7 Fulmar

Fulmar are a primarily pelagic species with a widespread distribution throughout the Northern Hemisphere (Burnell, 2023b). They are predominantly a surface feeder, feeling on small crustaceans and fish species however, fulmar are opportunistic and are often associated with fishing vessels scavenging on offal and discards (Garthe and Hüppop, 1994). Although not specialist predators, they have an extensive foraging range (542.3 ± 657.9km; Woodward *et al.*, 2019) with a tracked foraging trip during the breeding season recording an individual travelling as far as the mid-Atlantic ridge, a total round trip of approximately 6,000 km (Edwards *et al.*, 2013).

The European population of fulmar is estimated at between 6,350,000 and 7,660,000 mature individuals and is classified as vulnerable and decreasing (BirdLife International, 2021). Since the Seabird 2000 census, numbers of breeding fulmar in the UK have declined by an estimated 35% following the Seabirds Count, a loss of approximately 187,000 AOS (Burnell, 2023b). The largest declines were recorded at colonies in the north and west of Scotland however, declines were still present at Buchan Ness to Collieston Coast SPA as well as Fowlsheugh SPA on the east coast. Declines are likely linked to changes in the marine environment potentially linked to climate change; a 50-year study in Orkney, Scotland reported than annual breeding success in fulmar was negatively correlated to the winter North Atlantic Oscillation (NAO; Thompson and Ollason, 2011). Despite this, there are suggestions that fulmar numbers in the past have been unnaturally inflated by the industrialisation of fisheries and the subsequent increase in food availability due to discards and therefore recent declines with the ban on discards may be the population returning to more natural levels (Bicknell *et al.*, 2013).

Density estimates for site-specific DAS during the breeding season in the Array Area plus 2 km buffer (for surveys in which fulmar were recorded ranged from 0.06 birds/km^2 (95% CI 0.02 – 0.12) in May 2021 to 1.82 birds/km^2 (95% CI 1.05 – 2.71) in August 2022, equating to 31 birds (95% CI 10 – 59) and 918 birds (95% CI 529 – 1,371) respectively. In the non-breeding season, density estimates ranged between 0.11 birds/km^2 (95% CI 0.02 – 0.26) in March 2022 and 1.31 birds/km^2 (95% CI 1.01 – 1.63) in November 20251, equating to 58 birds (95% CI 10 – 132) and 663 birds (95% CI 511 – 824) respectively. Following the NatureScot response to the RIAA, Appendix A: HRA Stage One Screening Report, fulmar are only assessed qualitatively for distributional responses.

Table 12-13 Species conservation ([a]Birdlife International, 2018a; [b]Birdlife International, 2018c; [c]Birdlife International, 2018d; [d]Birdlife International, 2019; [e]Birdlife International, 2021a; [f]Birdlife International, 2021b; [g]Birdlife International, 2021c; [h]Birdlife International, 2021d;[i]Birdlife International, 2021e [j]Stanbury et al., 2021; [k]BTO, 2024; [l]Birdlife International, 2021f; [m]Birdlife International, 2021g; [n]OSPAR, 2024

	UK BIRDS OF CONSERVATION CONCERN[J&K]	IUCN RED LIST (EUROPE)	IUCN RED LIST (GLOBAL)	HABITAT REGULATIONS	OSPAR[N]
Kittiwake[d]	Red Listed	Vulnerable (Decreasing)[e]	Vulnerable (Decreasing)	SPA qualifier	Threatened or declining species
Herring gull[m]	Red Listed	Least concern (Decreasing)[l]	Least concern (Decreasing)	SPA qualifier	N/A
Guillemot[a]	Amber Listed	Least concern (increasing)[f]	Least concern (increasing)	SPA qualifier	N/A
Razorbill[l]	Amber Listed	Least concern (increasing)[m]	Least concern (increasing)[f]	SPA qualifier	N/A
Puffin[b]	Red Listed	Endangered (decreasing)[g]	Vulnerable (decreasing)	SPA qualifier	N/A
Gannet[c]	Amber Listed	Least concern (increasing)[h]	Least concern (increasing)	SPA qualifier	N/A
Fulmar[i*]	Amber Listed	Vulnerable (decreasing)[i]	Least concern (increasing)	SPA qualifier	N/A

** Fulmar are only scoped in for qualitative assessment of distributional responses (Section 13.4.4.1).*

12.4.4.2.8 Migratory birds

The only migratory bird species (excluding seabirds) recorded during the site-specific DAS were knot (*Calidris canutus)* and common scoter (*Melanitta nigra*). Eight observations of knot were recorded in July 2021 and four common scoter in July 2022 (EIAR Vol. 4, Appendix 19: Ornithology Baseline Report).

The information presented in this chapter on migratory species (other than seabirds) is based on the 'Migratory species collision risk modelling assessments' (WWT, 2014) and 'Strategic review of birds on migration in Scottish waters' (Woodward *et al*., 2023) which collated abundance estimates and migration information on 27 and 70 migratory species and populations respectively. As part of the assessment of migratory birds, migratory corridors mapped for each species in WWT (2014) and Woodward *et al.* (2023) were reviewed and those with migration zones and / or migration fronts that align with the Array Area have been considered. In the Scoping Workshop held 29th February 2024 and subsequent response to the Scoping Report received 23rd May 2024, NatureScot requested that in the absence of the migratory CRM (mCRM) tool, a qualitative assessment of migratory birds be undertaken which primarily relies on information presented in Woodward *et al.* (2023). This is further presented in Section 0.

It is understood that migratory species may encounter offshore wind farms (OWFs) during passage through UK waters however, it can be challenging to quantify the effects to migratory species. This is as a result of limited available data and therefore low confidence in key estimates such as population size and flight height for some species (WWT, 2014; Woodward *et al.*, 2023). As a result, there is no quantitative assessment provided for migratory species, but they are assessed qualitatively for collision risk with WTGs in Section 12.6.2.2.8.

12.4.4.3 Variation in guillemot numbers in site-specific DAS

The number of guillemot observed during site-specific DAS indicated variation between years, with observations lower in 2021 compared to 2022 (EIAR Vol. 4, Appendix 19: Ornithology Baseline Report). During the consultation process (in the NatureScot response to the Scoping Report (received 23rd May 2024) and discussed during the Ornithology Catch Up on the 7th August 2024), NatureScot requested that more information be provided to explain the observed variation (Table 12-3).

To understand the possible reasons behind these numbers, results from other OWFs off the east coast of Scotland near to the Project were investigated following the NatureScot response to the Scoping Report received 23rd May 2024. Following the advice, the period between July and November are the focus of this discussion, which covers the end of the breeding season and the start of the non-breeding season, specifically the post-breeding moult period (EIAR Vol. 4, Appendix 19: Ornithology Baseline Report).

A possible consideration to explain variation in abundance was the "auk wreck" which occurred in the autumn of 2021, with large numbers of dead guillemot reported along the shores of the North Sea and the Skagerrak (SEAPOP, 2021). The wreck was most likely influenced by adverse weather conditions and it was concluded that the most likely cause of death was starvation. The majority of the dead birds were going into their first winter, and were therefore young, which makes them particularly vulnerable to any change or reduction in prey resources. It is likely that if results from 2021 were affected by the auk wreck then the preceding year of surveys would also record similar or lower abundance of guillemot. However, density and abundance of guillemot in the second year of site-specific surveys was higher, suggesting no long term negative impacts due to adverse weather conditions the previous year.

Guillemot productivity from Scottish colonies was relatively consistent until a steep decline between 2002 and 2007. In 2007 the mean chicks fledged per pair was estimated at 0.23. Productivity increased from 2007 and stabilised, with productivity in 2019 estimated at 0.92 chicks fledged per pair. The decline in productivity between 2002 and 2007 was mainly attributed to a shortage of sandeel prey (JNCC, 2014). When considering similar data from other OWFs off the east coast of Scotland, it is evident that variation in guillemot density and abundance is regularly observed and is evident in years prior to 2021. The variation observed in guillemot abundance in site-specific DAS of the Project is reflected at other sites and is not considered to be unusual. For example, guillemot density at both Salamander Offshore Wind Farm and Ossian peaked in August 2022 (Table 12-14), when the auk wreck was reported to be ongoing. As these sites are further inshore and closer to coastal colonies, the earlier peaks compared to the Project are expected.

As such, the variation in the site-specific DAS of the Project is not considered to be cause for concern. It is more likely that the DAS has captured the natural variation in guillemot abundance which can be driven by a number of factors including sea surface temperature (SST; Hodges *et al.*, 2022), and prey distribution (Furness, 2015, Wakefield *et al.*, 2017). Evidence presented in Buckingham *et al.* (2023) further indicates how guillemot distribution, behaviour and diet can change in response to environmental conditions, which was observed in individuals originating from east coast Scotland colonies (Isle of May within Forth Islands SPA and Whinnyfold), which are directly relevant to the Project.

Table 12-14 Comparison of guillemot density at Scottish east coast offshore wind farms recorded during site-specific surveys

OFFSHORE WIND FARM (SURVEY TIMINGS)	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	PEAK
Cenos (Apr 2021– Mar 2022)	2.27 – 9.00	5.74 – 9.23	7.51 – 11.68	1.39 – 14.51	11.05 – 22.20	22.20 (Nov 2022)
Ossian (Mar 2021 – Feb 2023)	8.28 – 34.95	2.26 – 72.78	0.90 – 9.63	1.56 – 2.79	2.76 – 8.59	72.78 (Aug 2022)
Green Volt (May 2020 – Apr 2022)	4.43 – 11.23	1.76 – 10.76	1.75 – 154.46	11.18 – 13.00	4.49 – 6.85	154.46 (Sep 2021)
Salamander* (Mar 2021 – Feb 2023)	37.90 – 44.30	43.72 – 233.03	44.09 – 77.76	49.35 – 78.15	6.03 – 11.21	233.03 Aug 2022)
Berwick Bank* (Mar 2019 – Apr 2021)	10.23 – 24.93	32.94 – 40.28	5.96 – 47.25	6.26 – 10.78	2.12 – 7.80	47.25 (Sep 2022)
Seagreen† (Apr 2017 – Aug 2017)	28.62	3.07	2.03	1.45	0.60	28.62 (Jul 2017)
Neart na Gaoithe** (Nov 2009 – Oct 2011)	0.00 – 0.33 1.53 – 11.59	0.00 – 0.04 2.41 – 46.78	0.00 – 0.01 14.79 – 34.89	0.09 – 0.17 13.46 – 20.59	0.13 – 0.36 6.62 – 16.45	0.36 (Nov 2011) 46.78 (Aug 2012)

**DAS Area,*

†mean of all surveys in each month

***split by flying (left) and sitting (right) birds as no density estimates are available for 'all birds'*

12.4.5 Future baseline

12.4.5.1 Climate change

Globally, climate change is having a significant impact on the structure of marine ecosystems, affecting water temperature, water stratification and nutrient availability. This in turn is having an impact on the abundance and diversity of communities within the ecosystems. In the UK, climate change is considered to be one of the primary drivers of declines in seabird species (Burnell *et al.*, 2023c). As top predators, seabirds are sensitive to changes in the wider ecosystem which propagate through the food chain (Lynam *et al*. 2017). In the UK, declines of between 20 and 30% in breeding seabird abundance since the early 1900s have been partially driven by climate change in addition to other contributing factors (Mitchell *et al.*, 2018), with the proportion of species experiencing recurring breeding failures increasing over the last ten years (Mitchell *et al.*, 2020).

Climate change primarily affects seabirds indirectly through changes in prey availability (including any phenological mismatch), diversity and quality (Lynam *et al.*, 2017; Renner and Zohner, 2018). Since the early 1980s, the winter sea-surface temperature of the North Sea has increased by approximately 1ºC (Daunt and Mitchell, 2013), leading to changes in the composition and biomass of species at the lower trophic levels, such as plankton, which in turn affects species further up the food chain. Lesser sandeel are a key prey species of many seabirds including puffin, kittiwake, razorbill and European shag (*Phalacrocorax aristotelis,* hereafter 'shag') (Wanless *et al.*, 2018) and warming sea temperatures are known to impact the recruitment of sandeel into the breeding population. Since 2000, factors relating to climate change have led to a decline in the abundance and nutritional quality of sandeel and other small planktivorous fish including herring and sprat (Macdonald *et al.*, 2015; Wanless *et al.*, 2018).

In east Scotland, survival of over-wintering kittiwake was observed to be lower following winters of higher sea-surface temperatures in addition to reduced breeding success a year later likely due to sandeel availability and quality (Carroll *et al.*, 2017). On the Isle of May National Nature Reserve (NNR), energy content of sandeel is estimated to have reduced by up to 70% between 1973 and 2015; an increase in the presence of herring and sprat in kittiwake, razorbill and guillemot diets recorded over the last 25 years may support this as birds transition to alternate prey types (Wanless *et al.*, 2018; Daunt and Mitchell, 2013).

Generalist seabird species which feed on a variety of prey are likely to be more resilient to changes in prey availability than other more specialist species (Mitchell *et al.*, 2020). Water-column feeders such as gannet and shag forage from the seabed (depending on the water depth) up to the surface and so are able to feed on both demersal and pelagic prey while surface-feeders, such as kittiwake, fulmar and terns, are restricted to within approximately one to two meters below the surface. Therefore, changes in prey distribution from changes in stratification and temperature will affect species differently. As water-column feeders are more generalist, they are able to adapt better to changes in comparison with those restricted to the surface (Mitchell *et al.*, 2020). Although auks are able to forage within a large proportion of the water column, lack of prey is still considered a key factor in survival, particularly in terms of juvenile birds based on previous evidence of wrecks suspected to be caused by possible starvation (see Section 12.4.4.3 above). In addition, species with a limited foraging range may also not be able to adapt to changing prey distributions (Sadykova *et al.*, 2020).

Climate change can also impact seabirds through increased frequency of extreme weather events (Newell *et al.*, 2015). Extreme weather is likely to impact birds both during the breeding season and non-breeding season, impacting both breeding success and survival. Impacts are also likely to be species-specific due to differing ecology and life history as well as varying with exposure and susceptibility of individuals. Newell *et al*. (2015) reported a higher breeding failure rate in razorbill and kittiwake compared to shag and guillemot within the same colony in exposed plots due to storms. While re-laying is possible in some instances, it is not always, and still only provides partial compensation. In this case, this storm resulted in a net reduction in annual population production of 4.6%, 10.7%, 8.9% and 22.8% for shag, kittiwake, guillemot and razorbill respectively (Newell *et al.*, 2015). The increased frequency and strength of extreme weather events caused by climate change may become an increasing pressure on seabird success in the future.

12.4.5.2 Fisheries Management

Fisheries management will also likely affect seabird populations in the UK in the future. Prior to the Common Fisheries Policy (CFP) Landings Obligation ('discard ban'), many seabird species benefitted from fisheries discards, particularly scavenging species such as skuas, fulmar and large gull species including herring gull. By reducing the amount of discards available, the discard ban may result in food shortages in some species which in turn may lead to additional pressure on other seabird species with increased competition for prey or from direct predation (Bicknell *et al*., 2013).

At the beginning of 2024 the UK and Scottish Government officially closed the sandeel fishery in all Scottish waters and the English North Sea due to sandeel importance in the ecosystem and wider food web, linking plankton to top predators (DEFRA, 2024; Scottish Government, 2024). As sandeel is a key prey species for many types of seabird, including kittiwake and puffin, this closure may benefit these birds (Daunt *et al.*, 2008). It is, however, important to consider the caveats identified in respect of the effectiveness of this measure, such as differing demographics between seabird species, the difficulty in separating impacts from other sources of environmental change within the ecosystem as well as the availability of long-term data as presented in Searle *et al.* (2023b).

12.4.5.3 Highly Pathogenic Avian Influenza (HPAI)

The 2021 / 2022 summer outbreak of HPAI H5N1 was both unprecedented and widespread. Mass mortality was first recorded in Great skua (*Stercorarius skua*) during the summer of 2021 before spreading to waterfowl, particularly Barnacle geese (*Branta leucopsis)* in the winter of 2021 / 2022. By 2022, thousands of mortalities attributed to HPAI were recorded with 17 out of the 25 UK breeding seabird species tested positive for the virus (APHA, 2023). By the end of 2022, minimum losses were recorded at 20,000 bird mortalities across 160 locations in Scotland alone (NatureScot, 2023l).

Gannet were one of the most severely impacted seabird species, with minimum losses of 11,175 birds in Scotland in 2022 (NatureScot, 2023l). Gannet breeding numbers had been increasing previous to the outbreak, increasing by 39% in the UK between the Seabird 2000 and Seabird Count census' (Wanless *et al.*, 2023) however, the total number of recorded gannet AOS / AONs in 2023 decreased by 25% compared to pre-HPAI baseline counts with the greatest declines on the east coast recorded in Hermaness, Saxa Vord and Valla Field SPA (37%) and Forth Islands SPA (27%) (Tremlett *et al.*, 2024). This is of conservation concern as 58% of the global breeding population of gannet are found in the UK (Wanless *et al.*, 2023). At Bass Rock, within Forth Islands SPA, a count of 21,227 AON was recorded in 2022, however in 2023 the count increased to 51,844 AON, suggesting recovery of gannet post HPAI.

Kittiwake are currently Red-listed (BirdLife International. (2021a) due to severe declines in the breeding population and were a high priority target species during the HPAI outbreak. Moderate mortalities were recorded in 2022 with a minimum loss of 760 birds recorded in Scotland (NatureScot, 2023l). The largest declines in Scotland were recorded in Sumburgh Head SPA (83%), Copinsay SPA (69%) and Hermaness, Saxa Vord and Valla Field SPA (21%) however, the total number of kittiwake AONs recorded across all sites in the UK in 2023 increased by 8% compared to pre-HPAI counts (Tremlett *et al.*, 2024).

In terms of guillemot, minimum losses of 1,908 birds were recorded in Scotland in 2022 (NatureScot, 2023l) and a further 3,775 birds in England in the same year of all age groups (Tremlett *et al.*, 2023). The total number of guillemot recorded across all sites in 2023 declined by 6% compared to previous pre-HPAI counts with the largest declines in Scotland recorded in Copinsay SPA (56%) and Forth Islands SPA (32%). Breeding numbers of guillemot declined by 11% in the UK between the Seabirds 2000 census and the Seabird Count census, although declines were only present in Scotland (31%) with increases in the other nations; 57%, 76% and 106% in Northern Ireland, Wales and England respectively (Tremlett *et al.*, 2024).

The timing of impacts linked to the HPAI outbreak varied between species with some more acutely impacted towards the end of the 2022 breeding season, such as kittiwake and guillemot, while recorded mortality was higher for others during the 2023 breeding season (e.g. black-headed gull (*Chroicocephalus ridibundus*) and tern species, Tremlett *et al.*, 2024). Virus impacts also varied spatially where some colonies were more impacted than others; colonies with the largest losses included Hermaness, Foula, the Bass Rock and St Abbs. The long-term impacts of the recent HPAI outbreak are still poorly understood however, it has clearly impacted many seabird populations around the UK and so have been considered within the context of the Project. The effect of HPAI is also discussed in EIAR Vol. 4, Appendix 19: Ornithology Baseline Report.

12.4.6 Summary and key issues

Table 12-15 Summary and key issues for ornithology

SUMMARY AND KEY ISSUES	PROJECT AREA
	Array Area
	• The most abundant seabird species recorded in the Array Area during site-specific DAS were fulmar, gannet and guillemot; • Kittiwake and gannet are at risk of collision with WTGs within the Array Area; • Kittiwake, gannet and guillemot are at risk of distributional responses in the Array Area plus 2 km buffer; • Seabird abundance may be impacted by the impacts of climate change such through changes in prey availability and distribution, particularly for species with limited foraging ranges; and • The 2021 / 2022 HPAI outbreak impacted many seabird species, with severe declines recorded in gannet colonies, however recent surveys of Bass Rock in the Forth Islands SPA suggests productivity is increasing, post outbreak.
	EICC
	• The most abundant species recorded during VP counts of the landfall site were kittiwake, guillemot and herring gull; • Seabird diversity and abundance decreased with distance from the shore, with the exception of kittiwake in June 2024; and • Relatively low numbers of waterfowl and wader species were recorded, peaking with 16 observations of eider in April 2024.

12.4.7 Data gaps and uncertainties

As part of the development of the survey methodology, extensive review work was undertaken to define ornithological presence in the Array Area and wider marine environment. Combined with the ground-truthing observations made during the site-specific DAS and VP surveys, a robust baseline (as per Section 12.40 and EIAR Vol. 4, Appendix 19: Ornithology Baseline Report) is available for impact assessment with few data gaps regarding species use of the Project considered to be present.

The count data for seabird SPA colonies used to inform regional populations were taken from the most recent colony count data as hosted on the SMP. HPAI was first recorded during the summer of 2021 and although it coincided with the DAS, the impacts were not fully captured by the most recent census (the Seabirds Count (Burnell *et al.*, 2023c)). The full impact in the short, medium and long-term effects of the outbreak on seabird abundance and demographic rates (i.e. survival and breeding productivity) is still not fully understood and so the SPA colony counts used in assessment may not fully reflect the current conditions of these colonies.

As in other recent EIA applications (e.g. Ossian Wind Farm), all quantitative assessment has been undertaken without adjusting for the effects of HPAI however, where available, counts inclusive of HPAI effects were utilised for the Project, as agreed with NatureScot through written advice received 7th November 2024. This reflects the assumption that declines in population or colony size will be proportional to reductions in at-sea densities of birds and therefore, predicted mortalities in the Array Area.

12.5 Impact assessment methodology

12.5.1 Impacts requiring assessment

The impacts identified as requiring consideration for ornithology are listed in Table 12-16. Information on the nature of the effect (i.e. direct or indirect) is also described.

Table 12-16 Impacts requiring assessment for ornithology FTU refers to the entire turbine unit whereas WTG just refers to the part of the unit that is above water level and is directly involved in collision

POTENTIAL IMPACT	NATURE OF IMPACT	ZONE OF INFLUENCE
Construction		
Disturbance and / or displacement of ornithology receptors from vessels	Direct	Project Area
Disturbance and / or displacement of ornithology receptors during HDD	Direct	EICC
Changes to prey resources	Indirect	Project Area
Operation and maintenance		
Disturbance and / or displacement of ornithology receptors from vessels	Direct	EICC
Distributional responses from presence of FTUs	Direct	Array Area
Collision risk with WTGs	Direct	Array Area
Changes to prey resources	Indirect	Project Area

POTENTIAL IMPACT	NATURE OF IMPACT	ZONE OF INFLUENCE
Secondary entanglement	Indirect	Array Area
Decommissioning*		

** In the absence of detailed information regarding decommissioning works, and unless otherwise stated, the effects during the decommissioning phase are considered analogous with, or likely less than, those of the construction phase. The approach to decommissioning for the Project is outlined in EIAR Vol 2, Chapter 5: Project Description.*

12.5.2 Effects scoped out of the assessment

The impacts scoped out of assessment and the justification for this are listed in Table 12-17 .

Table 12-17 Impacts scoped out for ornithology

IMPACT SCOPED OUT	JUSTIFICATION
Construction	
Collision with WTGs	Collision is only a risk while turbines are moving, therefore this will not be an issue during the construction phase.
Distributional responses due to presence of FTUs	Distributional responses (the overarching term for displacement and barrier effects) only apply during the operation and maintenance phase when FTUs are present.
Underwater noise and vibration from piling activities	There is potential for diving birds (e.g. guillemot and gannet) to be present in the vicinity of the Project when noisy activities are occurring during construction (e.g. pin piling). It is likely birds will be aware of construction activities when they are not diving and be temporarily displaced. Although some species may be better adapted to hear underwater than others, it is assumed that most diving birds do not have the same capacity to hear underwater as aquatic animals, as they are primarily adapted for aerial environments. It should also be noted that any piling activities will be short in duration. Therefore, underwater noise during construction is scoped out of impact assessment.
Underwater noise and vibration from UXO on diving birds	Unexploded ordnances (UXO) clearance may affect diving birds such as guillemot and gannet. However, embedded mitigation, including Marine Mammal Observers (MMOs) will be deployed during UXO clearance to facilitate shutdown/cessation of such activities in the presence of marine mammals. MMOs will be aware of rafting birds if they are present so existing mitigation will be applied here (i.e. UXO clearance will be halted). Diving birds also do not have the same capacity to hear underwater as aquatic animals (Crowell *et al.*, 2015), as they are primarily adapted for aerial environments. Noise and vibration of a continuous noise is characterised using the sound pressure level (SPL). As the two are intrinsically linked the vibration through the water column will be addressed through the implementation of the MMO protocol. The other vibration that would likely result from UXO detonation is vibration through the seafloor which occurs through particle motion within the substrate or at the interface between water and substrate (DOSITS, 2021). However, ornithological receptors are unlikely to dive deep enough to encounter this effect.

IMPACT SCOPED OUT	JUSTIFICATION
Primary and secondary entanglement from subsea mooring systems	Subsea mooring systems will only be present in the environment during the operation and maintenance phase and therefore are scoped out during the construction phase.
Accidental spills to the marine environment	Accidental releases to the marine environment will be limited to the chemical or hydrocarbon inventory on construction vessels. All vessels involved in the Project will be required to comply with best practice management. This includes the application of strict environmental controls through the implementation of the Environmental Management Plan (EMP), which will include a Marine Pollution Contingency Plan (MPCP), to be secured through Section 36 and Marine Licence conditions. These plans will detail procedures in the event of an accidental release, characterise all sources for potential contaminant releases and provide key emergency contact details for use in the event of a release. Measures detailed in the EMP and MPCP will be in accordance with OSPAR Convention and Marine Pollution (MARPOL) Convention guidelines for preventing pollution at sea. Individual vessels will also have a Ship Oil Pollution Emergency Plan (SOPEP) in place. For these reasons, the potential for accidental release of contaminants from vessels is extremely unlikely and any incidents would be responded to quickly, with strict controls to effectively minimise the scale and impact of any accidental release on the marine environment. As this embedded mitigation minimises the likelihood of a significant effect to negligible, accidental releases to the marine environment has been scoped out of the EIA as a potential effect pathway.
Operation and maintenance	
Primary entanglement from subsea mooring systems	Primary entanglement (direct entanglement with mooring lines or cables etc.) is scoped out as the nature of the mooring lines in terms of tension, rigidity and cable diameter preclude the possibility of forming any entangling loops which could pose an entanglement risk to diving seabirds.
Accidental spills to the marine environment	Accidental releases to the marine environment will be limited to the chemical or hydrocarbon inventory on construction vessels. All vessels involved in the Project will be required to comply with best practice management. This includes the application of strict environmental controls through the implementation of the Environmental Management Plan (EMP), which will include a Marine Pollution Contingency Plan (MPCP), to be secured through Section 36 and Marine Licence conditions. These plans will detail procedures in the event of an accidental release, characterise all sources for potential contaminant releases and provide key emergency contact details for use in the event of a release. Measures detailed in the EMP and MPCP will be in accordance with OSPAR Convention and Marine Pollution (MARPOL) Convention guidelines for preventing pollution at sea. Individual vessels will also have a Ship Oil Pollution Emergency Plan (SOPEP) in place. For these reasons, the potential for accidental release of contaminants from vessels is extremely unlikely and any incidents would be responded to quickly, with

IMPACT SCOPED OUT	JUSTIFICATION
	strict controls to effectively minimise the scale and effect of any accidental release on the marine environment. As this embedded mitigation minimises the likelihood of a significant effect to negligible, accidental releases to the marine environment has been scoped out of the EIA as a potential effect pathway.
Decommissioning	
Collision risk with turbines for ornithology receptors	Collision is only a risk while turbines are moving, therefore this will not be an issue during decommissioning.
Primary and secondary entanglement from subsea mooring systems	Subsea mooring systems will only be present in the environment during the operation and maintenance phase and therefore are scoped out during the decommissioning phase.
Accidental spills to the marine environment	Accidental releases to the marine environment will be limited to the chemical or hydrocarbon inventory on construction vessels. All vessels involved in the Project will be required to comply with best practice management. This includes the application of strict environmental controls through the implementation of the Environmental Management Plan (EMP), which will include a Marine Pollution Contingency Plan (MPCP), to be secured through Section 36 and Marine Licence conditions. These plans will detail procedures in the event of an accidental release, characterise all sources for potential contaminant releases and provide key emergency contact details for use in the event of a release. Measures detailed in the EMP and MPCP will be in accordance with OSPAR Convention and Marine Pollution (MARPOL) Convention guidelines for preventing pollution at sea. Individual vessels will also have a Ship Oil Pollution Emergency Plan (SOPEP) in place. For these reasons, the potential for accidental release of contaminants from vessels is extremely unlikely and any incidents would be responded to quickly, with strict controls to effectively minimise the scale and impact of any accidental release on the marine environment. As this embedded mitigation minimises the likelihood of a significant effect to negligible, accidental releases to the marine environment has been scoped out of the EIA as a potential effect pathway.

12.5.3 Assessment methodology

An assessment of potential effects is provided separately for the construction, operation and maintenance and decommissioning phases. The approach to the assessment of cumulative effects, inter-related effects and transboundary effects is provided in Sections 12.7, 12.8 and 12.10 respectively.

The assessment for ornithology is undertaken following the principles set out in EIAR Vol. 2, Chapter 7: EIA Methodology and the Scoping Report (Table 12-3), taking account of relevant advice in the Scoping Opinion and consultation feedback received (Table 12-3). The sensitivity of the receptor is combined with the magnitude to determine the effect significance. Topic-specific sensitivity and magnitude criteria are assigned based on professional judgement, as described in Table 12-18 and Table 12-20. The consequence and significance of effect is then determined using the matrix provided in EIAR Vol. 2, Chapter 7: EIA Methodology. Specific to the ornithology assessment, the documents guidance set out in Section 12.2 have been considered.

The sensitivity of the ornithology receptors under consideration takes into account the ability of the receptor to tolerate, adapt to and recover from a change within the marine environment. These factors as well as the value of the receptor (i.e. the conservation value, protected status or economic value) are additionally used to define the species sensitivity. Sensitivity criteria are presented in Table 12-18; conservation value is presented in Table 12-19.

Table 12-18 Sensitivity criteria

SENSITIVITY OF RECEPTOR	DEFINITION
High	Distributional responses / collision risk: Receptor has a high vulnerability to distributional responses or collision risk effects and has no ability to recover or adapt. Other effects: Receptor has no ability to adapt and / or tolerate potential effects and so survival and / or reproductive rates may be affected. Receptor will be unable to make a permanent recovery.
Medium	Distributional responses / collision risk: Receptor has more moderate vulnerability to distributional responses or collision risk effects and has low availability to recover or adapt. Other effects: Receptor has 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 (e.g. one year).
Low	Distributional responses / collision risk: Receptor has low vulnerability to distributional responses or collision risk effects and will be able to recover from or adapt to an effect.

SENSITIVITY OF RECEPTOR	DEFINITION
	Other effects: Receptor is able to adapt and / or tolerate the effects, so there is no effect on survival or reproductive rates. Receptor is able to return to previous behavioural state or activity once activity has ceased.
Negligible	No perceptible effect on the receptor with no need to recover or adapt to an effect. Receptor is generally tolerant to all effects.

Table 12-19 Definition of conservation values

VALUE	DEFINITION
High	The receptor is of conservation value to an extent that is internationally or nationally important or the abundance of species found within the Array Area within a particular season is of international importance.
Medium	The receptor is of conservation value to an extent that is regionally important or the abundance of the species found within the Project Area within a particular season is of regional or national importance.
Low	The receptor is of conservation value to an extent that is locally important or the abundance of the species found within the Project Area within a particular season is of local importance.
Negligible	The receptor is widespread / common geographically and is of low conservation value.

The magnitude of the effect is defined in consideration of the following factors:

- The spatial extent of the effect (i.e., the area over which the effect is likely to occur);
- The duration of the effect (i.e., the period of time over which the effect is likely to occur);
- The frequency of the effect (i.e., the number of times that an effect is likely to occur over the lifecycle of the Project);
- The intensity of the effect (i.e., the severity of the effect); and
- The likelihood that the effect will occur.

Table 12-20 Magnitude criteria

MAGNITUDE CRITERIA	DEFINITION
High	Distributional responses / collision risk: Estimated mortalities are predicted to increase baseline mortality by above than 5%. • 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 at high intensity.
Medium	Distributional responses / collision risk: Estimated mortalities are predicted to increase baseline mortality by between 1% and 5%. • 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.
Low	Distributional responses / collision risk: Estimated mortalities are predicted to predicted to increase baseline mortality by between 0.1% and 1%. • 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).
Negligible	Distributional responses / collision risk: Estimated mortalities are predicted to increase baseline mortality by less than 0.1% or close to zero. • 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

MAGNITUDE CRITERIA	DEFINITION
	• The effect is very unlikely to occur and if it does occur at very low frequency or intensity.

12.5.4 Embedded mitigation

As described in EIAR Vol. 2, Chapter 7: EIA Methodology certain measures have been adopted as part of the Project development process to reduce the potential for impacts to the environment, as presented in Table 12-21. These have been accounted for in the assessment presented below. The requirement for additional mitigation measures (secondary mitigation) will be dependent on the significance of effects on ornithology receptors.

Table 12-21 Embedded mitigation measures relevant to ornithology

MITIGATION MEASURE	CODE	TYPE	DESCRIPTION	HOW MITIGATION WILL BE SECURED
Minimum air gap (in normal operating conditions) of 22 m above MHWS	MM-039	Primary	Compliance with MCA and RYA requirements around a minimum air gap. In particular ensuing a minimum air gap of 22 m is maintained in normal operating conditions. Maintaining a minimum air gap of this size reduces the risk of collision with WTGs for ornithological receptors typically flying below this height.	Mitigation by design.
Environmental Management Plan (EMP)	MM-006	Tertiary	The EMP will set out procedures to ensure all activities with the potential to affect the environment are appropriately managed and will include a description of planned activities and procedures, roles and responsibilities, pollution control and spillage response plans, incident reporting, chemical usage requirements, waste management plans, plant service procedures, communication and reporting structures, and programme of work. It will detail the final design selected and take into account Marine Licence conditions and commitments. The EMP will additionally include an INNS Management Plan (INNSMP) and a Marine Pollution Contingency Plan (MPCP) and will be developed in consultation with stakeholders.	production and approval of an EMP, including the INNSMP and MPCP, will be required under Section 36 Consent and / or Marine Licence conditions. An outline EMP is provided as part of the application EIAR Vol. 4 Appendix 32: Outline EMP.
Vessel Management Plan (VMP)	MM-021	Tertiary	A VMP will be developed and adhered to for the Project. The VMP will detail types and numbers of vessels to be utilised by the Project. To reduce potential for collision risk or injury to marine species, the Scottish Marine Wildlife	A VMP will be required under the Section 36 Consent and / or Marine Licence conditions.

MITIGATION MEASURE	CODE	TYPE	DESCRIPTION	HOW MITIGATION WILL BE SECURED
			Watching Code will be issued to all Marine Scheme vessels to be adhered to at all times, including a toolbox talk with the vessel crew ahead of mobilisation. This will include requirements to: • Not deliberately approach marine mammals or basking sharks; • Maintain a minimum vessel speed; and Avoid abrupt changes to vessel speed or direction should a marine mammal approach the vessel.	
Marine Pollution Contingency Plan (MPCP)	MM-010	Tertiary	Accidental releases to the marine environment will be limited to the chemical or hydrocarbon inventory on construction vessels. All vessels involved in the Project will be required to comply with best practice management. This includes the application of strict environmental controls through the implementation of the Environmental Management Plan (EMP), which will include a Marine Pollution Contingency Plan (MPCP), to be secured through Section 36 and Marine Licence conditions. These plans will detail procedures in the event of an accidental release, characterise all sources for potential contaminant releases and provide key emergency contact details for use in the event of a release. Measures detailed in the EMP and MPCP will be in accordance with OSPAR Convention and Marine Pollution (MARPOL) Convention guidelines for preventing pollution at sea. Individual vessels will also have a Ship Oil Pollution	The production and approval of an MPCP will be required under Section 36 Consent and / or Marine Licence conditions as part of the EMP. An outline EMP is provided as part of the application EIAR Vol. 4 Appendix 32: Outline EMP.

MITIGATION MEASURE	CODE	TYPE	DESCRIPTION	HOW MITIGATION WILL BE SECURED
			Emergency Plan (SOPEP) in place. For these reasons, the potential for accidental release of contaminants from vessels is extremely unlikely and any incidents would be responded to quickly, with strict controls to effectively minimise the scale and impact of any accidental release on the marine environment. As this embedded mitigation minimises the likelihood of a significant effect to negligible, accidental releases to the marine environment has been scoped out of the EIA as a potential impact pathway.	
Construction Method Statement (CMS)	MM-007	Tertiary	A CMS production and approval of an MPCP will be required under Section 36 Consent and / or Marine Licence conditions as part of the EMP. An outline EMP is provided as part of the application EIAR Vol. 4 Appendix 32: Outline EMP.	For the Project, the production and approval of the CMS will be required under Section 36 and / or Marine Licence conditions.
Lighting and Marking Plan (LMP)	MM-031	Tertiary	The LMP will set out specific requirements in relation to aviation and shipping and navigation which will ensure FTUs are not excessively lit. The reduction of the amount of lighting on FTUs will minimise the risk of avoidance, attraction or disorientation of ornithological receptors in relation to FTUs.	Lighting requirements will be detailed in the LMP, required under Section 36 Consent and / or Marine Licence consent conditions.

MITIGATION MEASURE	CODE	TYPE	DESCRIPTION	HOW MITIGATION WILL BE SECURED
Removal of debris from floating lines and cables to minimise potential for secondary entanglement	MM-022	Primary	Mooring lines and dynamic IACs will be inspected with a risk-based frequency using a Service Operations Vessel (SOV) which may be equipped with Remotely Operated Vehicles (ROV) used for subsea inspections. Over the operational life-cycle of the Project, inspections will be completed, starting at a higher frequency and likely declining after a number of years, based on evidence gathered during inspections. Any observed / detected debris on the floating lines and cables will be recovered based on a risk assessment which considers impact on environment, risk to asset integrity, risk to personnel and equipment, and cost of intervention.	This measure will be secured through production and approval of an EMP and OMP through the Section 36 Consent and / or Marine Licence conditions. This measure will be secured through production and approval of an EMP and OMP through the Section 36 Consent and / or Marine Licence conditions.

12.5.5 Worst-case scenario

As detailed in EIAR Vol. 2, Chapter 7: EIA Methodology, this assessment considers the worst-case scenario for the Project parameters which are predicted to result in the greatest environmental effect, known as the 'realistic worst-case scenario'. The worst-case scenario represents, for any given receptor and potential effect on that receptor, that which would result in the greatest potential for change.

Given that the worst-case scenario is based on the design option (or combination of options) that represents the greatest potential for change, confidence can be held that development of any alternative options within the design parameters will give rise to no worse effects than assessed in this impact assessment. Table 12-22 presents the worst-case scenario for potential effects on ornithology during construction, operation and maintenance and decommissioning.

Table 12-22 Worst-case scenario specific to ornithology impact assessment

POTENTIAL IMPACT	WORST-CASE SCENARIO	JUSTIFICATION
Construction		
Disturbance and / or displacement from vessels	Assessment is qualitative, based on the literature and application of expert judgement, informed by the following key information on the proposed vessel activity during the construction period; • A maximum offshore construction period of six calendar years (including one year pre-construction). • A maximum of 22 vessels at the site simultaneously, making a total of 1,487 return trips (across the six-year pre-construction and construction period).	The greatest amount of moorings, anchors and FTUs and therefore construction and vessel activity will cause the greatest disturbance and distributional responses to ornithology receptors.
Disturbance and / or displacement of ornithology receptors during HDD	• The exit point is approximately 190 m from the cliffs and at 26.5 m depth, below MHWS. • HDD construction is expected to occur in Year 1 of the construction phase (2030).	Maximum HDD and cable protection will cause greatest disturbance and displacement of ornithology receptors.
Changes to prey resources	Potential effects which are applicable to fish and shellfish (which represent many ornithological prey species) may have an indirect effect on offshore ornithological receptors. Therefore, the assessment is based on the worst-case parameters presented in EIAR Vol. 3, Chapter 13: Fish and Shellfish Ecology and EIAR Vol. 3, Chapter 10: Benthic Ecology.	The greatest amount of change of availability of prey resources will cause the greatest effect to ornithology receptors.

POTENTIAL IMPACT	WORST-CASE SCENARIO	JUSTIFICATION
Operation and maintenance		

Disturbance and / or displacement from vessels	Operational life of 35 years
	• Up to ten vessels operating simultaneously during operation and maintenance phase.
	• Operation and maintenance activities including:
	  • Routine inspections of FTUs, OSCPs, foundations and cables;
	  • Up to two major component exchanges per FTU involving a tow back to shore (i.e. up to 190 operations);
	  • Up to three major component exchanges per FTU conducted in-situ;
	  • Re-tensioning of each mooring line twice over operational life with up to 10% of mooring lines requiring replacement;
	  • Up to 10% of IACs requiring repair;
	  • Up to 10% of IACs requiring replacement; and
	  • Up to four Export/Import Cable repairs.
		The maximum number of vessels will cause the greatest amount of disturbance to ornithology receptors.

Distributional responses from FTUs	Assessment of seabird distributional responses effects (including barrier effects) is based on the Array Area plus 2 km buffer (JNCC *et al.*, 2022). See EIAR Vol. 4, Appendix 22: Distributional Responses Report. Disturbance may arise from windfarm operation and maintenance activities, including associated vessel movements.	In terms of assessment, potential disturbance effects are subsumed by Distributional responses which uses 'worst-case' rates of Distributional responses and mortality uniformly applied across the entire Array Area plus 2 km buffer, and across seasons.
Collision with WTGs	WTG components: • 15 MW scenario (gannet WCS);	The worst-case scenario differs between species assessed, with the 15 MW turbine scenario being the worst-case scenario for gannet and

POTENTIAL IMPACT	WORST-CASE SCENARIO	JUSTIFICATION
	- Up to 95 WTGs; - Maximum rotor radius of 121 m; and - Maximum blade width 5.1 m. • 18 MW scenario (kittiwake WCS): - Up to 80 WTGs; - Maximum rotor radius of 135 m; and - Maximum blade width of 7.2 m. • Minimum 22 m airgap for all scenarios. • Pitch set at ten degrees for all scenarios.	the 18 MW turbine scenario the worst-case for kittiwake as detailed in EIAR Vol. 4, Appendix 21: Collision Risk Modelling Report. It is likely the worst-case differs between species due to the interaction of inputted seabird parameters and turbine parameters. E.g. as kittiwake are smaller and use flapping flight characteristics compared to gannet which are larger and use gliding flight characteristics. The relationship between turbine size and interaction is likely to be non-linear, evidenced by the best-case scenario being the 21 MW turbine scenario, for both species.
Changes to prey resources	Potential impacts which are applicable to fish and shellfish (which represent many ornithological prey species) may have an indirect effect on offshore ornithological receptors. Therefore, the assessment is based on the worst-case parameters presented in EIAR Vol. 3, Chapter 13: Fish and Shellfish Ecology.	The greatest amount of change of availability of prey resources will cause the greatest effect to ornithology receptors.
Secondary entanglement from IACs and mooring lines	IACs: • 2 dynamic IAC sections per FTU in the water column. • Up to 190 dynamic IAC sections with total length of 70 km in the water column. Mooring lines: • Up to 6 mooring lines per FTU (semi-submersible); • Maximum of 757 m length per semi-taut mooring line (for semi-submersible); • Maximum 4.541 km semi-taut mooring line length per FTU (for semi-submersible); and	The maximum length of cables and mooring lines present in the water column will pose the biggest risk to ornithology receptors.

POTENTIAL IMPACT	WORST-CASE SCENARIO	JUSTIFICATION
	• Maximum proportion of mooring line in the water column = 68% (semi-submersible).	
Decommissioning		

**In the absence of detailed information regarding decommissioning works, the implications for ornithology are considered analogous to or likely less than those of the construction phase. Therefore, the worst-case parameters defined for the construction stage are also applicable to the decommissioning phase. The approach to decommissioning for the Project is outlined in EIAR Vol 2, Chapter 5: Project Description.*

12.6 Assessment of potential effects

12.6.1 Potential effects during construction

12.6.1.1 Disturbance and / or displacement of ornithology receptors from vessels

During the construction phase of the Project, various vessels will be required for site preparation, construction (WTGs, cable corridors etc) and support. These may cause temporary displacement and disturbance to ornithological receptors which could in turn result in energetic consequences and temporary loss of important habitat, for those individuals that may be 'flushed' from the area (Garthe and Huppop, 2004). The vessels present during the construction phase of the Project are detailed in Table 12-22 and EIAR Vol. 2, Chapter 5: Project Description. Temporary habitat loss associated with disturbance from construction vessels may result in displaced birds moving to areas already occupied by other birds, leading to increased intra- and inter-specific competition with more birds competing for the same resources. Alternatively, birds may be displaced to lower quality habitats with lower prey abundance or may have to travel longer distances in search of more suitable foraging habitats. This could impact displaced birds in terms of affecting their demographic fitness (e.g. survival and breeding productivity rates) as well as existing birds in the areas through increased competition. The sensitivity of each of the four assessed ornithological receptors to vessels during the construction phase varies. Guillemot are considered by Furness *et al.* (2013) to have a relatively high species concern index value, calculated using a combination of sensitivity to disturbance, ability to exploit a variety of habitats and conservation importance (Table 12-12). The species is not considered to have strong escape behaviour in the presence of vessel traffic or a large flight distance when approached however, due to their moderate foraging ranges (Woodward *et al*., 2019), they are relatively restricted in habitat choice. Guillemot are not assessed for the breeding season as the Array Area is outside of mmfr + 1SD of all colonies (Table 12-10), therefore all assessment relates to the non-breeding season only. As guillemot are able to tolerate most levels of vessel activity with survival not expected to be affected and full recovery anticipated within a short time frame after the construction phase is completed, the species is considered to have medium sensitivity to vessel activity.

Puffin is similarly scored by Furness *et al.* (2013) as guillemot due to similarities in their ecology however, despite having a larger maximum foraging range than guillemot (Woodward *et al.*, 2019), they are more restricted in their foraging ability and are more specialist predators (e.g. restricted to dive depths of up to 60 m depth compared with 180 m in guillemot; Burger and Simpson, 1986). However, the species exhibits more limited escape behaviour to vessel activity than guillemot, with shorter escape flight distance when approached (Bradbury *et al.*, 2014). Considering this, puffin are classed as of medium sensitivity to vessel activity.

The remaining two species under assessment (kittiwake, gannet) are considered to be less sensitive to disturbance from vessel activity with Furness *et al.* (2013) ranking kittiwake as most sensitive followed by gannet. These species have much larger foraging ranges than the auks (Woodward *et al.*, 2019) and are more generalist feeders meaning they are much less restricted to particular habitats. As such, these species are considered to have low sensitivity to vessel activity during the construction phase.

Vessel activity during the construction phase of the Project is detailed in EIAR Vol. 2, Chapter 5: Project Description and is expected to occur between 2030 and 2035. Up to 22 project vessels may be on site simultaneously during the construction phase with a maximum of 1,487 return vessel trips in total across six years of construction. It is assumed that construction vessels will be on-site throughout the duration of the construction phase however, only for short to medium periods. Vessel presence will be localised around the Array Area, EICC and relevant ports (detailed in EIAR Vol. 3, Chapter 15: Shipping and Navigation). The Applicant proposes careful management of offshore vessel operations through all phases of the Project, including through the Vessel Management Plan (Table 12-21). Vessels will also follow a set route in transit at a constant speed and are thus more predictable. therefore, the **magnitude** is assessed to be **negligible**.

Overall, the consequence to ornithological receptors is considered to be **negligible** for all species and **not significant** in EIA terms.

Evaluation of significance

Taking the **low** and **medium sensitivity** of the four assessed species and the **negligible magnitude** of the effect, the overall consequences are considered to be **negligible** and **not significant** in EIA terms.

Sensitivity	Magnitude of effect	Consequence
Low (gannet and kittiwake)	Negligible	Negligible
Medium (guillemot, puffin)	Negligible	Negligible

Effect significance - NOT SIGNIFICANT

12.6.1.2 Disturbance and / or displacement of ornithology receptors during HDD

During the construction phase of the Project, the cable installation at the landfall will be carried out using HDD. The cable will make landfall in Longhaven between the villages of Boddam and Longhaven on the Aberdeenshire Coast, at a sea cliff which is approximately 190 m offshore. Three holes will be drilled to house the two HVDC cables and fibreoptic cable. within 100 m of the HDD exit point, the cables will be jet trenched into the seabed. The HDD works and cable pull will be timed as per the NorthConnect proposals laid out in their EIAR, to specifically avoid disturbance of breeding birds. Full details of HDD and cable pull are described in Section 5.6.4.1 in EIAR Vol. 2, Chapter 5: Project Description.

During the vantage point surveys conducted for NorthConnect which covered an area from the coast out to 2 km to sea, guillemot were one of the most abundant species recorded (NorthConnect, 2018b). This was also the case for the most recent nearshore surveys completed in 2024 (refer to EIAR Vol. 4, Appendix 20: Intertidal & Nearshore Bird Surveys). The highest recorded peak count of guillemot was observed in May 2024 with 530 birds while the highest peak of puffin was observed in July 2024 with 76 birds. As discussed above in Section 12.4.4.2.3, guillemot are not considered to have strong escape behaviour due to disturbance or a large flight distance when disturbed (Furness *et al.*, 2013), though do have a relatively restricted foraging range (Woodward *et al.*, 2019) and thus are considered to have **medium** sensitivity. This is also the case for puffin as explained in Section 12.4.4.2.5, and razorbill in Section 12.4.4.2.4.

Kittiwake was also recorded in relatively high abundance (peak count 726 individuals in nearshore surveys) in addition to herring gull (peak count 112 individuals in nearshore surveys). Gannet were recorded in lower abundance during nearshore surveys with only five gannet recorded across the six months of surveys, all in August 2024. These species are considered less sensitive to impacts from HDD due to their larger foraging ranges and lower likelihood of being disturbed / displaced (Table 12-12). These species are more adaptable to changes in the environment and able to exploit a wider area and range of prey species. Taking this into consideration, these species are considered to be of low sensitivity to HDD during the construction phase.

Wader and waterfowl species recorded during intertidal and nearshore surveys conducted between April and September 2024 were recorded in lower numbers, peaking in April 2024 with 16 eider (*Somateria mollissima*) recorded. More information is presented in EIAR Vol. 4, Appendix 20: Intertidal & Nearshore Bird Surveys. The two species recording during the surveys that are classified in Bradbury *et al*. (2014) have moderate (eider) to high (red-throated diver (*Gavia stellata*)) sensitivity risk due to displacement Therefore, all waders and waterfowl are precautionarily assessed to have high sensitivity. Drilling fluids are treated to be treated and recycled onshore prior to the pilot holes being extended to the seabed, this is to minimise losses to the marine environment at the pop-out., however small volumes of drilling fluid and some material may be lost to the environment (detailed in EIAR Vol. 2, Chapter 5: Project Description); it is unknown how suspended sediment may impact prey distribution and visibility in the water column for diving birds.

The disturbance of ornithological receptors during HDD is expected to be localised and temporary in nature. Similarly, any impacts resulting from release of excavated material will be localised and temporary. Due to the proximity to shore and therefore to breeding colonies, the magnitude of the effect is assessed to be low for all receptors. For waders and waterfowl due to the relatively low numbers recorded during nearshore and intertidal surveys the magnitude is assessed to be negligible.

Overall, consequences to ornithological receptors is considered to be negligible for all species and not significant in EIA terms. This is consistent with conclusions within the NorthConnect application, of which the Project will be using the same cable route (NorthConnect, 2018c; Section 12.4.3.2).

Evaluation of significance

Taking the high, medium and low sensitivity and the low to negligible magnitude of the effect to ornithological receptors, the overall consequence to ornithological receptors is considered to be negligible to minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High (waders and waterfowl)	Negligible	Negligible
Medium (guillemot, puffin, razorbill)	Low	Minor
Low (kittiwake, herring gull, gannet)	Low	Minor
	Effect significance - NOT SIGNIFICANT	

12.6.1.3 Changes to prey resources

The presence, availability and distribution of seabird prey species may be altered during the construction phase which may indirectly impact seabirds foraging within the Project Area. The ability of seabirds to tolerate or adapt to changes in prey resources is species-specific and dependent on diet variability and flexibility in habitat use.

Construction activities may indirectly impact seabirds through impacts to their prey species (i.e. fish and shellfish) through underwater noise (e.g. vessel noise and UXO clearance) in addition to habitat change (seabed disturbance and suspended sediments). The potential effects of these activities on prey species are assessed in EIAR Vol. 3, Chapter 13: Fish and Shellfish Ecology and EIAR Vol. 3, Chapter 10: Benthic Ecology.

The sensitivity of the fish groups to changes to the seabed and sensitive fish habitats ranged from low to high, but the magnitude of the risk for all species and the overall consequence are classified as negligible. Underwater noise and vibrations was assessed for fish mortality and fish injury potential as well as Temporary Threshold Shift (TTS) and behavioural disturbance. The sensitivity of the different fish species ranged from low to medium sensitivity with low magnitude and overall minor consequence.

Similar to construction, the long-term impact to the seabed and sensitive fish habitats during operation and maintenance ranged from low to high sensitivity but the magnitude of the impact and overall consequence are assessed to be negligible. Underwater noise and Electro-magnetic field (EMF) have an overall negligible consequence on all fish and shellfish receptors while the overall consequence for the Project acting as a fish aggregation device was minor.

Although there may be some local short-term impacts on prey species the negligible and minor consequences of each impact mean and changes in prey are unlikely to be significant enough to impact ornithological receptor populations.

Seabird species react to changes in prey abundance and distribution differently depending on prey choice, foraging range and flexibility to adapt to variation in prey species/foraging location. Kittiwake are surface feeders, primarily relying on small shoaling species, and so are considered to be of medium sensitivity to temporary changes in prey, particularly in the summer months where they are mostly dependent on lesser sandeel (Furness and Tasker, 2000). However, the species does have a moderate foraging range (Woodward *et al.*, 2019) and is able to exploit other prey sources meaning that they are relatively flexible to changes in resources.

Guillemot are pursuit divers and can dive up to 180 m to catch prey (Bennet, 2023). They are able to exploit a wide variety of prey species including Clupeidae (sprat or young Atlantic herring *Clupea harengus*), Gadidae (young whiting *Merlangius merlangus*), as well as sandeel). Guillemot have a moderate foraging range (Woodward *et al.*, 2019) meaning that they are relatively flexible to changes in foraging habitat availability and thus are considered to have medium sensitivity to change in prey availability. Similarly, puffin have a moderate foraging range and although able to exploit a variety of prey, they are more restricted than guillemot and so are also considered to have medium sensitivity to changes in prey availability.

Gannet prey on a wide variety of small to medium-sized pelagic fish, predominately mackerel, herring and more demersal cod-type fish (Wanless *et al*., 2023). Gannet have a large foraging range (Woodward *et al.*, 2019) and this, coupled with their ability to flexibly forage (Wade *et al*., 2016), means they are considered to be of low sensitivity to the disturbance of their prey species. Fulmar are not assessed for changes in prey availability as they are only scoped in for distributional responses (Section 12.4.4.1).

The effect on prey species during the construction phase are expected to be localised and temporary in nature and therefore, the magnitude of the effect on the four assessed seabird species is assessed to be low.

Overall, the consequences to the four assessed seabird species is considered to be negligible and not significant in EIA terms.

Evaluation of significance

Taking the medium and low sensitivity of the four assessed seabird species and the low magnitude of the effect, the overall consequences are considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
Medium (kittiwake, guillemot, puffin)	Low	Minor
Low (gannet)	Low	Minor
Effect significance - NOT SIGNIFICANT		

12.6.2 Potential effects during operation and maintenance

12.6.2.1 Disturbance and / or displacement of ornithology receptors from vessels

During the operation and maintenance phase of the Project, there will be fewer vessels (up to ten) present within the Array Area and EICC compared with the construction and decommissioning phases. Those present may cause temporary displacement and disturbance to seabirds which could result in energetic consequences and temporary loss of important habitat for birds that experience flushing effects (Garthe and Huppop, 2004).

The sensitivity of each of the four assessed seabird species to vessels during the operation and maintenance phase can vary. As discussed in Section 12.6.1.1, the auk species (i.e. guillemot and puffin) are more sensitive to disturbance / displacement from vessel activity. These species are considered to be susceptible to displacement and combined with their moderate foraging ranges and degree of habitat flexibility (Furness *et al.*, 2013; Bradbury *et al.*, 2014), both guillemot and puffin are considered to have medium sensitivity to this effect.

The other two assessed species (kittiwake and gannet) are considered less sensitive to disturbance from vessels. It is likely these receptors are able to return to their previous behaviour once the vessel activity has ceased with no long-lasting impacts. All three species have large foraging ranges and are classed as being of very low population vulnerability to displacement (Table 12-12; Furness *et al.*, 2013; Bradbury *et al.*, 2014). In addition, both species are generalist foragers and are thus not restricted to particular habitats / prey. Kittiwake and gannet are therefore considered to be of low sensitivity to disturbance and / or displacement from vessel activity.

There will be reduced vessel activity during the operation phase compared to the construction and decommissioning phases of the Project, these are detailed in EIAR Vol. 2, Chapter 5: Project Description and EIAR Vol. 3, Chapter 15: Shipping and Navigation. Up to ten project vessels may be on site simultaneously during the operation and maintenance phase. The Project proposes careful management of offshore vessel operations through all phases of the Project, the VMPs. Therefore, the magnitude of the effect has been assessed as negligible.

The overall consequences of the effect on the four assessed seabird species is assessed to be **negligible** and **not significant** in EIA terms.

Evaluation of significance

Taking the **low** and **medium sensitivity** of the four assessed seabird species and the **negligible magnitude** of the effect, the overall consequence is considered to be **negligible** and **not significant** in EIA terms.

Sensitivity	Magnitude of effect	Consequence
Medium (guillemot, puffin)	Negligible	Negligible
Low (gannet, kittiwake)	Negligible	Negligible
Effect significance - NOT SIGNIFICANT		

12.6.2.2 Distributional responses from presence of FTUs

Distributional responses encompasses both displacement and barrier impacts arising due to the presence of operational FTUs. Displacement is defined as '*a reduced number of birds occurring within or immediately adjacent to an offshore wind farm*' (Furness *et al.*, 2013; Bradbury *et al.*, 2014) as a direct result of birds avoiding an area with operational turbines. Barrier effects may occur where birds that would have previously flown through an area (e.g. in transit to feeding, resting or nesting areas), either have to cease flying or alter their flight path due to an OWF (JNCC *et al.*, 2024). Responses from both displacement and barrier effects are generally species-specific and for those which are less adaptive or have highly localised foraging areas, impacts may lead to population-level effects. During the operational phase, species may be displaced from the Array Area and surrounding area due to the presence and activity of the FTUs as described in **EIAR Vol. 4, Appendix 22: Distributional Responses Report.**

For the purpose of this assessment, effects from displacement and barrier effects are assessed as recommended by NatureScot guidance (NatureScot, 2023h). Typically, the two effects are assessed together as it is relatively challenging to differentiate between them, as for both effects the measurable component is the reduction of birds within the wind farm footprint (Cook *et al.*, 2014).

For distributional responses, the MSPs for the Array Area and 2 km buffer were calculated from site-specific DAS data (**EIAR Vol. 4, Appendix 19: Ornithology Baseline Report**) and were used to create matrices of impacts as recommended in SNCB guidance (JNCC *et al.*, 2024). The MSP and displacement and mortality rates used per species are presented in Table 12-23. Displacement matrices are presented in **EIAR Vol. 4, Appendix 22: Distributional Responses Report** with seasonal mortality estimates from distributional responses for the upper and lower displacement and mortality rates presented in Table 12-24.

Within **EIAR Vol. 4, Appendix 22: Distributional Responses Report**, information using both the matrix approach and SeabORD are presented. However, results from SeabORD are purely provided for context and results from the matrix approach are those which are taken through impact assessment. This approach was discussed and agreed with NatureScot at the Scoping Workshop on 29th February 2024.

Within this section, fulmar is considered qualitatively for distributional responses, following the NatureScot response to the RIAA, Appendix A: HRA Stage One Screening Report and subsequent consultation with NatureScot (Table 12-3 and Ornithology Catch Up on 7th August 2024). NatureScot considered the primary effect would be barrier effects during operation however, since it is not currently possible to reliably distinguish between displacement and barrier effects, fulmar are screened in for qualitative assessment of distributional responses during the operation and maintenance phase. Guillemot is only considered in the non-breeding season for distributional responses as the Project is beyond the mmfr + 1SD from the nearest breeding colony (Woodward *et al.*, 2019).

The combined effect of distributional responses from presence of FTUs and collision risk with WTGs is assessed for kittiwake and gannet in Section 12.6.2.3.

Table 12-23 Mean Seasonal Peak (MSP) abundance estimates and displacement / mortality rates used in assessment of distributional responses

SPECIES	BREEDING SEASON MSP	NON-BREEDING SEASON MSP	BREEDING SEASON DISPLACEMENT/MORTALITY RATE	NON-BREEDING SEASON DISPLACEMENT/MORTALITY RATE
Kittiwake	208	97	30% / 1% 30% / 3%	30% / 1% 30% / 3%
Guillemot	n/a	8,139	n/a	60% / 1% 60% / 3%
Puffin	221	67	60% / 3% 60% / 5%	60% / 1% 60% / 3%
Gannet	216	263	70% / 1% 70% / 3%	70% / 1% 70% / 3%

** No MSP for fulmar as qualitative assessment only*

Table 12-24 Mortalities from distributional responses during the breeding and non-breeding seasons, to the nearest whole bird. Percentage point change in adult survival rate indicated within parentheses

SPECIES	REGIONAL POPULATION (IND.)	DISPLACEMENT MORTALITIES (NO. OF BIRDS PER ANNUM)						
Displacement rate		30%		60%			70%	
Mortality rate		1%	3%	1%	3%	5%	1%	3%
Breeding season								
Kittiwake	231,732	1 (0.000)	2 (0.001)	-	-	-	-	-
Guillemot	Not assessed in breeding season							
Puffin	215,019	-	-	-	4 (0.002)	7 (0.003)	-	-
Gannet	238,322	-	-	-	-	-	2 (0.001)	5 (0.002)

SPECIES	REGIONAL POPULATION (IND.)	DISPLACEMENT MORTALITIES (NO. OF BIRDS PER ANNUM)						
Non-breeding season								
Kittiwake	829,937*	0 (0.000)	1 (0.000)	-	-	-	-	-
Guillemot**	1,617,306	NA	-	50 (0.003)	150 (0.009)	-	-	-
Puffin	231,957	-	-	0 (0.000)	1 (0.001)	-	-	-
Gannet	456,298*	-	-	-	-	-	2 (0.000)	6 (0.001)

**Autumn migration population from Furness 2015 as mean seasonal peaks for both species occurred during the autumn*

***Percentage point change in adult survival rate derived using BDMPS regional population for UK North Sea and Channel (Furness, 2015) as no breeding season regional population was derived due to the Project being outside of breeding season foraging range, as discussed with NatureScot at ornithology consultation*

12.6.2.2.1 Kittiwake

Sensitivity of receptor

Although kittiwake are not considered to be particularly sensitive to distributional responses (Furness *et al.*, 2013; Bradbury *et al.*, 2014; Wade *et al.*, 2016), quantitative assessment of kittiwake distributional responses has been included in EIAR Vol. 4, Appendix 22 Report A20: Ornithology Displacement Assessment and Section 12.6.2.2, following the joint SNCB interim advice (SNCB *et al.*, 2022) which states species which score three or higher in either disturbance susceptibility or habitat specialisation in Bradbury *et al.* (2014) should be progressed to assessment using the matrix approach (Table 12-12; SNCB *et al.*, 2022). NatureScot guidance also recommends the inclusion of kittiwake in assessment of distributional responses (NatureScot, 2023h). Additionally, it is understood that quantitative assessment of kittiwake distributional responses in both the breeding and non-breeding season is regularly requested by MD-LOT for offshore wind projects in Scottish waters, as presented in applications for Green Volt Floating Windfarm, Ossian Offshore Wind Farm, Salamander Offshore Wind Farm and Berwick Bank Offshore Wind Farm, etc.

As set out in Table 12-12, kittiwake are considered to have a very low vulnerability to displacement (Furness *et al.*, 2013; Bradbury *et al.*, 2014). They have a relatively large foraging range (Woodward *et al.*, 2019) and are generalist foragers making them more tolerant to changes in the environment. There is evidence from several offshore wind farm projects that kittiwake are unlikely to experience significant displacement due to the presence of operational offshore wind farms. For example, post-construction data from Vanermen *et al.* (2014) and Dierschke *et al.* (2016) and in Scotland, data from Beatrice Offshore Windfarm (MacArthur Green, 2023), where kittiwake were observed within the array area in increased abundance (although the trend was not significant). As such, as set out in Table 12-18, kittiwake are considered to be of low sensitivity to distributional responses.

Magnitude of effect

Using the displacement rate of 30% and the worst-case mortality rate of 3% (the high scenario) advised in the Scoping Opinion (MD-LOT, 2024), results in a mortality of two birds during the breeding season and one bird in the non-breeding season (Table 12-25 and EIAR Vol. 4, Appendix 22: Distributional Responses Report).

Considered against a regional population of 231,732 breeding adults in the breeding season, kittiwake mortality from distributional responses equates to a percentage point change in adult survival of 0.000 – 0.001% for the low (30% displacement, 1% mortality) and high scenarios (30% displacement and 3% mortality) respectively. This equates to annual mortalities of one bird under the low scenario and three birds under the high scenario. Therefore, as set out in Table 12-20, the magnitude of the effect is assessed to be negligible.

Significance of the effect

Kittiwake have an adult survival rate of 85.4% and a moderate foraging range (Horswill and Robinson, 2015; Woodward *et al.*, 2019) and are therefore able to travel relatively high distances in search of prey. Overall, considering kittiwake sensitivity to disturbance from distributional responses and the magnitude of effect, the consequence of the Project in terms of distributional responses to kittiwake is considered to be negligible and not significant in EIA terms.

12.6.2.2.2 Guillemot

Sensitivity of receptor

Guillemot are considered to be highly sensitive to distributional response effects (Furness *et al*., 2013; Bradbury *et al.*, 2014; Wade *et al.*, 2016) and, as agreed with NatureScot (Table 12-3), were assessed on this basis (EIAR Vol. 4, Appendix 22: Distributional Responses Report). Since guillemot are outside of breeding season foraging range (as presented in Woodward *et al.* (2019)), the species was not assessed during the breeding season. Following this, in the non-breeding season, effects were assessed in the context of the non-breeding regional population as presented in Furness (2015), following advice from NatureScot received 2nd April 2024.

Guillemot are scored as of moderate vulnerability to displacement in Bradbury *et al.* (2014) and Furness *et al.* (2013; Table 12-12). As guillemot were only assessed in the non-breeding season, birds are likely to be less restricted and although this may mean sensitivity differs slightly in comparison to the breeding season, there is currently limited information as to how sensitivity may differ between seasons. Therefore, using the definitions presented in Table 12-18, in this assessment guillemot are considered to have medium sensitivity to distributional responses.

Magnitude of effect

The effect of distributional responses on guillemot is not assessed during the breeding season, as there are no breeding colonies within foraging range of the Project using Woodward *et al.* (2019) mmfr + 1SD (Table 12-3). Guillemot were only assessed in the non-breeding season where a displacement rate of 60% and mortality rates of 1% and 3% were used as agreed through consultation and the Scoping Opinion (MD-LOT, 2024; Table 12-3). The estimated worst-case mortality of 150 birds is less than 0.01% of the non-breeding regional population of 1,617,306 birds and equates to a percentage point change in adult survival of 0.009%. This equates to an annual mortality of 50 birds under the low scenario (60% displacement, 1% mortality) and 150 birds under the high scenario (60% displacement, 3% mortality) The magnitude of the effect of displacement on guillemot is therefore, assessed to be negligible.

Significance of the effect

Horswill and Robinson (2015) estimate guillemot average survival rate as 93.9%. When considering this, the medium sensitivity of guillemot to disturbance from distributional responses and their relatively small foraging range, as well as the negligible magnitude of the effect, the overall consequence of distributional responses to guillemot is considered to be negligible and not significant in EIA terms.

12.6.2.2.3 Puffin

Sensitivity of receptor

Puffin are considered to have low vulnerability to displacement by Bradbury *et al.* (2014) and Furness *et al.* (2013; Table 12-12). However, considered with the fact the species is relatively restricted in terms of flexibility to exploit different habitats, results in puffin being considered to be of medium sensitivity to distributional responses.

Magnitude of effect

During the breeding season, results derived from a displacement rate of 60% and mortality rates of 3% and 5% were used within assessment, following the NatureScot guidance and as agreed during consultation and in the Scoping Opinion (MD-LOT, 2024; Table 12-3). In the non-breeding season, a displacement rate of 60% and mortality rates of 1% and 3% were used.

Total annual mortality from the low (60% displacement, 3% mortality in the breeding season; 60% displacement, 1% mortality in the non-breeding season) and high scenario (60% displacement, 5% mortality in the breeding season; 60% displacement, 3% mortality in the non-breeding season) was estimated at four and eight birds, respectively (Table 12-25). Mortality from distributional responses for the high scenario represents a percentage point change in adult survival of 0.003% during the breeding season and 0.001% in the non-breeding season. Considering this, the magnitude of effect on puffin from distribution responses is assessed as negligible.

Significance of the effect

The baseline adult survival rate for puffin is estimated at 90.6% (Horswill and Robinson, 2015). Considering the medium sensitivity of puffin and the negligible magnitude of distributional responses, the overall effect on puffin from distributional responses during the operational phase is assessed as negligible and not significant in EIA terms.

12.6.2.2.4 Gannet

Sensitivity of receptor

Gannet are considered to be sensitive to distributional responses and is Scoped In for this effect following SNCB guidance (SNCB *et al.*, 2022; Table 12-12). Quantitative assessment of gannet distributional responses is presented in EIAR Vol. 4, Appendix 22: Distributional Responses Report. Due to their ability to forage over large areas with little known association with particular marine habitats or features and limited escape behaviour from air and marine traffic, gannet are considered by Bradbury *et al.* (2014) and Furness *et al.* (2013) to have very low vulnerability to displacement (Table 12-12). For the purpose of this assessment, gannet sensitivity to distributional responses is considered to be low.

Magnitude of effect

A mortality of five birds from distributional responses was estimated during the breeding season using the high scenario of a displacement rate of 70% and 3% mortality as agreed during consultation and in the Scoping Opinion (MD-LOT, 2024; Table 12-3). During the non-breeding season, mortality from distributional responses was estimated at six birds. The annual mortality for the high scenario was estimated at 11 birds with the low scenario (70% displacement, 1% mortality) estimated at four birds. For the breeding and non-breeding season, this equates to a percentage point change in adult survival of 0.002% and 0.001%. Therefore, the magnitude of distributional responses is determined to be negligible as set out in Table 12-20.

Significance of the effect

Taking the low sensitivity of gannet and the negligible magnitude of the effect in addition to the relatively high species-specific baseline adult survival rate (91.9%; Horswill and Robinson, 2015), the overall significance of distributional responses for gannet is assessed as negligible. This is not significant in EIA terms.

12.6.2.2.5 Fulmar

Sensitivity of receptor

Following the NatureScot response to the HRA Stage One Screening Report, fulmar are assessed qualitatively for distributional responses only.

Fulmar are flexible predators with a very large foraging range (Woodward *et al.*, 2019) and are therefore able to exploit a variety of prey from a wide range of marine habitats. They are not disturbed and exhibit a very short flight distance when approached (Furness *et al*, 2013) and are classed as of very low vulnerability to displacement by Bradbury *et al*. (2014; Table 12-12). Assessment by Dierschke *et al.* (2016) concluded that fulmar exhibit weak avoidance of offshore wind farms, therefore for the purpose of this assessment, fulmar are considered to have negligible sensitivity to distributional responses.

Magnitude of effect

Over two years of DAS there was a total of 650 raw observations of fulmar in the Array Area and 2 km buffer, with 407 birds recorded in the Array Area alone. Peak density for the Array Area calculated using design-based density estimation was estimated at 2.23 birds/km^2, recorded in August 2022. The relatively small size of the Project in comparison to the foraging range available to fulmar, in addition to the distance of the Project offshore and the very low sensitivity to disturbance and displacement (Furness *et al*, 2013; Bradbury *et al.*,2014) indicates that the magnitude of effect will be negligible. More detail is available in the RIAA.

Significance of the effect

Given the very large foraging range, it is unlikely distributional responses will affect fulmar survival or reproductive rates in a perceptible way. This very large foraging range, together with the negligible sensitivity to disturbance from distributional responses and negligible magnitude of effect, means the significance of the effect is assessed to be negligible. This is not significant in EIA terms.

Evaluation of significance

Taking the low, medium and negligible sensitivity of the five assessed seabird species and the negligible magnitude of the effect, the overall consequences is considered to be negligible and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
Low (kittiwake, gannet)	Negligible	Negligible
Medium (guillemot, puffin)	Negligible	Negligible
Negligible (fulmar)	Negligible	Negligible
Effect significance - NOT SIGNIFICANT		

Collision risk with WTGs

There is the potential for the presence of WTGs to lead to direct mortality of ornithology receptors while in flight through collision with turbine blades. Sensitivity to collision is not uniform across all species (Furness *et al.*, 2013; Bradbury *et al.*, 2014) and although direct collisions may not always result in death, for this assessment it is assumed that all collisions with operational WTGs result in mortality.

In line with NatureScot guidance, generic flight height data from Johnston *et al.* (2014) was used during assessment of collision risk. In August 2024, joint guidance regarding bird Collision Risk Modelling (CRM) was released by the Statutory Nature Conservation Bodies (SNCBs), superseding previous advice from NatureScot (NatureScot, 2023d). The new advisory note recommends the use of a web-based tool for modelling with Option 2 of the Basic Band model now the only option required (JNCC *et al.*, 2024). Species-specific avoidance rates have also been updated. For more details on the CRM methodology, refer to EIAR Vol.4, Appendix 21: Collision Risk Modelling Report. Of the five seabird species considered in this EIAR chapter, a collision assessment was only required for kittiwake and gannet, as agreed with NatureScot during Scoping and the Scottish Ministers in the Scoping Opinion (Flotation Energy, 2024; Table 12-3).

For kittiwake, the 18 MW scenario represents the worst-case scenario whereas for gannet it is the 15 MW scenario. Results for the 15 MW scenario are based on 95 turbines and the 18 MW scenario is based on 80 turbines. Difference between worst-case scenario between species is likely due to multiple interacting factors within the collision modelling from turbine specifications such as rotation speeds, swept area, blade pitch and bird biometrics and behaviour including species specific flight height curves and flight speed which means model outputs vary for different species and not necessarily linearly. The worst-case scenario for each species (i.e. the scenario which estimates the highest number of collision mortalities) is used in the assessment. The combined effect of collision risk with distributional responses for kittiwake and gannet is presented in Section 12.6.2.3.

12.6.2.2.6 Kittiwake

Sensitivity of receptor

The conservation importance of kittiwake is presented in Table 12-13. According to Furness *et al*. (2013), kittiwake are considered to be of high sensitivity to collision effects as approximately 16% of kittiwake fly at turbine height. Scoping in kittiwake for the assessment of collision risk was discussed and agreed with NatureScot during the Scoping process (Table 12-3) and is presented in EIAR Vol. 4, Appendix 21: Collision Risk Modelling Report.

Bradbury *et al.* (2014) classify kittiwake as of high vulnerability to collision, calculated using flight altitude, flight manoeuvrability, percentage of time flying when at sea and nocturnal activity (Table 12-12). Kittiwake spend less than 20% of their time at sea in flight with very high flight manoeuvrability and are relatively active during the night (Bradbury *et al.*, 2014). However, a large proportion of birds fly at blade height and are therefore at risk of collision and so within this assessment kittiwake sensitivity to collision risk is considered to be medium.

Magnitude of effect

Under the worst-case scenario for kittiwake (18 MW scenario), the estimated number of collisions is higher in the breeding season than the non-breeding season (8.0 birds compared with 5.0 birds respectively). Despite this, these mortalities represent a percentage point change in adult survival of 0.00437% with annual total collision mortality estimated at 13.0 birds (95% CI 9.2 – 16.8). As per Table 12-20, as estimated moralities in both seasons represent less than 1% of the regional population, the magnitude of collision risk for kittiwake is considered to be negligible.

Significance of the effect

The results from CRM demonstrated that for kittiwake, the 18 MW scenario represents both the worst-case and most-likely scenario. Despite the species' medium sensitivity to collision, as collision mortalities in both seasons are less than 0.01% of the regional population and thus of negligible magnitude, the overall significance of collision risk is assessed to be negligible. This is not significant in EIA terms.

Table 12-25 Kittiwake collision mortality in the breeding and non-breeding seasons with percentage point change in adult survival

SCENARIO	BREEDING SEASON REGIONAL POPULATION	BREEDING SEASON COLLISION MORTALITY	NON-BREEDING SEASON COLLISION MORTALITY	TOTAL MORTALITY	PERCENTAGE POINT CHANGE IN ADULT SUVIVIAL
18 MW (worst-case and most likely case)	231,732	8.0 (4.6 – 11.5)	5.0 (3.4 – 6.6)	13.0 (9.2 – 16.8)	0.006

12.6.2.2.7 Gannet

Sensitivity of receptor

Considering variables such as flight agility and amount of time flying while at sea as well as the percentage of birds flying at turbine blade height, gannet are considered to have a high total risk score to collision (Furness *et al.*, 2013; Bradbury *et al.*, 2014) and therefore a medium sensitivity to collision risk.

Gannet are considered to be more likely than other species to exhibit macro-avoidance where avoidance responses of a bird to the presence of a wind farm development occur beyond the boundary of the development, likely resulting in a redistribution of birds (Skov *et al.*, 2018). To account for this in the assessment, estimated mortality of gannet in the non-breeding season was corrected for macro-avoidance *post-hoc* using an avoidance rate of 70% (refer to EIAR Vol. 4, Appendix 21: Collision Risk Modelling Report for further detail). During the Ornithology Catch Up on 7th August it was agreed with NatureScot that estimated mortality should not be corrected for macro-avoidance in the breeding season, as are there are currently not enough data for Scottish sites or from studies close to Scottish SPAs. This is considered to be precautionary as evidence from post-construction monitoring at Beatrice OWF showed that very few gannet entered the Beatrice OWF array area throughout the year (MacArthur Green, 2023).

Magnitude of effect

Under the worst-case scenario for gannet (15 MW scenario), collision mortality estimates are higher in the breeding season than the non-breeding season with 17.1 and 2.9 collision mortalities estimated respectively (Table 12-26). The annual total collision mortality of 20.1 birds (95% CI 12.5 – 27.6) equates to a percentage point change in adult survival of 0.008% and therefore the magnitude of effect is considered to be negligible.

Significance of the effect

Gannet are considered to be of medium sensitivity to the effects of collision with most collisions associated with the breeding season. The non-breeding season collision estimates were adjusted for macro-avoidance however, given the large species-specific foraging range (Woodward *et al.*, 2019) and habitat flexibility as well as the negligible magnitude of effect, the significance of collision risk on gannet is considered to be negligible and not significant in EIA terms.

Table 12-26 Gannet collision mortality in the breeding and non-breeding seasons with percentage point change in adult survival

SCENARIO	REGIONAL POPULATION	BREEDING SEASON COLLISION MORTALITY	NON-BREEDING SEASON COLLISION MORTALITY	TOTAL MORTALITY	PERCENTAGE POINT CHANGE IN ADULT SUVIVIAL
15 MW (worst-case scenario)	238,322	17.1 (9.9 – 24.4)	2.9 (1.1 – 4.9)	20.1 (12.5 – 27.6)	0.008

12.6.2.2.8 Migratory species

WWT (2014) delivered a strategic assessment of collision risk to migratory species in order to identify species at risk of collision with Scottish OWFs. Collison risk was assessed for all proposed offshore wind farm projects in Scottish waters at the time including Beatrice, Moray East, the European Offshore Wind Development Centre (Aberdeen Bay), Neart na Gaoithe, Inch Cape, SeaGreen (Alpha and Bravo), Argyll Array and Islay offshore wind farms.

Using species population size, migration corridor width and flight data (height and speed), WWT (2014) estimated the annual collision mortalities for non-seabirds against the '*combined spring and autumn passage populations*'. Macarthur Green carried out the collision risk modelling using the migration option from Band (2012) with a 98% avoidance rate used for all species modelled. The report notes that the estimates for geese are therefore precautionary as NatureScot had amended the avoidance rate for geese to 99.8% by the time the report was published.

To assess collision risk, 'fronts' were added to maps perpendicular to the main migration routes in Scotland. Of the 57 non-seabird species reviewed by WWT (2014), 29 have migration fronts that, in part, line up with the Project. Of this group, the species with the highest proportion of birds assessed to be at risk of collision with Scottish OWFs at the time of the review is the Taiga bean goose (*Anser fabalis*; here after 'bean goose) with an estimated annual collision mortality of three individuals, equating to 0.4% of the combined passage population.

In addition to collision risk, WWT (2014) provided the width of the migration corridor for each species. This width can be compared against the width of the Array Area to determine the proportion of the migration route width potentially impacted by the Project. For example, as the width of the Array Area is 19.46 km (see EIAR Vol. 4, Appendix 21: Collision Risk Modelling Report) and the bean goose migration corridor is 196.5 km, it can be calculated that the Array Area takes up 9.9% of the width of the overall migration corridor. This is the highest proportion of all species considered in the WWT (2014) report.

In 2023, Woodward *et al*. produced an updated strategic review of collision for migratory species for the UK. The report reviewed 70 non-seabird features of SPAs, considering the 40 OWFs in operation at the time, with a further 11 either under construction or with consent granted (Woodward *et al*., 2023). Woodward *et al*. (2023) suggests the five goose species, 16 duck species, 19 wader species, five raptor and owls, a single swan species and any other species which have migratory paths that cross over with the Array Area.

Woodward *et al*. (2023) estimated the proportion of the species populations at risk of collision by combining the percentage of the populations potentially flying at collision risk height, with updated avoidance rates assigned to species groups. The avoidance rates were higher than the 98% used in the WWT (2014) review, ranging from 98.01% to 99.99% depending on the species (Woodward *et al*. 2023). Several duck species are calculated to be at the greatest risk of collision with OWFs around the UK, with an estimated 1.49% of their populations potentially exposed to the cumulative risk.

Each of the species migration routes cover a substantial large portion of UK waters, either across the North Sea and / or out towards Iceland (Woodward *et al*., 2023). The Array Area covers a very small portion of the overall area and for some species such as the light-bellied goose (*Brantabernicla hrota*) the Array Area sits on the edge of their migration route, which likely further reduces any potential impact of the Project.

The geese and swan species reviewed in Woodward *et al.* (2023) are considered to be the group most likely to be impacted by collision risk as precautionarily it is assumed that for each species, 90-100% of the biogeographic population is at risk of collision with OWFs around the UK, except the Taiga bean goose (*Anser fabalis*) which is only 1% of the biogeographic population. However, when a high avoidance rate is incorporated the collision risk drops significantly (Woodward *et al.*, 2023).

Nearby projects such as Ossian, located approximately 100 km west of the Project, quantitatively assessed collision risk using the Strategic Ornithological Support Services Migration Assessment Tool (SOSSMAT) (OWFL, 2024). Most species assessed were estimated to have zero annual mortalities, eight species were estimated to have one annual mortality; dunlin (*Calidris alpina*) and snipe (*Gallinago gallinago*) were estimated to have two annual collisions whereas pink-footed goose (*Anser brachyrhynchus*) was estimated to have three annual mortalities. The greatest increase in mortality rate (percentage points) was 0.003 for the barnacle goose (*Branta leucopsis*; Svalbard population) and eider followed by 0.001 for pink footed goose and oystercatcher (*Haematopus ostralegus*). All other species have a 0.000 percentage point change (OWFL, 2024). It was therefore concluded that migratory species have low to medium vulnerability to collision risk and low to high recoverability. Being precautionary and using the worst-case of medium vulnerability and low recoverability they assessed migratory birds to have high sensitivity to collision risk but the magnitude of the risk was low (OWFL, 2024).

For Salamander Offshore Wind Farm, migratory species were scoped out of assessment as the SOSSMAT outputs showed that the Array Area only overlapped with a minor proportion of the migration corridors, the highest overlap being 4% for eider and dotterel (ERM, 2024).

Given the precautionary values provided in Woodward *et al.*, (2023) and that a collision is assumed to result in mortality, the sensitivity of migratory species is precautionarily assessed to be high.

Taking into account the avoidance rates of the migratory species, the assessment conclusions for other offshore wind farms in proximity to the Project (Ossian and Salamander offshore wind farms) and the Array Area making up such a small area of the overall migration corridors, the magnitude is assessed to be low.

The overall effect of collision risk for the Project alone is therefore assessed to be negligible. Woodward *et al.*, (2023) assessed the risk of collision for migratory species for all UK OWFs combined; when avoidance rate is incorporated, the highest proportion of a population at risk of collision was 1.49% for several species of duck. The addition of the Project is unlikely to significantly alter this.

Evaluation of significance

Taking the **high sensitivity** of all ornithological receptors and the **low** to **negligible magnitude** of the effect, the overall consequences to ornithological receptors is considered to be **negligible** to **minor**, which is **not significant** in EIA terms.

Sensitivity	Magnitude of effect	Consequence
Medium (kittiwake, gannet)	Negligible	Negligible
High (migratory species)	Low	Minor

Effect significance - NOT SIGNIFICANT

12.6.2.3 Combined effect of collision risk with WTGs and distributional responses from presence of FTUs

Both collision risk with WTGs and distributional responses from the presence of FTUs were assessed separately following quantitative analysis (refer to Section 12.6.2.2 and 0 respectively). During the operation and maintenance phase, some scoped in species are sensitive to either collision or distributional responses (i.e. guillemot are sensitive to distributional responses but not collision risk) however, for species which are assessed for both potential impacts (i.e. kittiwake and gannet), typically estimated impacts are combined to assess the effect of both impacts on ornithological receptors, following advice from MD-LOT and NatureScot. The combined effect of collision risk with WTGs and distributional responses from presence of FTUs is assessed for the Project alone in this section with cumulative assessment presented in Section 12.7. While it is true that a single bird cannot be both displaced from the wind farm and collide with a wind turbine, the two impacts are considered additive.

12.6.2.3.1 Kittiwake

Sensitivity of receptor

The sensitivity of kittiwake to distributional responses is assessed to be low, as there is limited evidence available indicating a strong response at existing offshore wind farms (Vanermen *et al.*, 2014; Dierschke *et al.*, 2016). However, the sensitivity of kittiwake to collision with WTGs is expected to be medium when considering kittiwake flight characteristics (Bradbury *et al.*, 2014). Taking the low sensitivity of kittiwake to distributional responses and the medium sensitivity to collision with WTGs, the sensitivity to kittiwake to the combined effect of collision risk with WTGs and distributional responses from the presence of FTUs is considered to be **medium.**

Magnitude of effect

Combined impacts for kittiwake (i.e. estimated mortalities from collision and distributional responses) may result in up to 16 mortalities per year (Table 12-27) under the worst-case scenario, equating to a 0.007 percentage point change in adult survival, below the threshold for requiring PVA as discussed with NatureScot during the Ornithology Catch Up on 7th August 2024. Compared to the area of habitat available for kittiwake to utilise, the impact is predicted to be of a low spatial extent, in addition to the relatively high distance from breeding colonies and since both impacts will occur over a relatively long duration, the magnitude of impact is considered to be negligible.

Significance of the effect

Despite the high sensitivity of kittiwake to collision, as the overall effect from both impacts is less than 0.01% of the regional population (Table 12-27) and results in under 0.01% percentage point change in survival, and thus is of a negligible magnitude, the overall significance of the combined effect of collision risk with WTGs and distributional responses from presence of FTUs is considered to be negligible, which is not significant in EIA terms.

Table 12-27 Summary of mortality due to collision and distributional responses for kittiwake during the operation and maintenance phase

	DISPLACEMENT MORTALITY		COLLISION MORTALITY		TOTAL MORTALITY		
SCENARIO	BREEDING SEASON	NON-BREEDING SEASON	BREEDING SEASON	NON-BREEDING SEASON	BREEDING SEASON	NON-BREEDING SEASON	ANNUAL
Kittiwake	1 - 2	0 - 1	8.0	5.0	9.0 – 10.0	5.0 – 6.0	14.0 – 16.0

12.6.2.3.2 Gannet

Sensitivity of receptor

As gannet can forage over large areas and utilise a variety of habitats, while having low observed escape behaviour from air and marine traffic, gannet are considered to have a low sensitivity to distributional responses. When considering collision risk with WTGs however, gannet are considered to have medium sensitivity, primarily attributed to their flight characteristics and time flying while at sea (Furness *et al.*, 2013; Bradbury *et al.*, 2014). Taking the low sensitivity of gannet to distributional responses and the medium sensitivity to collision with WTGs, the sensitivity of gannet to the combined effect of collision risk with WTGs and distributional responses due to the presence of FTUs is considered to be medium.

Magnitude of effect

The combined impacts from collision and distributional responses may result in up to 31 gannet mortalities per year (Table 12-28) under the worst-case scenario. This equates to a 0.013 percentage point change in adult survival, below the threshold for requiring PVA as discussed with NatureScot during the Ornithology Catch Up on 7th August 2024. Compared to the area of habitat available for kittiwake to utilise, the impact is predicted to be of a low spatial extent, in addition to the relatively high distance from breeding colonies. Since both impacts will occur over a relatively long duration, the magnitude of impact is considered to be negligible.

Significance of the effect

Despite the high sensitivity of gannet to collision, as the overall effect from both impacts is less than 0.01% of the regional population (Table 12-28) and results in under 0.01% percentage point change in survival, and thus is of a negligible magnitude, the overall significance of the combined effect of collision risk with WTGs and distributional responses from presence of FTUs is considered to be negligible, which is not significant in EIA terms.

Table 12-28 Summary of mortality due to collision and distributional responses for gannet during the operation and maintenance phase

	DISPLACEMENT MORTALITY		COLLISION MORTALITY		TOTAL MORTALITY		
SCENARIO	BREEDING SEASON	NON-BREEDING SEASON	BREEDING SEASON	NON-BREEDING SEASON	BREEDING SEASON	NON-BREEDING SEASON	ANNUAL
Gannet	2 – 5	2 - 6	17.1	2.9	19.1 – 22.1	4.9 – 8.9	24.0 – 31.0

Evaluation of significance

Taking the medium sensitivity of kittiwake and gannet and the negligible magnitude of the effect, the overall consequence to ornithological receptors is considered to be negligible, which is not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
Medium (kittiwake, gannet)	Negligible	Negligible
Effect significance - NOT SIGNIFICANT		

12.6.2.4 Changes to prey resources

During construction, the presence and activity of vessels during operation and maintenance may indirectly impact seabird species, through any changes in the prey resource as a result of vessel movements or other operation and maintenance activity.

It is likely that disturbance to prey species will be more pronounced during the construction phase than during the operation and maintenance phase however, all effects to prey species are detailed in EIAR Vol. 2, Chapter 13: Fish and Shellfish Ecology. The conclusions from the assessment within EIAR Vol. 2, Chapter 13: Fish and Shellfish Ecology have been considered for assessment of this effect pathway in relation to ornithological receptors.

As discussed in Section 12.6.1.3 above, sensitivity to changes in prey resources is species-specific with some species affected more than others depending on the size of their foraging range and flexibility in prey selection and habitat use. Fulmar is not included in for assessment of this effect as the species is screened in for qualitative assessment of distributional responses during the operation and maintenance phase only.

Auk species, including guillemot and puffin, have moderate foraging ranges (Woodward *et al.*, 2019) and so are less able to adapt or tolerate localised changes in prey resources although they are still generally flexible foragers and able to exploit alternative food sources when required. It is likely these species are able to recover within a short-time frame once the pressure has been removed and as such are considered to have **medium** sensitivity to changes in prey sources. Kittiwake are similar to the auks with moderate foraging ranges and flexibility in prey selection and as such this species is also considered to be of **medium** sensitivity to changes in prey resources within the Array Area.

Gannet are wide-ranging with a large foraging range and are able to exploit a wide variety of prey (Wanless *et al.*, 2023) meaning they are able to tolerate and adapt to changes in prey availability with little or no lasting effects on reproductive or survival rates. For the purpose of this assessment, they are considered to have **low** sensitivity to this potential effect.

The magnitude of this effect during the operation and maintenance phase is likely to be less severe than during the construction phase as well as more localised and temporary. Therefore, the magnitude of effect is considered to be **negligible** for all species.

Overall, the consequences to the four assessed seabird species to changes in prey resources is considered to be **negligible** and **not significant** in EIA terms.

Evaluation of significance

Taking the **medium** and **low sensitivity** of the four assessed seabird species and the **negligible magnitude** of the effect, the overall consequences is considered to be **negligible** and **not significant** in EIA terms.

Sensitivity	Magnitude of effect	Consequence
Medium (kittiwake, guillemot, puffin)	Negligible	Negligible
Low (gannet)	Negligible	Negligible

Effect significance - NOT SIGNIFICANT

12.6.2.5 Secondary Entanglement

The risk of secondary entanglement of ornithological receptors may occur as a result of abandoned, lost or discarded fishing gear (ALDFG) which becomes entangled around FTU mooring lines and dynamic sections of IACs. While present in the marine environment ALDFG can continue to trap marine species until it breaks down over time or sinks to the seabed. The primary concern with secondary entanglement within the Array Area is the possibility of ALDFG wrapping around WTG mooring lines and potentially remaining within the water column for an extended period of time, prolonging the risk of accidental entanglement of marine wildlife including seabirds.

Species sensitivity is related to both the material used in the fishing gear and also individual specific factors such as body size and behaviour / feeding strategy (Benjamins *et al.*, 2014). All diving birds are at risk of secondary entanglement. Ryan (2018) reviewed images from online resources to look at entanglement of birds in plastics and other synthetic materials on a global scale, finding that discarded fishing gear was responsible for 83% of the recorded entanglements.

Fish that are caught in the gear may also act as bait for diving seabirds (Gilman *et al.*, 2021) which may increase the risk to opportunistic feeders such as gannet. Although entanglement tends to occur relatively infrequently for most species (Ryan, 2018), if an individual seabird did become entangled it is likely it would result in injury or death and therefore the sensitivity to secondary entanglement for all species with the exception of kittiwake which is not a diving bird are assessed as high.

There will be two dynamic IAC sections in the water column and up to 6 mooring lines per FTU (Table 12-22) however, there are low levels of fishing activity in ICES rectangle 43F, where the Array Area is located (Table 12-3). The fishing gear from demersal trawling, which is the most common type around the Array Area, is generally recovered in the same location it is lost (Oliveira *et al.*, 2015; as referenced in the Scoping Report). Other fishing gear used in the region, such as seine nets and pelagic trawl nets are either weighted or the gear itself is heavy enough that it would be expected to drop through the water column relatively quickly to settle on the seabed.

To date, there have been no recorded instances of secondary entanglement in mooring systems of renewable devices or for anchored Floating Production Storage and Offloading vessels (FPSOs) used in the oil and gas industry which have similar or more complex mooring systems compared to those proposed by Cenos (Sparling *et al.*, 2013; Benjamins *et al.*, 2014). It is expected that annual basic inspection of FTU mooring lines and dynamic IACs will be conducted.

The mooring connection point on the floating substructure will be at least at 15 - 20 m depth, which will mostly remove the risk to many seabird species diving near the surface, such as kittiwake and puffin. The angle and material used in the Tension Leg Platform (TLP) design means that trapped gear is likely to slide down the mooring line to the seabed, removing it from the water column. Additionally, a Fisheries Liaison Officer (FLO) will be put in place to facilitate engagement with fishermen to record lost / snagged gear in relation to the Project. Therefore, with the likely low volume of fishing activity in the area, it is very unlikely that either design would result in secondary entanglement and the magnitude has been assessed to be negligible for all five seabird species assessed.

The overall consequences of secondary entanglement on the four seabird species are assessed to be negligible and not significant in EIA terms.

Evaluation of significance

Taking the **high sensitivity** of the four assessed seabird species and the **negligible magnitude** of the effect, the overall consequences are considered to be **minor** and **not significant** in EIA terms.

Sensitivity	Magnitude of impact	Consequence
High (all species excluding kittiwake)	Negligible	Negligible

Effect significance - NOT SIGNIFICANT

12.6.3 Potential effects during decommissioning

In the absence of detailed information regarding decommissioning works, the effects during the decommissioning phase of the Project are considered analogous with, or likely less than, those of the construction phase.

As detailed in **EIAR Vol. 2, Chapter 5: Project Description**, the Energy Act 2004, as amended by the Scotland Act 2016 contains statutory requirements in relation to the decommissioning of Offshore Renewable Energy Installations and require the Project to provide a Decommissioning Programme, supported by details of the type and timing of appropriate financial security proposed. The Decommissioning Programme will follow the guidance found in the Scottish Government's Decommissioning of Offshore Renewable Energy Installations in Scottish Waters (Scottish Government, 2022b). Decommissioning activities will comply with all relevant legislation at that time and best practice at the time of decommissioning will be followed.

Throughout the Project lifespan, the Decommissioning Programme will be reviewed and updated every five years. It is anticipated that the final revision process will commence two years prior to the initiation of decommissioning activities. Best practice will be followed when developing a Decommissioning Programme.

For the purposes of the EIAR, the following decommissioning principles have been assumed:

- FTU substructure components will be removed and towed to port;
- Mooring lines will be removed and where possible, piles will be removed or cut to a suitable distance below the mudline such that the upper portion is removed;
- Cables no longer required will be removed where safe to do so. Where they cross live third-party assets, they may be cut and left in-situ to prevent damage to third-party operations; and
- The OSCPs will be decommissioned, and the jacket and topside(s) will be towed to shore. The piles will be cut to a suitable distance below the mudline.

It is expected that decommissioning will require similar vessels to those used in construction and take a similar period of time.

12.6.4 Repowering

If any of the infrastructure, moorings, cabling or OSCPs are suitable for repowering, they will be retained for reuse in the updated system. All materials brought to shore will be decommissioned and waste managed in accordance with the waste hierarchy (Waste (Scotland) Regulations 2012). For example, they may be reused or recycled rather than disposed of to land. All the steel elements will be recyclable[1].

Effects are likely to include disturbance and / or displacement of ornithology receptors from vessels as vessel activity in the area will increase during the decommissioning phase, where various vessels will be required for dismantling and transporting the FTUs / associated cables. The vessels present in the decommissioning phase of the Project are detailed in EIAR Vol. 2, Chapter 5: Project Description. With up to 22 vessels estimated to be present within the Array Area during decommissioning, sensitivity of receptors and magnitude of the effect are considered to be the same as during the construction phase.

As such and as discussed in Section 12.6.1, within this assessment, guillemot and puffin are classified as of medium sensitivity to disturbance and displacement from vessels associated with offshore wind farms, while kittiwake and gannet are classified as low sensitivity (Bradbury *et al.*, 2014). It is assumed that vessels will be on-site throughout the entirety of the decommissioning phase both within the Array Area, EICC and relevant ports (detailed in EIAR Vol. 2, Chapter 15: Shipping and Navigation) and thus the magnitude of the effect of disturbance and / or displacement from vessel activity is assessed to be negligible for all four seabird species assessed, with the overall consequences assessed to be not significant in EIA terms.

Similarly, the effect of changes in prey availability during the decommissioning phase are considered to be analogous to those during the construction phase (Section 12.6.1.3). The sensitivity of kittiwake, guillemot and puffin is considered to be medium due to their moderate foraging ranges and degree of prey specialisation meaning reproductive rates may be affected during the impact however, there is unlikely to be a significant effect on survival as they are still able exploit other prey sources and habitats when required. It is also anticipated that these species will be able to recover within a short period of time post-decommissioning. Due to their larger foraging range and higher habitat flexibility, gannet are classed as low sensitivity to changes in prey availability and distribution during the decommissioning phase. It is expected that this species will be able to tolerate any effects of the impact with no discernible effect on survival or reproductive rates. It is likely effects will be localised and of low magnitude and that once decommissioning is complete, recovery of prey species is expected to be rapid. Therefore, the overall consequences to the four seabird species assessed is considered to be negligible and not significant in EIA terms.

Fulmar are assessed qualitatively for distributional responses during the operation and maintenance phase only and as such are not considered during the assessment of potential effects during the decommissioning phase.

[1] *Repowering subject to a separate consenting process.*

12.6.5 Summary of potential effects

A summary of the outcomes of the assessment of potential effects from the construction, operation and maintenance and decommissioning phases of the Project is provided in Table 12-29.

No significant effects on ornithology receptors were identified. Therefore, mitigation measures in addition to the embedded mitigation measures listed in Section 12.5.4 are not considered necessary.

Table 12-29 Summary of potential effects on ornithological receptors

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF EFFECT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
Construction						
Disturbance and / or displacement of ornithology receptors from vessels	Gannet, kittiwake	Low	Negligible	Negligible (not significant)	*None required above existing embedded mitigation measures.*	n/a
	Guillemot, puffin	Medium	Negligible	Negligible (not significant)	*None required above existing embedded mitigation measures.*	n/a
Disturbance and / or displacement ornithology receptors during HDD	Gannet, kittiwake, herring gull	Low	Low	Minor (not significant)	*None required above existing embedded mitigation measures.*	n/a
	Guillemot, puffin, razorbill	Medium	Low	Minor (not significant)	*None required above existing embedded mitigation measures.*	n/a

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF EFFECT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
	Waders and waterfowl	High	Negligible	Negligible (not significant)	*None required above existing embedded mitigation measures.*	n/a
Changes to prey resources	Gannet	Low	Low	Minor (not significant)	*None required above existing embedded mitigation measures.*	n/a
	Kittiwake, guillemot, puffin	Medium	Low	Minor (not significant)	*None required above existing embedded mitigation measures.*	n/a
Operation and maintenance						
Disturbance and / or displacement of ornithology receptors from vessels	Gannet, kittiwake	Low	Negligible	Negligible (not significant)	*None required above existing embedded mitigation measures.*	n/a
	Guillemot, puffin	Medium	Negligible	Negligible (not significant)	*None required above existing embedded mitigation measures.*	n/a

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF EFFECT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
Distributional responses from presence of FTUs	Fulmar	Negligible	Negligible	Negligible (not significant)	*None required above existing embedded mitigation measures.*	n/a
	Kittiwake, gannet	Low	Negligible	Negligible (not significant)	*None required above existing embedded mitigation measures.*	n/a
	Guillemot, puffin	Medium	Negligible	Negligible (not significant)	*None required above existing embedded mitigation measures.*	n/a
Collision risk with WTG	Kittiwake, gannet	Medium	Negligible	Negligible (not significant)	*None required above existing embedded mitigation measures.*	n/a
	Migratory species	High	Low	Minor (not significant)	*None required above existing embedded mitigation measures.*	n/a

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF EFFECT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
Combined effect of collision risk with WTGs and distributional responses from presence of FTUs	Kittiwake, gannet	Medium	Negligible	Negligible (not significant)	*None required above existing embedded mitigation measures.*	n/a
Changes to prey resources	Gannet	Low	Negligible	Negligible (not significant)	*None required above existing embedded mitigation measures.*	n/a
	Kittiwake, guillemot, puffin	Medium	Negligible	Negligible (not significant)	*None required above existing embedded mitigation measures.*	n/a
Secondary Entanglement	All ornithological receptors excluding kittiwake	High	Negligible	Negligible (not significant)	*None required above existing embedded mitigation measures.*	n/a

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF EFFECT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
Decommissioning*						

** In the absence of detailed information regarding decommissioning works, and unless otherwise stated, the effects during the decommissioning phase are considered analogous with, or likely less than, those of the construction phase. The approach to decommissioning for the Project is outlined in EIAR Vol 2, Chapter 5: Project Description.*

12.7 Assessment of cumulative effects

12.7.1 Introduction

There is potential for impacts from the Project to act cumulatively with those from other projects, plans and activities in the vicinity of the Project on ornithology receptors. The general approach to the cumulative effects assessment on a Project level is presented in EIAR Vol. 2, Chapter 7: EIA Methodology and EIAR Vol. 4, Cumulative Effects Assessment. Further detail on the methods used specifically for ornithology are presented herein.

The Planning Inspectorate (PINS) provides criteria which can be used to assign other projects, plans and activities into tiers, from Tier 1 (most certain) and Tier 3 (least certain) (Table 12-30) (PINS, 2019) and this has been used as a basis for considering what projects to include in the cumulative effects assessment for the Project. This allows a measure of certainty, reflecting the availability of information pertaining to each project, plan or activity to be incorporated into the cumulative assessment.

Table 12-30 Definition of tiers used within cumulative effects assessment, adapted from those presented by the Planning Inspectorate (PINS) (PINS, 2019)

TIER	DEFINITION
Tier 1	Project, plan or activity is at one of the following stages: • Operational; • Under construction; • Consented; or • Application submitted.
Tier 2	Project, plan or activity has Scoping Report submitted.
Tier 3	Project, plan or activity is either: • Scoping Report has not been submitted; • Identified in the relevant Development Plan (and emerging Development Plans – with appropriate weight being given as they move closer to adoption) recognising that there will be limited information available on the relevant proposals; or • Identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward.

The 2024 Scoping Report stated the following impacts from the Project would have the potential to act cumulatively with impacts from other developments and would be assessed quantitatively:

- Distributional responses during operation; and
- Collision risk during operation.

Within the 2024 Scoping Report no other impacts were proposed to be assessed. MD-LOT agreed with this approach to cumulative assessment within the Scoping Opinion (Table 12-3) and in their response to the Scoping Report received 23rd May 2024, NatureScot also stated they agreed with the proposed approach for assessment of cumulative effects on ornithology receptors in their response to the Scoping Report.

The list of offshore wind farm projects to be included in cumulative assessment was presented to MD-LOT and NatureScot and the Applicant was provided with written confirmation that they were content with the projects included received on 5th December 2024. NatureScot were content that as guillemot are outside of foraging range during the non-breeding season, that projects be included based on whether they were situated within the UK North Sea and Channel region as defined in Furness (2015).

The list of projects to be included in cumulative assessment is presented in Table 12-32. More explanation as to why other potential impacts to ornithology receptors are scoped out of cumulative assessment is presented in Table 12-31.

Table 12-31 Potential cumulative impacts relating to the ornithology chapter

IMPACT PATHWAY	POTENTIAL FOR CUMULATIVE EFFECT	RATIONALE
Construction		
Disturbance and / or displacement of ornithology receptors from vessels	No	The magnitude and significance of this impact pathway is assessed to be negligible for all stages of the project alone assessment due to the localised nature of the impact and the management plans in place for offshore vessel operations. Since the impacts of the vessels around the Project Area are localised, it is not expected that there would be any cumulative impact from vessels at any other site which may have temporal overlap in any of the project phases.
Disturbance and / or displacement of ornithology receptors during HDD	No	For the Project alone assessment, the impact of HDD is assessed to be of low magnitude and negligible consequence. As set out in 12.6.1.2, any disturbance during HDD will be very localised and temporary in nature. It is not anticipated that there will be any overlap in HDD with that of other OWF projects. Further, the work will be timed as per the NorthConnect EIA (NorthConnect, 2018c) to specifically avoid disturbance of breeding seabirds.
Changes to prey resources	No	The magnitude and significance of this impact pathway is assessed to be negligible for all stages of the project alone assessment due to the localised and temporary nature. It is therefore unlikely that there would be any significant cumulative impacts over the lifetime of the Project.
Operation and maintenance		
Disturbance and / or displacement of ornithology receptors from vessels	No	The magnitude and significance of this impact pathway is assessed to be negligible for all stages of the project alone assessment due to the localised nature of the impact and the management plans in place for offshore vessel operations. Since the impacts of the vessels around the Array Area are localised, it is not expected that there would be any cumulative impact from vessels at any other site which may have overlap in any of the project phases. Although several OWF's will use the same ports it is unlikely that there will be significant increase of vessel traffic compared to existing port usage.

IMPACT PATHWAY	POTENTIAL FOR CUMULATIVE EFFECT	RATIONALE
Distributional responses from presence of FTUs	Yes	Assessed quantitatively in Section 12.7.3.
Collision risk with WTGs	Yes	Assessed quantitatively below in Section 12.7.3.
Changes to prey resources	No	The magnitude and significance of this impact pathway is assessed to be negligible for all stages of the project alone assessment due to the localised and temporary nature. It is therefore unlikely that there would be any significant cumulative impacts over the lifetime of the project.
Secondary entanglement	No	The magnitude and significance of this impact pathway is assessed to be negligible for the project alone assessment due to the localised nature of the impact and the design of the two potential mooring systems. Therefore, it is not anticipated that there is potential for the occurrence of cumulative impacts with other projects.
Decommissioning*		

** In the absence of detailed information regarding decommissioning works, and unless otherwise stated, the effects during the decommissioning phase are considered analogous with, or likely less than, those of the construction phase. The approach to decommissioning for the Project is outlined in EIAR Vol 2, Chapter 5: Project Description.*

The ornithological receptors considered within the cumulative effects assessment are:

- Kittiwake;
- Guillemot;
- Puffin; and
- Gannet.

The cumulative assessment of distributional responses and collision risk during the operation and maintenance phase relates to offshore wind farms only, and no other project, plan or development is considered within this cumulative assessment. Onshore wind farms are not considered, as there are not expected to be shared receptors between onshore wind farms and the Project.

To determine the projects included in the assessment of cumulative effects, species-specific mmfr + 1SD as presented in Woodward *et al.* (2019) during the breeding season and BDMPS regions as presented in Furness (2015) during the non-breeding season are used. The only exception to this is for guillemot as the Project is outside the breeding season mmfr + 1SD from Woodward *et al.* (2019). In the advice following the Scoping Workshop received 2nd April 2024, NatureScot requested that the displacement assessment for guillemot in the non-breeding season should be undertaken using the BDMPS regional population as presented in Furness (2015). As such, the UK North Sea and Channel regional population of guillemot, which is the regional population of relevance to the Project, has been used within the Project alone assessment (Section 12.6) and within the assessment of cumulative effects. Further consultation with NatureScot on 21st October 2024 confirmed that since guillemot are outside of foraging range during the breeding season, no assessment to SPA colonies should be conducted for this season to be presented in the RIAA; the same logic was applied to this assessment and guillemot were only assessed during the non-breeding season.

Only projects which fall within the species-specific boundaries are included in the cumulative assessment. Since these areas differ with species and season, the projects which are included differ between receptors; the list of projects per species and season is presented in EIAR Vol. 4, Appendix A25: Population Viability Analysis Report. All projects included within the ornithology cumulative assessment are presented in Table 12-32; note that not all projects will be included for all species / impact combinations. Within the cumulative assessment for ornithology, only projects within Tier 1 and Tier 2 are included, where estimates of mortality are available which can be inputted into quantitative assessment. The list of projects and distance to projects included in cumulative assessment, per species of interest, was agreed through written consultation with MD-LOT and NatureScot on 2nd December 2024.

Table 12-32 List of developments considered for the ornithology cumulative effects assessment

LOCATION	PROJECT TYPE	PROJECT NAME	DISTANCE TO PROJECT (KM)	STATUS	CONFIDENCE[2]
United Kingdom	Offshore wind farm	Aberdeen Bay (EOWDC)	198.2	Operational	High
United Kingdom	Offshore wind farm	Beatrice Offshore Wind Farm (BOWL)	293.5	Operational	High
United Kingdom	Offshore wind farm	Berwick Bank Wind Farm	192.3	Application	Low
United Kingdom	Offshore wind farm	Blyth Demonstration Site	264.8	Operational	High
United Kingdom	Offshore wind farm	Dogger Bank A & B Offshore Wind Farms	225.4	Under Construction	High
United Kingdom	Offshore wind farm	Dogger Bank C & Sofia Offshore Wind Farms	242.7	Under Construction	High
United Kingdom	Offshore wind farm	Dogger Bank South Offshore Wind Farms (DBS East and DBS West)	256.9	Application	Low
United Kingdom	Offshore wind farm	Dudgeon Offshore Wind Farm	414.2	Operational	High
United Kingdom	Offshore wind farm	Dudgeon Extension & Sheringham Shoal Extension	414.2	Consented	Medium

[2] *Confidence ratings have been applied to each cumulative development where: 'Low' = pre-application or application, 'Medium' = consented and 'High' = under construction or operational.*

LOCATION	PROJECT TYPE	PROJECT NAME	DISTANCE TO PROJECT (KM)	STATUS	CONFIDENCE[2]
		Offshore Windfarms			
United Kingdom	Offshore wind farm	East Anglia One	528.0	Operational	High
United Kingdom	Offshore wind farm	East Anglia ONE NORTH	514.6	Consented	Medium
United Kingdom	Offshore wind farm	East Anglia THREE	483.6	Under Construction	High
United Kingdom	Offshore wind farm	East Anglia TWO	534.2	Consented	Medium
United Kingdom	Offshore wind farm	Five Estuaries	576.6	Application	Low
United Kingdom	Offshore wind farm	ForthWind Demonstration Project	296.9	Consented	Medium
United Kingdom	Offshore wind farm	Galloper Offshore Windfarm	569.7	Operational	High
United Kingdom	Offshore wind farm	Greater Gabbard Offshore Windfarm	569.7	Operational	High
United Kingdom	Offshore wind farm	Green Volt Offshore Wind Farm	135.3	Consented	Medium
United Kingdom	Offshore wind farm	Gunfleet Sands Offshore Windfarm	595.9	Operational	High

LOCATION	PROJECT TYPE	PROJECT NAME	DISTANCE TO PROJECT (KM)	STATUS	CONFIDENCE[2]
United Kingdom	Offshore wind farm	Hornsea 1	347.7	Operational	High
United Kingdom	Offshore wind farm	Hornsea 2	340.8	Operational	High
United Kingdom	Offshore wind farm	Hornsea 3	358.1	Under Construction	High
United Kingdom	Offshore wind farm	Hornsea 4	325.0	Consented	Medium
United Kingdom	Offshore wind farm	Humber Gateway Offshore Wind Farm	406.9	Operational	High
United Kingdom	Offshore wind farm	Hywind Scotland Pilot Park (Hywind)	175.3	Operational	High
United Kingdom	Offshore wind farm	Inch Cape Offshore Wind Farm	226.3	Under Construction	High
United Kingdom	Offshore wind farm	Kentish Flats + Extension	634.3	Operational	High
United Kingdom	Offshore wind farm	Kincardine Offshore Wind Farm	190.8	Operational	High
United Kingdom	Offshore wind farm	Lincs, Lynn, Inner Dowsing Offshore Wind Farms	455.9	Operational	High

LOCATION	PROJECT TYPE	PROJECT NAME	DISTANCE TO PROJECT (KM)	STATUS	CONFIDENCE[2]
United Kingdom	Offshore wind farm	London Array Offshore Windfarm	597.7	Operational	High
United Kingdom	Offshore wind farm	Methil Offshore Wind Demonstration Zone (Levenmouth)	296.9	Operational	High
United Kingdom	Offshore wind farm	Moray East Offshore Windfarm	274.0	Operational	High
United Kingdom	Offshore wind farm	Moray West Offshore Wind Farm	294.7	Under Construction	High
United Kingdom	Offshore wind farm	Neart na Gaoithe Offshore Wind Farm (NNG)	245.9	Under Construction	High
United Kingdom	Offshore wind farm	Norfolk Boreas	460.9	Consented	Medium
United Kingdom	Offshore wind farm	Norfolk Vanguard	473.3	Consented	Medium
United Kingdom	Offshore wind farm	North Falls	595.9	Application	Low
United Kingdom	Offshore wind farm	Ossian Offshore Wind Farm	103.5	Application	Low
United Kingdom	Offshore wind farm	Outer Dowsing Offshore Wind Farm	375.8	Application	Low

LOCATION	PROJECT TYPE	PROJECT NAME	DISTANCE TO PROJECT (KM)	STATUS	CONFIDENCE[2]
United Kingdom	Offshore wind farm	Pentland Floating Offshore Wind Farm	371.5	Consented	Medium
United Kingdom	Offshore wind farm	Race Bank Offshore Wind Farm	428.0	Operational	High
United Kingdom	Offshore wind farm	Rampion Offshore Windfarm	751.0	Operational	High
United Kingdom	Offshore wind farm	Rampion 2 Offshore Windfarm	751.0	Application	Low
United Kingdom	Offshore wind farm	Salamander Offshore Wind Farm	161.9	Application	Low
United Kingdom	Offshore wind farm	Scroby Sands	496.3	Operational	High
United Kingdom	Offshore wind farm	Seagreen (A&B) Offshore Wind Farms	188.6	Operational	High
United Kingdom	Offshore wind farm	Sheringham Shoal Offshore Wind Farm	438.6	Operational	High
United Kingdom	Offshore wind farm	Teesside Wind Farm	327.8	Operational	High
United Kingdom	Offshore wind farm	Thanet Offshore Windfarm	620.5	Operational	High

LOCATION	PROJECT TYPE	PROJECT NAME	DISTANCE TO PROJECT (KM)	STATUS	CONFIDENCE[2]
United Kingdom	Offshore wind farm	Triton Knoll	401.8	Operational	High
United Kingdom	Offshore wind farm	West of Orkney Wind Farm	382.6	Application	Low
United Kingdom	Offshore wind farm	Westermost Rough	384.1	Operational	High

12.7.2 Cumulative construction effects

Following the information presented in Table 12-31, there are no potential impacts occurring during the construction phase have the potential to cumulatively impact ornithological receptors, as presented in the Scoping Report and agreed with MD-LOT through the Scoping Opinion (Table 12-3). Agreement with MD-LOT and NatureScot on the Cumulative Long List and Methodology (EIAR Vol. 4 A31: Cumulative Effects Assessment) was received 2nd December 2024. NatureScot also stated that they agreed with the proposed approach for assessment of cumulative effects on ornithology receptors.

12.7.3 Cumulative operation and maintenance effects

As outlined in Table 12-31, the impacts assessed cumulatively with other offshore wind farm projects are those of collision and distributional responses as presented in the Scoping Report and agreed with MD-LOT through the Scoping Opinion (Table 12-3). NatureScot also stated that they agreed with the proposed approach for assessment of cumulative effects on ornithology receptors.

Assessments are carried using total annual mortality, derived from mortality estimates for projects within the breeding season and non-breeding season regions. As discussed and agreed with NatureScot during the Ornithology Catch Up on 7th August 2024, collated mortality estimates as presented in the Salamander Offshore Wind Farm application are used, with the addition of any other offshore wind farm projects which have since submitted their applications. Total mortality is presented both with and without impacts from Berwick Bank Offshore Wind Farm, as outlined in the Scoping Report and confirmed by MD-LOT in the Scoping Opinion (Table 12-3).

The Project received specific advice from MD-LOT, that estimated mortalities from the original application for West of Orkney Windfarm were not to be included in assessment therefore, these have been removed from assessment of cumulative effects. West of Orkney submitted an EIA Addendum which became publicly available in October 2024 and the Project received advice on 20th November 2024 from MD-LOT that data from the West of Orkney Windfarm EIA Addendum be included within the assessment. Therefore, all estimates of mortality in the cumulative assessment discount information from the original West of Orkney Windfarm EIA and include information from the West of Orkney Windfarm EIA Addendum. The following scenarios for cumulative assessment have been performed for all species, as per the Scoping Report and agreement with MD-LOT and NatureScot in the Scoping Opinion (Table 12-3):

- Total mortality including Berwick Bank; and
- Total mortality excluding Berwick Bank.

Since collated estimates from another application are being relied upon within this assessment, it is likely that there will inherently be uncertainty around the figures which comprise mortality totals. The Salamander Offshore Wind Farm application based their assessment from total mortalities presented in the Berwick Bank Offshore Wind Farm application, which does not present mortality per project, but rather a total figure for North Sea projects. It may be that since older projects are included in this assessment that there are differences in how projects have quantitatively assessed potential impacts compared to current guidance. Within this assessment it is also assumed that all projects build to their worst-case scenario; however, it may be that changes to project design occur post-consent. As such, this cumulative assessment is considered to be precautionary.

As presented in EIAR Vol. 4, Appendix: A25: Population Viability Analysis Report, during the non-breeding season, impacts were scaled to the contribution of the breeding season regional population to the BDMPS non-breeding population as presented in Furness (2015). This is to allow a proportion of the impacts to be assigned to birds which do not comprise the regional population.

For the assessment of cumulative effects, a sabbatical rate of 10% for kittiwake and gannet and 7% for auks was applied during the breeding season, to account for the presence of non-breeding adult birds which are not included in breeding season population counts, which make up the breeding season regional population. The consideration of sabbatical birds follows PVA guidance published by NatureScot (NatureScot, 2023x) and has been done for other Scottish offshore wind farm projects such as for Berwick Bank Offshore Wind Farm. Sabbatical rates have not been applied to any non-breeding season impact estimates.

Within this cumulative assessment, cumulative estimated mortality from distributional responses and collision with WTGs is presented for each impact separately (Sections 12.7.3.1 and 12.7.3.2), and also as a combined impact (Section 12.7.3.3). Impacts associated with distributional responses and collision were considered additive and assessed together for gannet and kittiwake, which is considered to be precautionary as the same bird cannot collide with a WTG and be displaced. To keep the assessment approach as pragmatic as possible and reduce the total numbers of PVAs required, considering the number of scenarios, PVAs were only run for distributional responses for guillemot and puffin and for the combined impact of distributional responses and collision for kittiwake and gannet. Where baseline adult survival was predicted to meet or exceed the threshold of 0.02 percentage point change in baseline adult survival and the project alone contribution was equal to or more than 0.2 of a bird, the requirement for PVA was triggered, consistent with advice the Project received from NatureScot during the Ornithology Catch Up on 7th August 2024 and the subsequent written advice received 10th September 2024.

The threshold to require a PVA was met or exceeded for all species and scenarios considered. Percentage point change in adult survival was calculated against the breeding season regional population for all species except guillemot. For guillemot, the BDMPS population was used, as the Project is outwith foraging range during the breeding season which prevents the calculation of a regional population.

12.7.3.1 Cumulative effect of distributional responses during the operational phase

The presence of multiple OWFs in areas typically used by seabirds to forage, rest and moult may lead to displacement to other areas or barrier effects (distributional responses), which could lead to increased energy use or increased time spent foraging. There is potential for a cumulative effect of distributional responses to occur during the operational phase of the Project and other projects in the vicinity.

To assess the cumulative effect of distributional responses, the MSP abundances of the species of interest (kittiwake, guillemot, puffin and gannet) were collated for all projects considered, to give a total abundance which was fed into displacement matrices, using the same methodology as presented for the Project alone assessment (Section 12.6.2.1 and EIAR Vol. 4, Appendix 22: Distributional Reponses Report). Each species section below presents the projects included in the cumulative assessment, the total abundance used within displacement matrices, the estimated mortality under each scenario, and the resultant percentage point change in baseline adult survival rate.

A comprehensive assessment of potential impacts for the Project alone is presented in Section 12.6.2.2. For all four species the consequence of distributional responses for the Project alone was determined to be **negligible** which is **not significant** in EIA terms.

For kittiwake and gannet, the population-level consequences of distributional responses are considered together with collision in Section 12.7.3.3; results from PVA for puffin and guillemot are considered within this section, as they are only considered for distributional responses.

Kittiwake

The cumulative mortality for kittiwake under each scenario is presented in Table 12-33, along with the percentage point change in adult survival, which is used as the threshold to require PVA. The projects included in cumulative assessment of kittiwake distributional responses, associated MSP abundance and cumulative matrices are presented in EIAR Vol. 4, Appendix: 25: Population Viability Analysis Report. As presented in Table 12-33 all cumulative scenarios exceed the threshold for requiring PVA. As kittiwakes may be susceptible to distributional responses and collision risk, the population consequences of these impacts are assessed together and presented in Section 12.7.3.3.

For projects within Scottish waters, kittiwakes are regularly assessed for distributional responses; however, in English waters this is not usually the case. Therefore, the cumulative assessment for kittiwake for distributional responses only includes information from Scottish projects.

Table 12-33 Cumulative mortality from distributional responses for kittiwake for the Project and each cumulative scenario

		DISPLACEMENT MORTALITY 30% / 1%	DISPLACEMENT MORTALITY 30% / 1%			DISPLACEMENT MORTALITY 30% / 3%	DISPLACEMENT MORTALITY 30% / 3%		
SCENARIO	REGIONAL POPULATION	BREEDING SEASON	NON-BREEDING SEASON	ANNUAL	PERCENTAGE POINT CHANGE IN ADULT SURVIVAL[1]	BREEDING SEASON	NON-BREEDING SEASON	ANNUAL	PERCENTAGE POINT CHANGE IN ADULT SURVIVAL[1]
The Project	231,732	0.6	0.3	0.9	0.000	1.9	0.9	2.8	0.001
Cumulative scenarios									
Excluding Berwick Bank	231,732	77	15	92	0.040	232	46	278	0.120
Including Berwick Bank	231,732	134	36	170	0.073	403	109	512	0.221

[1]Percentage point change in adult survival calculated using figures adjusted for the presence of sabbatical birds during the breeding season (10%)

Guillemot

Estimates of mortality from distributional responses under each cumulative scenario are presented for guillemot in Table 12-34. As the Project is outside the foraging range for guillemot during the breeding season, impacts are only considered during the non-breeding season, following project-specific advice received from NatureScot on 2nd April 2024. Following this advice, the non-breeding season regional population, as presented in Furness (2015), was used to assign impacts, rather than the regional population derived using the breeding season foraging range. For the other species considered, impacts were scaled by the contribution of the breeding season regional population to the Furness BDMPS population. In this instance, there was no breeding season regional population which could be used to provide this scaling factor, so this was not applied.

The projects included in the cumulative assessment of guillemot distributional responses, associated MSP abundance and cumulative matrices are presented in EIAR Vol. 4, Appendix: 25: Population Viability Analysis Report. As presented in Table 12-34, all cumulative scenarios exceed the threshold for requiring PVA. Compared to the level of cumulative mortality predicted for guillemot, the contribution of the Project is relatively small (also evidenced by the very low project-alone percentage point change in adult survival for this impact pathway). The outputs for all scenarios for the operational life of the Project (35 years) are presented in Table 12-35. Outputs for 20 and 50 years as requested by NatureScot, are presented in EIAR Vol. 4, Appendix 25: Population Viability Analysis Report.

Table 12-34 Cumulative mortality from distributional responses for guillemot for the Project and each cumulative scenario

		DISPLACEMENT MORTALITY 60% / 1%			DISPLACEMENT MORTALITY 60% / 3%		
SCENARIO	REGIONAL POPULATION	NON-BREEDING SEASON	ANNUAL	PERCENTAGE POINT CHANGE IN ADULT SURVIVAL*	NON-BREEDING SEASON	ANNUAL	PERCENTAGE POINT CHANGE IN ADULT SURVIVAL*
The Project	1,617,306	50	50	0.003	150	150	0.009
Cumulative scenarios							
Excluding Berwick Bank	1,617,306	2,256	2,256	0.139	6,769	6,769	0.419
Including Berwick Bank	1,617,306	2,522	2,522	0.156	7,565	7,565	0.468

**The impact to guillemot is described in terms of change to adult survival. While impacts could have been applied to all age classes in proportion, including immatures and sabbatical adults, limiting the impacts to adult survival as done here reflects the most consequential outcome when applied to a PVA*

Table 12-35 Outputs from PVA for cumulative assessment of distributional responses for guillemot for the operational life of the project (35 years). CPC = counterfactual (ratio) of population growth-rate, CPS = counterfactual (ratio) of final population size (CPS), CI = confidence interval around counterfactual ratio metrics

SCENARIO	MEDIAN POPULATION SIZE	MEDIAN COUNTERFACTUALS			
		CPC	CPC CI	CPS	CPS CI
Baseline (unimpacted)	4,007,120	-	-	-	-
Scenario 1: Excluding Berwick Bank (low displacement mortality rates)	3,787,231	0.998	0.998 - 0.999	0.946	0.943 - 0.948
Scenario 2: Excluding Berwick Bank (high displacement mortality rates)	3,385,946	0.995	0.995 - 0.995	0.845	0.843 - 0.848
Scenario 3: All wind farms (low displacement mortality rates)	3,764,795	0.998	0.998 - 0.998	0.939	0.937 - 0.942
Scenario 4: All wind farms (high displacement mortality rates)	3,319,151	0.995	0.995 - 0.995	0.828	0.826 - 0.831

Under all scenarios, the median population size for guillemot is expected to increase, with a predicted baseline median population size of 4,007,120 individuals after 35 years compared to the starting population of 1,608,658 individuals (the modelled baseline population pre-impact derived from the NE PVA Tool after applying the five-year burn in period; Table 12-35).

Under the low scenario and when excluding Berwick Bank impacts, there is predicted to be a 5.4% reduction in the counterfactual of final population size, which ranges to 17.2% when considering all projects and the high displacement scenario. The rate of displacement mortality used affected the predicted impact on the population considerably, with low scenarios predicted to change the counterfactual of final population size by 5.4% and 6.1% respectively, compared to 15.5% and 17.2% under high displacement mortality. Despite observed changes in the counterfactual of final population size, it should be noted that under the baseline scenario the population is predicted to increase markedly, therefore differences in population size for impacted scenarios are not likely to have a considerable impact on overall population trend.

There is some evidence from post-construction studies that displacement and mortality rates exhibited by guillemots may not be as high as currently recommended by the SNCBs (Searle *et al.*, 2014, 2018 in APEM, 2022). Following this, it may be that out of the scenarios tested, Scenarios 1 and 3 which use a 60% displacement and 1% mortality rate give results which are more realistic, of the scenarios considered, in terms of predicted population-level effects. From these two scenarios, there is a small predicted cumulative effect on population growth rate (0.2% under both scenarios). The inclusion of Berwick Bank data did not alter the counterfactual of population growth rate. The counterfactual of population growth rate can be considered to be a more robust metric to use when models are conducted with density independence (which has been performed here to align with NatureScot guidance).

The NatureScot 2023 guidance states "*Modelled data from SeabORD suggests that mortality due to displacement may be higher than 1%. Our current advice is therefore to use higher displacement mortality rates for the matrix method in order to ensure that outputs more closely match the SeabORD outputs*." However as mentioned above, the Project is beyond mmfr + 1SD for guillemot in the breeding season as reported in Woodward *et al.* (2019), and therefore there will be no additional mortality from the Project in the breeding season. On this basis, any cumulative effect on guillemot in the breeding season is not considered to be as a result of any impacts from the Project. This, coupled with the small cumulative effect on the counterfactual of population growth rate results in the magnitude of impact being considered to be low under all scenarios.

In line with the Project alone assessment, the sensitivity of guillemot to distributional responses is considered to be medium, based on assessment of vulnerability to displacement by Bradbury *et al.* (2014) and Furness *et al.* (2013).

Considering the medium sensitivity of guillemot to distributional responses and the low predicted magnitude of impact against the regional population, the significance of the effect is assessed to be minor. This is not significant in EIA terms.

Evaluation of significance

Taking the medium sensitivity of guillemot and the low magnitude of the impact, the overall consequence is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of impact	Consequence
Medium (All scenarios)	Low	Minor

Impact significance - NOT SIGNIFICANT

Puffin

Estimated mortality for puffin for the project alone and under each cumulative scenario is presented in Table 12-36 along with the percentage point change in adult survival, which acts as the threshold for requiring PVA. The projects included in the cumulative assessment of puffin distributional responses, associated MSP abundance and cumulative matrices are presented in EIAR Vol. 4, Appendix: 25: Population Viability Analysis Report.

For mortality impacts during the non-breeding season, impacts were scaled by the contribution of the breeding season regional population. For puffin this was calculated at 93%; more information is presented within EIAR Vol. 4, Appendix: 25: Population Viability Analysis Report. The scaling factor is applied to impacts when impact on adult survival rate is inputted into PVA models and is presented in EIAR Vol. 4, Appendix: 25: Population Viability Analysis Report.

Table 12-36 Cumulative mortality from distributional responses for puffin for the Project and each cumulative scenario

		DISPLACEMENT MORTALITY 60% / 3%	DISPLACEMENT MORTALITY 60% / 1%			DISPLACEMENT MORTALITY 60% / 5%	DISPLACEMENT MORTALITY 60% / 3%		
SCENARIO	REGIONAL POPULATION	BREEDING SEASON	NON-BREEDING SEASON	ANNUAL	PERCENTAGE POINT CHANGE IN ADULT SURVIVAL[1]	BREEDING SEASON	NON-BREEDING SEASON	ANNUAL	PERCENTAGE POINT CHANGE IN ADULT SURVIVAL[1]
The Project	215,019	4.0	0.4	4.4	0.001	6.6	1.2	7.8	0.003
Cumulative scenarios									
Excluding Berwick Bank	215,019	300	146	446	0.208	501	438	939	0.437
Including Berwick Bank	215,019	377	146	523	0.243	628	438	1,066	0.496

[1]Percentage point change in adult survival calculated using figures adjusted for the presence of sabbatical birds during the breeding season (7%)

Table 12-37 Outputs from PVA for cumulative assessment of distributional responses for puffin for the operational life of the project (35 years). CPC = counterfactual (ratio) of population growth-rate, CPS = counterfactual (ratio) of final population size (CPS), CI = confidence interval around counterfactual ratio metrics

SCENARIO	MEDIAN POPULATION SIZE	MEDIAN COUNTERFACTUALS			
		CPC	CPC CI	CPS	CPS CI
Baseline (unimpacted)	91,065	-	-	-	-
Scenario 1: Excluding Berwick Bank (low displacement mortality rates)	77,073	0.998	0.997 - 0.998	0.916	0.901 - 0.93
Scenario 2: Excluding Berwick Bank (high displacement mortality rates)	69,840	0.995	0.994 - 0.995	0.831	0.816 - 0.844
Scenario 3: All wind farms (low displacement mortality rates)	75,909	0.997	0.997 - 0.998	0.902	0.888 - 0.916
Scenario 4: All wind farms (high displacement mortality rates)	68,039	0.994	0.994 - 0.995	0.810	0.796 - 0.823

Puffin median population size is predicted to decrease under all scenarios, including the baseline scenario where no impacts are applied, which reduced from 218,621 birds (the modelled baseline population pre-impact derived from the NE PVA Tool after applying the five-year burn in period) to 91,065 birds (Table 12-37).

The magnitude of the predicted impact varied per scenario. For Scenario 1, where Berwick Bank impacts were excluded and the low displacement mortality scenario was used, the counterfactual of population growth rate was estimated to decrease by 0.2%, with the counterfactual of population size decreasing by 8.4%. In this instance the cumulative magnitude could be considered low; the cumulative magnitude for Scenario 3 is also considered to be low. However, predicted changes to counterfactuals of population growth rate and population size for Scenario 2 result in the cumulative magnitude more likely to be considered medium, when taking into account the 0.5% decrease in counterfactual of population growth rate and 16.9% decrease in counterfactual of population size. Under Scenario 4, where all OWFs are considered including Berwick Bank, the cumulative impact is considered to be **medium**, when considering final median population size and the estimated counterfactuals of population growth rate and population size (0.994 and 0.810 respectively).

In line with the Project alone assessment, the sensitivity of puffin to distributional responses is considered to be **medium**, based on assessment of vulnerability to displacement by Bradbury *et al.* (2014) and Furness *et al.* (2013).

Considering the **medium** sensitivity of puffin to distributional responses and the **low** to **medium** predicted magnitude of impact against the regional population, the significance of the effect is assessed to be **minor** or **moderate**, depending on the scenario considered. Where the significance is considered to be **minor**, cumulative impact is **not significant** in EIA terms; where the significance is considered to be **moderate**, cumulative impact is **significant** in EIA terms.

Similar to other species assessments, the contribution of the Project to the cumulative assessment should be considered when determining the significance of potential impacts. For puffin for the Project alone, the impact of distributional responses was determined to be **negligible**, which is not significant in EIA terms.

Table 12-36 presents the predicted mortality of puffin for the Project alone and the cumulative contribution from all included projects. It is determined that the project's contribution is not material in this regard, representing only a 0.001% - 0.003% percentage point change in adult survival (for low - high scenarios respectively).

Evaluation of significance

Taking the **medium** sensitivity of puffin and the **low**, to **medium** magnitude of the impact, the overall consequence is considered to be **minor** to **moderate.** Minor impacts are **not significant** in EIA terms; moderate impacts are **significant** in EIA terms.

Sensitivity	Magnitude of impact	Consequence
Medium (Scenario 1, Scenario 3)	Low	Minor
Medium (Scenario 2, Scenario 4)	Medium	Moderate

Impact significance - NOT SIGNIFICANT / SIGNIFICANT

Gannet

The cumulative mortality for gannet under each cumulative scenario is presented in Table 12-38, along with the percentage point change in adult survival, which is used as the threshold to require PVA. The projects included in the cumulative assessment of gannet distributional responses, associated MSP abundance and cumulative matrices are presented in EIAR Vol. 4, Appendix: A25: Population Viability Analysis Report. As presented in Table 12-38, all cumulative scenarios exceed the threshold for requiring PVA.

As gannet may be susceptible to distributional responses and collision risk, the population consequences of these impacts are assessed together and presented in Section 12.7.3.3. This is considered to be precautionary as the impacts of distributional responses and collision cannot act on the same individual (i.e. the same bird cannot collide with a turbine and be displaced from the area). Post-construction evidence from Beatrice Offshore Windfarm indicates that collision impacts are very low, with very few birds recorded within the array (MacArthur Green, 2023).

Table 12-38 Cumulative mortality from distributional responses for gannet for the Project and each cumulative scenario

		DISPLACEMENT MORTALITY 70% / 1%	DISPLACEMENT MORTALITY 70% / 1%			DISPLACEMENT MORTALITY 70% / 3%	DISPLACEMENT MORTALITY 70% / 1%		
SCENARIO	REGIONAL POPULATION	BREEDING SEASON	NON-BREEDING SEASON	ANNUAL	PERCENTAGE POINT CHANGE IN ADULT SURVIVAL[1]	BREEDING SEASON	NON-BREEDING SEASON	ANNUAL	PERCENTAGE POINT CHANGE IN ADULT SURVIVAL[1]
The Project	238,322	1.5	1.8	3.3	0.001	4.5	5.5	10.0	0.004
Cumulative scenarios									
Excluding Berwick Bank	238,322	167	119	286	0.120	500	358	858	0.360
Including Berwick Bank	238,322	196	126	322	0.135	590	378	968	0.406

[1]Percentage point change in adult survival calculated using figures adjusted for the presence of sabbatical birds during the breeding season (10%)

12.7.3.2 Cumulative effect of collision with WTGs

There is potential for collision risk from multiple OWF projects to act cumulatively on ornithological receptors, as birds may fly through OWF areas during foraging or migration. Collision with WTGs poses a risk of injury or mortality. Within this assessment, only mortality is considered.

A comprehensive assessment of potential impacts for the Project alone is presented in Section 12.6; for both kittiwake and gannet the consequence of collision for the Project alone was determined to be minor which is not significant in EIA terms.

Within the Salamander Offshore Windfarm application, which NatureScot requested cumulative information be based on, a correction was applied to collision impacts derived using avoidance rates presented in SNCBs (2014) to be more consistent with data derived using avoidance rates presented in Ozsanlav-Harris *et al.* (2023). This corrected cumulative mortality as presented in the Salamander Offshore Windfarm application has been used within the application for the Project. For projects which have submitted since the Salamander Offshore Windfarm application, no correction has been applied.

Kittiwake

Cumulative predicted collision mortality for kittiwake during the breeding and non-breeding season is presented in Table 12-39, with total mortality presented both with and without Berwick Bank Offshore Wind Farm. The population level effects of collision and distributional responses are considered together within Section 12.7.3.3.

Table 12-39 Kittiwake cumulative mortality from collision with WTGs for each cumulative scenario and percentage point change in adult survival

SCENARIO	REGIONAL POPULATION	BREEDING SEASON	NON-BREEDING SEASON	ANNUAL	PERCENTAGE POINT CHANGE IN ADULT SURVIVAL[1]
The Project	231,732	8.0	5.0	13.0	0.004
Cumulative scenarios					
Excluding Berwick Bank	231,732	255.0	386.0	641.0	0.277
Including Berwick Bank	231,732	533.8	438.0	971.8	0.419

[1]Percentage point change in adult survival calculated using figures adjusted for the presence of sabbatical birds during the breeding season (10%)

Gannet

Cumulative predicted collision mortality for gannet during the breeding and non-breeding season is presented in Table 12-40, with total mortality presented both with and without Berwick Bank Offshore Wind Farm. It is likely that the avoidance rates (and other modelling parameters) used within assessments differ between projects, but as there is no accepted approach on how to account for this, mortality as presented in project EIARs is presented with the caveat that there may be some variation in methodology between projects.

Following advice from NatureScot received 7th August 2024, the Project has based cumulative mortality totals on the Salamander Offshore Windfarm application. Since the Salamander Offshore Windfarm application uses collated mortalities for the North Sea and is based on those presented in the application for Berwick Bank Offshore Wind Farm, there is no way to determine which projects are considered within this sum total of mortality. Due to this, it is not possible to determine which projects have accounted for macro-avoidance of gannet within assessment. In the breeding season this has generally not been done for Scottish projects, as NatureScot do not believe there is enough evidence at Scottish sites to currently account for gannet macro-avoidance during this period; however, the correction is applied more regularly for English projects. To avoid applying the correction to projects for which it has already been applied, no correction for gannet macro-avoidance has been applied to collated cumulative mortality. This is considered to provide the most precautionary assessment.

The population level effects of collision and distributional responses are considered together within Section 12.7.3.3.

Table 12-40 Gannet cumulative mortality from collision with WTGs for each cumulative scenario and percentage point change in adult survival

SCENARIO	REGIONAL POPULATION	BREEDING SEASON	NON-BREEDING SEASON	ANNUAL	PERCENTAGE POINT CHANGE IN ADULT SURVIVAL[1]
The Project	238,322	17.1	2.9	20.1	0.007
Cumulative scenarios					
Excluding Berwick Bank	238,322	619.6	373.0	992.6	0.416
Including Berwick Bank	238,322	709.9	378.0	1,087.9	0.457

[1]Percentage point change in adult survival calculated using figures adjusted for the presence of sabbatical birds during the breeding season (10%)

12.7.3.3 Cumulative combined effect of collision risk with WTGs and distributional responses from presence of FTUs

Based on advice from NatureScot, kittiwake and gannet are considered to be susceptible to potential impacts from both collision with WTGs and distributional responses. Due to this, estimated mortalities from both potential impacts are considered additive and analysed cumulatively with other OWF developments. Following the consultation process (Table 12-3), impacts are assessed both with and without Berwick Bank Offshore Wind Farm.

Within the Salamander Offshore Windfarm application, which NatureScot requested cumulative information be based on, a correction was applied to collision impacts derived using avoidance rates presented in SNCBs (2014) to be more consistent with data derived using avoidance rates presented in Ozsanlav-Harris *et al.* (2023). This corrected cumulative mortality as presented in the Salamander Offshore Windfarm application has been used within the application for the Project. For projects which have submitted since the Salamander Offshore Windfarm application, no correction has been applied.

Kittiwake

Estimated mortality from distributional responses and collision risk for the Project and each cumulative scenario is presented in Table 12-41, along with the percentage point change in adult survival, which acts as the threshold for requiring PVA. The list of projects included in cumulative assessment and estimated mortality per project for collision and distributional responses is presented in EIAR Vol. 4, Appendix: 25: Population Viability Analysis Report.

For mortality impacts during the non-breeding season, impacts were scaled by the contribution of the breeding season regional population. For kittiwake this was calculated at 28%; more information is presented within EIAR Vol. 4, Appendix: 25: Population Viability Analysis Report. The scaling factor is applied to impacts when impact on adult survival rate is inputted into PVA models and is presented in EIAR Vol. 4, Appendix: 25: Population Viability Analysis Report.

Table 12-41 Cumulative mortality from distributional responses and collision with WTGs for kittiwake for the Project and each cumulative scenario

		DISPLACEMENT MORTALITY 30% / 1% + COLLISIONS	DISPLACEMENT MORTALITY 30% / 1% + COLLISIONS			DISPLACEMENT MORTALITY 30% / 3% + COLLISIONS	DISPLACEMENT MORTALITY 30% / 3% + COLLISIONS		
SCENARIO	REGIONAL POPULATION	BREEDING SEASON	NON-BREEDING SEASON	ANNUAL	PERCENTAGE POINT CHANGE IN ADULT SURVIVAL[1]	BREEDING SEASON	NON-BREEDING SEASON	ANNUAL	PERCENTAGE POINT CHANGE IN ADULT SURVIVAL[1]
The Project	231,732	8.6	5.3	13.9	0.005	9.9	5.9	15.8	0.005
Cumulative Scenarios									
Excluding Berwick Bank	231,732	332.4	401.0	733.4	0.316	487.2	432.0	919.2	0.397
Including Berwick Bank	231,732	667.9	474.0	1,141.9	0.493	937.0	547.0	1,484.0	0.640

[1]*Percentage point change in adult survival calculated using figures adjusted for the presence of sabbatical birds during the breeding season (10%)*

Table 12-42 Outputs from PVA for cumulative assessment of distributional responses and collision risk for kittiwake for the operational life of the project (35 years). CPC = counterfactual (ratio) of population growth-rate, CPS = counterfactual (ratio) of final population size (CPS), CI = confidence interval around counterfactual ratio metrics

SCENARIO	MEDIAN POPULATION SIZE	MEDIAN COUNTERFACTUALS			
		CPC	CPC CI	CPS	CPS CI
Baseline (unimpacted)	250,613	-	-	-	-
Scenario 1: Excluding Berwick Bank (low displacement mortality rates)	196,998	0.996	0.996 - 0.997	0.874	0.862 - 0.885
Scenario 2: Excluding Berwick Bank (high displacement mortality rates)	190,471	0.995	0.995 - 0.996	0.844	0.833 - 0.855
Scenario 3: All wind farms (low displacement mortality rates)	182,934	0.994	0.994 - 0.995	0.810	0.798 - 0.820
Scenario 4: All wind farms (high displacement mortality rates)	171,498	0.992	0.992 - 0.993	0.760	0.749 - 0.771

After 35 years of impact, the unimpacted median population size for kittiwake is estimated at 250,613 individuals, which is slightly higher than the starting population of 235,171 (the modelled baseline population pre-impact derived from the NE PVA Tool after applying the five-year burn in period) (Table 12-42). The median population size after 35 years suggests the population will remain relatively consistent. In all impacted scenarios, the median population size is expected to decrease.

When excluding Berwick Bank impacts, the predicted impacts to kittiwake are lower. This is likely due to the relatively high collision impacts from Berwick Bank increasing the estimated mortality fed into the model, especially in the breeding season. Under Scenario 1 and Scenario 2, the counterfactual of population size is estimated to decrease by 12.6% and 15.6% respectively. Where Berwick Bank impacts are included (Scenario 3 and Scenario 4), this is estimated at a 19.0% and 24.0% decrease. However, as the counterfactual of population growth rate remains relatively high (≥ 99.2%), it is likely that this effect will not lead to a noticeable change in population size. Even when considering the level of predicted cumulative impact to kittiwake, the maximum contribution of the Project to total annual cumulative mortality is 0.8% (Scenario 1 and Scenario 2).

It should be noted that in reality, the impacts of distributional responses and collision cannot act on the same individual, as is assumed in this analysis (i.e. the same bird cannot collide with a turbine and be displaced from the area). As such, the results from this cumulative assessment for kittiwake can be considered precautionary (e.g. SNCBs, 2022a). Current evidence for displacement is relatively limited due to the paucity of data, and as such only one study provides evidence of kittiwake displacement (Peschko *et al.*, 2020). Additionally, there is emerging evidence that birds are more effective at avoiding wind farms than is currently accounted for within models, such as evidence from Aberdeen Bay Offshore Windfarm (EOWDC), where no kittiwake collisions were reported throughout the full study period despite kittiwakes being recorded within the array (Tjørnløv *et al.*, 2023). Despite this, within this assessment the impacts of collision risk with WTGs and distributional responses from presence of FTUs is considered additive, in line with current expectations from MD-LOT and NatureScot.

For Scenario 1 and Scenario 2, where the counterfactuals of population size remain above 84% and the population growth rate is predicted to remain only 0.5% lower than the baseline, the magnitude of the impact is considered medium. The magnitude of impact for Scenario 3 is also considered to be medium. However, where Berwick Bank impacts and high displacement mortality are considered (Scenario 4), the impact should be considered to be of a high magnitude. This follows a maximum reduction of the counterfactual of population size of 24% and 0.8% for the counterfactual of population growth rate (Scenario 4).

Aligning with the Project alone assessment, the sensitivity of kittiwake to distributional responses is considered low while the sensitivity to collision with WTGs is considered to be medium. Evidence presented by Bradbury *et al.* (2014) and Furness *et al.* (2013) suggests sensitivity to be high, although evidence from post-construction studies at Scottish offshore wind farms suggest kittiwake are more adept than previously thought at avoiding collisions with WTGs, and actual collisions are likely to be low if not zero (MacArthur Green, 2023; Tjørnløv *et al.*, 2023). As such, the sensitivity is considered to be medium. Within the Project alone assessment, the impact to kittiwake from both impacts was considered to be negligible, which is not significant in EIA terms.

Considering the low sensitivity to distributional responses and the medium sensitivity to collision with WTGs, the sensitivity of kittiwake to both impacts is considered to be medium. When considered with the medium and high magnitude of impact, the significance of the effect is considered to be moderate, which would be significant in EIA terms. However, since the impacts of distributional responses and collision are assumed to be additive within this assessment, the conclusion of moderate consequence should be considered precautionary.

The contribution of the Project to the cumulative assessment should be considered when determining the significance of potential impacts. For kittiwake for the Project alone, the combined effect of collision risk with WTGs and distributional responses from presence of FTUs was determined to be negligible, which is not significant in EIA terms. Table 12-41 presents the predicted mortality of kittiwake for the Project alone and the cumulative contribution from all included projects. When considering the percentage point change in adult survival of impacts from the Project alone (0.005% for both high and low scenarios), it suggests the majority of impact is associated with other projects.

The EIA has concluded a not-significant Project alone effect but a significant cumulative effect. The contribution of the Project represents a negligible portion of the existing cumulative effect conclusion.

Evaluation of significance

Taking the **medium** sensitivity of kittiwake and the **medium** and **high** magnitude of the impact, the overall consequence is considered to be **moderate** which is **significant** in EIA terms.

Sensitivity	Magnitude of impact	Consequence
Medium (Scenario 1, Scenario 2, Scenario 3)	Medium	Moderate
Medium (Scenario 4)	High	Moderate

Impact significance - SIGNIFICANT

Gannet

Estimated mortality from distributional responses and collision risk for the Project and each cumulative scenario is presented in Table 12-43 along with the percentage point change in adult survival, which acts as the threshold for requiring PVA. The list of projects included in cumulative assessment and estimated mortality per project for collision and distributional responses is presented in EIAR Vol. 4, Appendix: 25: Population Viability Analysis Report.

For mortality impacts during the non-breeding season, impacts were scaled by the contribution of the breeding season regional population. For gannet this was calculated at 52%; more information is presented within EIAR Vol. 4, Appendix: 25: Population Viability Analysis Report. The scaling factor is applied to impacts when impact on adult survival rate is inputted into PVA models and is presented in EIAR Vol. 4, Appendix: 25: Population Viability Analysis Report.

Table 12-43 Cumulative mortality from distributional responses and collision with WTGs for gannet for the Project and each cumulative scenario

		DISPLACEMENT MORTALITY 70% / 1% + COLLISIONS	DISPLACEMENT MORTALITY 70% / 1% + COLLISIONS			DISPLACEMENT MORTALITY 70% / 3% + COLLISIONS	DISPLACEMENT MORTALITY 70% / 3% + COLLISIONS		
SCENARIO	REGIONAL POPULATION	BREEDING SEASON	NON-BREEDING SEASON	ANNUAL	PERCENTAGE POINT CHANGE IN ADULT SURVIVAL[1]	BREEDING SEASON	NON-BREEDING SEASON	ANNUAL	PERCENTAGE POINT CHANGE IN ADULT SURVIVAL[1]
The Project	238,322	18.6	4.7	23.3	0.008	21.6	8.4	30.0	0.011
Cumulative scenarios									
Excluding Berwick Bank	238,322	786.1	492	1,278.1	0.536	1,119.1	731	1,850.1	0.776
Including Berwick Bank	238,322	906.1	504	1,410.1	0.592	1,299.4	756	2,055.4	0.862

[1]*Percentage point change in adult survival calculated using figures adjusted for the presence of sabbatical birds during the breeding season (10%)*

Table 12-44 Outputs from PVA for cumulative assessment of distributional responses and collision risk for gannet for the operational life of the project (35 years). CPC = counterfactual (ratio) of population growth-rate, CPS = counterfactual (ratio) of final population size (CPS), CI = confidence interval around counterfactual ratio metrics

SCENARIO	MEDIAN POPULATION SIZE	MEDIAN COUNTERFACTUALS			
		CPC	CPC CI	CPS	CPS CI
Baseline (unimpacted)	300,636	-	-	-	-
Scenario 1: Excluding Berwick Bank (low displacement mortality rates)	235,757	0.994	0.993 - 0.994	0.797	0.788 - 0.804
Scenario 2: Excluding Berwick Bank (high displacement mortality rates)	212,780	0.991	0.991 - 0.991	0.719	0.711 - 0.726
Scenario 3: All wind farms (low displacement mortality rates)	230,147	0.993	0.993 - 0.993	0.778	0.77 - 0.786
Scenario 4: All wind farms (high displacement mortality rates)	204,999	0.990	0.990 - 0.990	0.693	0.685 - 0.700

The unimpacted scenario for gannet indicates the median population size will increase over the lifetime of the Project (35 years), increasing by 26% from 237,881 birds (the modelled baseline population pre-impact derived from the NE PVA Tool after applying the five-year burn in period) to 300,636 birds (Table 12-44).

Under all impacted scenarios the median population size is predicted to decrease. For Scenario 1 the difference between the median population size and that of the unimpacted scenario is 24%, which rises to 38% for Scenario 4 when all wind farms and the highest displacement mortality (3%) is considered. It should be noted that the baseline scenario predicts an increasing population after 35 years therefore impacts predicted under Scenarios 1 and 3 may be within the bounds of natural variation.

The overall effect on growth rate is expected to be less than 1%, as evidenced by the counterfactual of population growth rate remaining at over 0.990 for all scenarios. However, when considered with the reduction in the counterfactual of population size, the overall impact to populations is not inconsequential. For example, under Scenario 3 and Scenario 4 where high displacement mortality rates (3%) are considered, the counterfactual of population size is estimated to decrease by 28.1% and 30.7% respectively over the 35-year period.

As expected, the cumulative impact to gannet is largely driven by collision impacts and increased by high displacement mortality (3%) used within models for some scenarios. There is evidence to suggest that gannets are effective at avoiding wind farms on macro (e.g. displacement), meso and micro scales (Skov *et al.*, 2018), and that by incorporating macro-avoidance, impacts could be reduced by 70%. The use of updated avoidance rates within the model such as those proposed by Ozsanlav-Harris *et al.* (2023), will reduce predicted impacts, but emerging evidence from other offshore wind farm sites suggests that avoidance may be even higher than this (e.g. such as from Aberdeen Bay (EOWDC) Offshore Windfarm and Beatrice Offshore Windfarm where no collisions were recorded for any species (MacArthur Green, 2023; Tjørnløv *et al.*, 2023).

Cook *et al.* (2021) suggested that gannet collision assessments should take into account macro-avoidance, supported by evidence in Pavat *et al.* (2023); however, in this cumulative assessment this was not possible. The impacts of collision mortality were derived from the Salamander Offshore Windfarm application (as per NatureScot advice at the Ornithology Catch Up on 7th August 2024), which derives mortality estimates for 'North Sea projects' as presented in the Berwick Bank Offshore Windfarm application. It is not stated which projects comprise this total. Due to this, it is not possible to determine which projects have accounted for macro-avoidance of gannet within the assessment. In the breeding season this has generally not been done for Scottish projects, as NatureScot do not believe there is enough evidence at Scottish sites to currently account for gannet macro-avoidance during this period; however, the correction is applied more regularly for English projects. To avoid applying the correction to projects for which it has already been applied, no correction for gannet macro-avoidance has been applied to collated cumulative mortality. This is considered to provide the most precautionary assessment.

It should also be noted that in reality, the impacts of distributional responses and collision cannot act on the same individual, as is assumed in this analysis (i.e. the same bird cannot collide with a turbine and be displaced from the area). As such, the results from this cumulative assessment for gannet can be considered precautionary (e.g. SNCBs, 2022a).

For all scenarios, the magnitude of impact is considered to be medium, since the counterfactuals of population growth rate and population size are expected to decrease by over 0.6% (counterfactual of population growth) and 20% (counterfactual of population size) for all scenarios. Although the Project alone contribution to annual cumulative morality is not immaterial, it should be noted that this still only comprises between 1.1% and 1.3% of the total mortality estimated for the projects included in cumulative assessment.

Following the Project alone assessment, the sensitivity of gannet to distributional responses is considered low while the sensitivity to collision with WTGs is considered to be medium. Evidence presented by Bradbury *et al.* (2014) and Furness *et al.* (2013) suggests sensitivity to be high, although evidence from post-construction studies at Scottish offshore wind farms suggest gannet are more adept than previously thought at avoiding collisions with WTGs, and actual collisions are likely to be low if not zero (MacArthur Green, 2023; Tjørnløv *et al.*, 2023). As such, the sensitivity is considered to be medium. Within the Project alone assessment, the impact to gannet from both impacts was considered to be negligible, which is not significant in EIA terms.

Considering the low sensitivity to distributional responses and the medium sensitivity to collision with WTGs, the sensitivity of gannet to both impacts is considered to be medium, to be precautionary. When considered with the medium magnitude of impact, the significance of the effect is considered to be moderate, which is significant in EIA terms. However, since the impacts of distributional responses and collision are assumed to be additive within this assessment, the conclusion of moderate consequence should be considered precautionary.

The contribution of the Project to the cumulative assessment should be considered when determining the significance of potential impacts. For gannet for the Project alone, the combined effect of collision risk with WTGs and distributional responses from presence of FTUs was determined to be negligible, which is not significant in EIA terms. Table 12-43 presents the predicted mortality of gannet for the Project alone and the cumulative contribution from all included projects. When considering the percentage point change in adult survival of impacts from the Project alone (0.008% and 0.011% for low and high scenarios respectively), it suggests the majority of impact is associated with other projects. The EIA has concluded a not-significant Project alone effect but a significant cumulative effect. The contribution of the Project represents a negligible portion of the existing cumulative effect conclusion.

Evaluation of significance

Taking the medium sensitivity of gannet and the high magnitude of the impact, the overall consequence is considered to be moderate which is significant in EIA terms.

Sensitivity	Magnitude of impact	Consequence
Medium (All scenarios)	Medium	Moderate

Impact significance - SIGNIFICANT

12.7.4 Onward development

A central aim of the Project is to provide the opportunity for oil and gas assets located in the waters surrounding the Array Area to electrify via transmission infrastructure connecting to Cenos' electricity hub (i.e. OSCPs). These future projects form part of the anticipated future Onward Development which will be originated by Cenos, referred to as Onward Development Connections.

The Onward Development Connections for oil and gas electrification will be finalised and brought forward by 3rd party oil and gas operators, subject to separate marine licensing and permitting requirements (including separate EIA, as appropriate). At this very early stage in the process, the information available about these connections is limited and cannot be confirmed by the Project. In accordance with standard practice and relevant industry guidance, the level of information available means there is insufficient detail to enable full inclusion within a cumulative effects assessment. However, recognising industry feedback and a keen interest in this topic from stakeholders, the Applicant has voluntarily provided a qualitative assessment of the combined impact of the Project and Onward Development Connections, to the extent it can with the limited details on possible Onward Development. Please refer to EIAR Vol. 3, Chapter 22: Statement of Combined Effect for further details.

12.7.5 Cumulative decommissioning effects

Following the information presented in Table 12-31, there are no potential impacts occurring during the decommissioning phase that have the potential to cumulatively impact ornithological receptors, as presented in the Scoping Report and agreed with MD-LOT through the Scoping Opinion (Table 12-3). NatureScot also stated that they agreed with the proposed approach for assessment of cumulative effects on ornithology receptors.

12.7.6 Summary of cumulative effects

A summary of the outcomes of the assessment of cumulative effects for the construction, operation and maintenance and decommissioning phases of the Project is provided in Table 12-45.

Table 12-45 Summary of assessment of cumulative effects

POTENTIAL IMPACT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF IMPACT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
Construction						
n/a	n/a	n/a	n/a	n/a	*None required above existing embedded mitigation measures.*	n/a
Operation and maintenance						
Cumulative effect of distributional responses during the operational phase	Guillemot	Medium (all scenarios)	Low	Minor (not significant)	*None required above existing embedded mitigation measures.*	n/a
	Puffin	Medium (Scenario 1, Scenario 3)	Low	Minor (not significant)	*None required above existing embedded mitigation measures.*	n/a
		Medium (Scenario 2, Scenario 4)	Medium	Moderate (significant)	Compensatory measures proposed for protected sites where AEOSI is concluded (as presented in the RIAA)	There are no expected residual consequences as the contribution of the Project (which is deemed to be negligible and therefore

POTENTIAL IMPACT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF IMPACT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
						not significant in EIA terms) will be compensated for
Cumulative effect of distributional responses and collision with WTGs combined	Kittiwake	Medium (Scenario 1, Scenario 2, Scenario 3)	Medium	Moderate (significant)	Compensatory measures proposed for protected sites where AEOSI is concluded (as presented in the RIAA)	There are no expected residual consequences as the contribution of the Project (which is deemed to be negligible and therefore not significant in EIA terms) will be compensated for
		Medium (Scenario 4)	High	Moderate (significant)	Compensatory measures proposed for protected sites where AEOSI is concluded (as presented in the RIAA)	There are no expected residual consequences as the contribution of the Project (which is deemed to be negligible and therefore not significant in EIA terms) will be compensated for
	Gannet	Medium (all scenarios)	Medium	Moderate (significant)	Compensatory measures proposed for protected sites where AEOSI is concluded (as presented in the RIAA)	There are no expected residual consequences as the contribution of the Project (which is deemed to be negligible and therefore not significant in EIA terms) will be compensated for

POTENTIAL IMPACT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF IMPACT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
Decommissioning						
n/a	n/a	n/a	n/a	n/a	n/a	n/a

12.8 Inter-related effects

Inter-related effects are the potential effects of multiple impacts, effecting one receptor or a group of receptors. Inter-related effects include interactions between the impacts of the different phases of the Project (i.e. interaction of impacts across construction, operation and maintenance and decommissioning), as well as the interaction between impacts on a receptor within a Project phase. The potential inter-related effects for ornithology receptors are described below.

12.8.1 Inter-related effects between Project phases

Inter-related effects between the construction and decommissioning phases are expected to be minimal, given the long temporal delay between these phases. There is the potential for vessel activity within each phase to enhance the impact of disturbance and / or displacement of ornithological receptors. Vessels will be required during all stages of the Project at varying intensities however, the volume of vessels will be higher during the construction and decommissioning phases than during the operational phase. The magnitude of vessel impacts on ornithological receptors is calculated to be negligible in all phases of the Project, due to the localised nature of vessel movements and the embedded mitigation such as vessel management plans. The impacts on ornithological receptors from vessel activity within a single phase are not expected to interact with impacts from another phase, nor result in combined effects of greater magnitude or significance than the assessment presented for each individual phase.

It is expected that the presence, availability and distribution of seabird prey species may be altered during all phases of the Project in some way. Changes in prey resources during the construction and decommissioning phases are anticipated to be temporary, with prey resources recovering rapidly post-phase. Therefore, across the lifetime of the Project, the effects of prey resources on seabirds are not expected to interact in such a way to lead to inter-related effects between different phases that are of greater significance than those impacts within a single phase.

The potential exists for spatial and temporal interactions between underwater noise, primarily entanglement and accidental spills into the marine environment during the lifetime of the Project however, all of these individual impacts were scoped out of assessment (Table 12-17) as the effects were determined to be not significant as standalone impacts. As such, any inter-related effects between these impacts are deemed to be not significant in EIA terms.

12.8.2 Inter-related effects within a Project phase

As well interacting between Project phases, impacts may interact within a single Project phase to create an overall significant impact on ornithological receptors.

The primary impact pathways likely to be inter-related within a single project phase are collision and distributional responses during the operational phase. Both impacts were assessed separately following quantitative analysis (refer to Section 12.6.2.2 and 0 respectively) and assessed together within Section 12.6.2.3. Gannet and kittiwake were assessed for this potential effect, as they are deemed susceptible to negative impacts from collision and distributional responses. Within the assessment, both impacts were considered additive; this is highly precautionary as the same bird cannot collide with a turbine and be displaced from an area. Despite both species being considered of high sensitivity to collision impacts (Section 0), the overall sensitivity to the combined effect of collision risk with WTGs and distributional responses due to the presence of FTUs was considered medium for both species. This is due to the low sensitivity of both species to distributional responses (Section 12.6.2.2). The magnitude of the effect was considered to be negligible when considering the foraging range of both species and the habitat flexibility they both exhibit. Therefore, it was concluded the overall significance of the combined effect of collision risk with WTGs and distributional responses from presence of FTUs is considered to be **negligible**, which is **not significant** in EIA terms.

It is not anticipated that short-term, temporary impacts on seabirds (i.e. secondary entanglement, prey resources) will associate in any meaningful or measurable way with the long-term operational impacts (collision, displacement and barrier effects) to create an overall significant impact to ornithological receptors. There is no scope that inter-related effects during the Project lifetime would lead to population-level changes for any of the seabird species assessed, either at individual colonies or at the wider regional scale.

12.8.3 Inter-relationships

Inter-relationships are defined as the interaction between the impacts assessed within different topic assessment chapters on a receptor. The other chapters and impacts related to the assessment of potential effects on ornithology are provided in Table 12-46.

Table 12-46 Ornithology inter-relationships

CHAPTER	IMPACT	DESCRIPTION
EIAR Vol. 3, Chapter 9: Marine Water and Sediment Quality	• Changes to benthic habitats and species associated with changes in water quality from suspended sediments or due to disturbance of contaminants in the sediment.	Changes in water and sediment quality can result in indirect impacts on benthic fauna and habitats which are sensitive to water quality, disturbance of sediment, and contamination. This is assessed in EIAR Vol. 3, Chapter 9: Marine Water and Sediment Quality.
EIAR Vol. 3, Chapter 10: Benthic Ecology	• Changes to benthic habitat and species.	Changes to benthic habitats and species can lead to an indirect impact on ornithology due to changes in prey availability of fish, which may be impacted due to changes to benthic habitat on which they rely. Direct impacts to benthic habitats and species from the Project are assessed within EIAR Vol 3, Chapter 10: Benthic Ecology. Both impacts are assessed to be not significant.

CHAPTER	IMPACT	DESCRIPTION
EIAR Vol. 3, Chapter 13: Fish and Shellfish Ecology	• Long-term impacts to the seabed and sensitive fish habitats (e.g. spawning and/or nursery habitats) • Operational wind farm may act as a Fish Aggregation Device (FAD)	Changes to distribution and abundance of seabird prey species have the potential to indirectly affect ornithological receptors. The potential impact on prey availability on ornithological receptors is presented within EIAR Vol. 3, Chapter 13: Fish and Shellfish Ecology, changes to distribution and abundance are assessed to be not significant. The potential for the operational wind farm to act as a FAD is presented within EIAR Vol. 3, Chapter 13: Fish and Shellfish Ecology. The potential for the operational wind farm to act as a FAD is assessed to be not significant.
EIAR Vol. 3, Chapter 14: Commercial fisheries	• Entanglement of fishing gear around mooring lines	There is the potential for lost or derelict fishing gears to become entangled with FTU mooring lines within the Array Area, therefore introducing the risk of secondary entanglement to diving bird species. As presented in EIAR Vol 3, Chapter 14: Commercial Fisheries, increased risk of loss or damage to fishing gear (snagging risk) throughout the construction, operation and maintenance and decommissioning phases of the Project are concluded as not significant.

12.9 Whole project assessment

Any onshore aspects of the Project (e.g. any aspects which are located landward of MLWS, including onshore HDD entry point and cable pull through, are currently consented through the NorthConnect HVDC Cable Planning Consent[3]. The relationship between NorthConnect and the Project is described in Section 12.4.3.2 and Section 12.6.1.2 and covered in more detail within EIAR Vol. 2, Chapter 5: Project Description. As such, no onshore aspects have been assessed as part of the Project. There is no overlap between any onshore aspects and impacts on ornithology receptors considered in Section 12.6.1.2. As described in Section 12.6.1.2, disturbance and / or displacement of ornithology receptors during HDD in the construction phase would be localised and temporary in nature. There is no potential for the ornithology receptors considered to be negatively affected.

[3] *Source: https://marine.gov.scot/data/06771-and-06870-marine-licences*

12.10 Transboundary effects

Transboundary effects arise when impacts from a development within one European Economic Area (EEA) state's territory affects the environment of another EEA state(s).

The Array Area is located approximately 200 km offshore from the north-east coast of Aberdeen, Scotland and covers an area of 332.71 km². The next nearest coastline (outside of the UK) is Norway which is approximately 290 km from the Array Area. This is outside the foraging distance of all species Scoped In for assessment, apart from gannet. The nearest gannet colonies along the Norwegian coast are in the north of the country and over 1,200 km away from the Array Area, which is considerably further than the gannet foraging range (Barret, 2017; Woodward *et al.*, 2019). There is potential for connectivity during the non-breeding season as well as the breeding season however, this is likely to be minimal.

Therefore, there is no potential for transboundary impacts upon ornithological receptors due to construction, operation and maintenance and decommissioning of the Project. The potential impacts are localised and are not expected to affect other EEA states. Therefore, transboundary effects for ornithological receptors do not need to be considered further.

12.11 Ecosystem assessment

Due to preying on a wide variety of prey species, seabirds are considered to be top predators within the North Sea marine food web, along with marine mammals and some fish species. As part of the EIAR, it is important to consider the effect of potential impacts which may occur at an ecosystem scale and in particular across trophic levels; i.e. impacts on prey species leading to reduced availability which in turn affects predator species. Changes in seabird abundance and / or distribution may have a cascading impact on other species within the ecosystem, affecting both prey species as well as other predator species directly or indirectly. Ecosystem effects are also discussed in EIAR Vol. 3, Chapter 10: Benthic Ecology, EIAR Vol. 3, Chapter 11: Marine Mammal Ecology and EIAR Vol. 3, Chapter 13: Fish and Shellfish Ecology.

As discussed in Section 12.4.5.1, climate change is considered to be one of the primary drivers of seabird population size and decline in the UK and wider Europe (Daunt and Mitchell, 2013; Pierce-Higgins, 2021). Changes in climate can affect the availability, abundance and distribution of prey species, potentially leading to impacts to seabird populations. Similarly, as per Section 12.4.5.2, fishing pressure may also impact the abundance and distribution of prey species in addition to the prey community structure, subsequently affecting seabird populations.

During all phases of the Project, kittiwake, guillemot and puffin are considered to be of medium sensitivity to changes in prey resources while gannet are considered to be of low sensitivity. The construction and operation of the Project may lead to habitat loss and / or disturbance to prey species resulting in reduced prey availability. Conversely, the presence of the Project also has the potential to attract prey species (i.e. fish aggregation) therefore, potentially increasing abundance (Copping *et al*., 2021). EIAR Vol. 2, Chapter 13: Fish and Shellfish Ecology concluded for all species long term impacts to the seabed and sensitive fish habitats was negligible and not significant for all receptors. The potential for the Project to act as a FAD was assessed to be minor and not significant in EIA terms.

As no significant effects were identified for any impact on ornithology, there is not considered to be a significant long-term change in the abundance and / or distribution of seabirds within the Project which could result in ecosystem-level effects. From consideration of ecosystem effects throughout the chapters of the EIAR, it is not anticipated that the Project will lead to ecosystem effects which impact on ornithology either as a direct impact to seabirds or through indirect effects to their prey species.

12.12 Summary of mitigation and monitoring

For the Project alone, all assessed impacts were considered to be at the worst, minor (not significant) which is considered not significant in EIA terms. As such, no secondary mitigation, over and above the embedded mitigation measures proposed in Section 12.5.4, is either required or proposed in relation to the potential effects of the Project on ornithology for the Project alone.

Cumulatively, moderate significant effects were concluded for puffin, kittiwake and gannet. For puffin, this conclusion was reached only when the maximum recommended displacement and mortality rates were used in analysis. For gannet and kittiwake, moderate significant impacts were determined for the cumulative effect of distributional responses and collision combined, but it should be noted that birds were considered to be able to collide with turbines while also being displaced from the area, increasing the level of impact included within assessment. The combination of data from older projects which may have been derived using evidence which has since been updated has the potential to increase the level of cumulative mortality used in assessment. Due to this, some parts of the assessment may be considered precautionary.

For all species and impact pathways, when the scale of the effects from the Project alone was compared to the cumulative effect, it illustrated that the vast majority of the cumulative effect was associated with the additive effects from other Projects. The contribution of the Project represents a negligible portion of the cumulative effect conclusion, as evidenced by the Project alone assessment (Section 12.6.2). For all scenarios assessed, significant cumulative effects would be concluded with or without the Project's contribution.

The Applicant can only reduce impacts which arise from the Project, and as discussed in Section 12.7, the contribution of the Project to the cumulative effect is very small. If Scottish Ministers conclude there is Adverse Effects on Site Integrity (AEoSI) for any SPAs as part of the RIAA in-combination with other Projects, the Applicant has provided a HRA without prejudice derogation case and Habitats Regulation Appraisal (HRA) - Compensation and Implementation Strategy which demonstrate that these impacts can be compensated. No monitoring is currently proposed for ornithology as there were no significant effects from the Project alone during any phase (Section 12.6.2).

12.13 References

Anderson, H.B., Evans, P.G.H., Potts, J.M., Harris, M.P. & Wanless, S. (2014). The diet of common guillemot *Uria aalge* chicks provides evidence of changing prey communities in the North Sea. *Ibis*, 156(1), pp. 23 – 34.

APEM. (2021). *Digital Aerial Seabird and Cetacean Surveys Off the East Coast of Scotland. Scottish Government. Final Report*. APEM Scientific Report P0003988.

APEM. (2022). Green Volt Offshore Wind Farm. Technical Appendix 12.1: Offshore and Intertidal Ornithology Baseline Technical Report. Offshore EIA Report: Volume 2.

APEM. (2022). *Review of evidence to support auk displacement and mortality rates in relation to offshore wind farms*. APEM Scientific Report P00007416. Ørsted, January 2022, Final, 49 pp.

APHA. (2023). *Confirmed cases of wild birds with highly pathogenic avian influenza (bird flu) in Great Britain*. Available online at: https://www.gov.uk/government/publications/avianinfluenza-in-wild-birds [Accessed 4 September 2024].

Barrett, R. T., Strøm, H., & Melnikov, M. (2017). On the polar edge: the status of the northern gannet (*Morus bassanus*) in the Barents Sea in 2015 – 16. *Polar Research*, 36(1).

Benjamins, S., Harnois, V., Smith, H.C.M., Johanning, L., Greenhill, L., Carter, C. & Wilson, B. (2014). *Understanding the potential for marine megafauna entanglement risk from renewable marine energy developments*. Scottish Natural Heritage Commissioned Report No. 791.

Bennet, S. (2023). Common Guillemot *Uria aalge*. In: Burnell, D., Perkins, A.J., Newton, S.F., Bolton, M., Tierney, T.D. & Dunn, T.E. (2023). *Seabird Count: a census of breeding seabirds in Britain and Ireland (2015 – 2021)*. Lynx Nature Books.

Bicknell, A.W.J., Oro, D., Camphuysen, K. & Votier, S.C. (2013). Potential consequences of discard reform for seabird communities. *Journal of Applied Ecology*, 50, pp. 649 – 658.

BirdLife International. (2018a). *Uria aalge*. *The IUCN Red List of Threatened Species* 2018: e.T22694841A132577296. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T22694841A132577296.en [Accessed 30 August 2024].

BirdLife International. (2018b). *Puffinus puffinus*. *The IUCN Red List of Threatened Species* 2018: e.T22698226A132636603. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T22698226A132636603.en [Accessed 3 September 2024].

BirdLife International. (2018c). *Fratercula arctica*. *The IUCN Red List of Threatened Species* 2018: e.T22694927A132581443. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T22694927A132581443.en [Accessed 30 August 2024].

BirdLife International. (2018d). *Morus bassanus*. *The IUCN Red List of Threatened Species* 2018: e.T22696657A132587285. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T22696657A132587285.en [Accessed 30 August 2024].

BirdLife International. (2019). *Rissa tridactyla* (amended version of 2018 assessment). *The IUCN Red List of Threatened Species* 2019: e.T22694497A155617539. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T22694497A155617539.en [Accessed 30 August 2024].

BirdLife International. (2021a). *Rissa tridactyla (Europe assessment)*. *The IUCN Red List of Threatened Species* 2021: e.T22694497A166280839. https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T22694497A166280839.en [Accessed 30 August 2024].

BirdLife International. (2021b). *Uria aalge (Europe assessment)*. *The IUCN Red List of Threatened Species* 2021: e.T22694841A166288433. https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T22694841A166288433.en [Accessed 30 August 2024].

BirdLife International. (2021c). *Fratercula arctica (Europe assessment)*. *The IUCN Red List of Threatened Species* 2021: e.T22694927A166290968. https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T22694927A166290968.en [Accessed 30 August 2024].

BirdLife International. (2021d). *Morus bassanus (Europe assessment)*. *The IUCN Red List of Threatened Species* 2021: e.T22696657A166314602. https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T22696657A166314602.en [Accessed 30 August 2024].

BirdLife International. (2021e). *Fulmarus glacialis (Europe assessment)*. *The IUCN Red List of Threatened Species* 2021:e.T22697866A166328870. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T22697866A166328870.en. Accessed on 04 December 2024.

BirdLife International. (2021f). *Larus argentatus (Europe assessment)*. *The IUCN Red List of Threatened Species* 2021:e.T22697866A166328870. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T22697866A166328870.en. Accessed on 04 December 2024.

BirdLife International. (2021g). *Alca torda (Europe assessment)*. *The IUCN Red List of Threatened Species* 2021:e.T22697866A166328870. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T22697866A166328870.en. Accessed on 04 December 2024.BirdLife International (2024a) Species factsheet: Black-legged Kittiwake *Rissa tridactyla*. Available online at: https://datazone.birdlife.org/species/factsheet/black-legged-kittiwake-rissa-tridactyla [Accessed 23 September 2024].

Bradbury, G., Trinder, M., Furness, B., Banks, A.N, Caldow, R.W.G. & Hume, D. (2014). Mapping Seabird Sensitivity to Offshore Wind Farms. *PLoS ONE*, 9(9): e106366.

BTO (British Trust for Ornithology). (2024). *Birdfacts: profiles of birds occurring in the United Kingdom*. Available online at: https://www.bto.org/understanding-birds/welcome-birdfacts [Assessed 23 September 2024].

Buckingham, L., (2023) Razorbill *Alca torda* in: Burnell, D., Perkins, A.J., Newton, S.F., Bolton, M., Tierney, T.D. & Dunn, T.E. (2023). Seabird Count: a census of breeding seabirds in Britain and Ireland (2015 – 2021). Lynx Nature Books.

Buckingham, L., Bogdanova, M.I., Green, J. G., Dunn, R.R., 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.., Weston, E.D., Furness, R.W. & Daunt, F. (2022). Interspecific variation in non-breeding aggregation: a multi-colony tracking study of two sympatric seabirds. *Marine Ecology Progress Series*, 684, pp. 181 – 197.

Buckingham, L., Daunt, F., Bogdanova, M.I., Furness, R.W., Bennet, S., Duckworth, J., Dynn, R.E., Wanless, S., Harris, M.P., Jardine, D.C., Newell, M. A., Ward, R.M, Weston, E.D. & Green, J.A. (2023). Energetic synchrony throughout the non-breeding season in common guillemots from four colonies. *Journal of Avian Biology*, (1-2).

Burger, A.E. & Simpson, M. (1986). Diving depths of Atlantic puffins and common murres. *The Auk*, 103 (4), pp. 828 – 830.

Burnell, D., Perkins, A.J., Newton, S.F., Bolton, M., Tierney, T.D. & Dunn, T.E. (2023c). *Seabird Count: a census of breeding seabirds in Britain and Ireland (2015 – 2021)*. Lynx Nature Books

Burnell, D. (2023a) Herring gull Larus argentatus in: Burnell, D., Perkins, A.J., Newton, S.F., Bolton, M., Tierney, T.D. & Dunn, T.E. (2023). *Seabird Count: a census of breeding seabirds in Britain and Ireland (2015 – 2021)*. Lynx Nature Books.

Burnell, D. (2023b). Northern fulmar *Fulmarus glacialis*. In: Burnell, D., Perkins, A.J., Newton, S.F., Bolton, M., Tierney, T.D. & Dunn, T.E. (2023). *Seabird Count: a census of breeding seabirds in Britain and Ireland (2015 – 2021)*. Lynx Nature Books.

Caneco, B. & Humphries, G. (2022). *HiDef Aerial Surveying stochLAB*. Available online at: https://www.github.com/HiDef-Aerial-Surveying/stochLAB.

Carroll M.J., Bolton, M., Owen, E., Anderson, G.Q.A., Mackley, E.K., Dunn, E.K. & Furness, R.W. (2017). Kittiwake breeding success in the southern North Sea correlates with prior sandeel fishing mortality. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 27(6), pp. 1164 – 1175.

Cleasby, I.R., Owen, E., Wilson, L., Wakefield, E.D., O'Connell, P. & Bolton, M. (2020). Identifying important at-sea areas for seabirds using species distribution models and hotspot mapping. *Biological Conservation*, *241*.

Cook, A.S.C.P., Humphreys, E.M., Masden, E.A., & Burton, N.H.K. (2014). *The avoidance rates of collision between birds and offshore turbines*. Scottish Marine and Freshwater Science Volume 5 Number 16. Marine Scotland Science, Aberdeen.

Copping, A.E., Hemery, L.G., Viehman, H., Seitz, A.C., Staines, G.J. & Hasselman, D.J. (2021). Are fish in danger? A review of environmental effects of marine renewable energy on fishes. *Biological Conservation*, 262, 109297.

Cork Ecology. (2017). NnG Offshore Wind Appendix 9.2 Summary of Results from Baseline Surveys.

Crowell, S.E., Wells-Berlin, A.M., Carr, C.E., Olsen, G.H., Therrien, R.E., Yannuzzi, S.E., & Ketten, D.R. (2015). A comparison of auditory brainstem responses across diving bird species. *Journal of Comparative Physiology*.

Daunt, F & Mitchell, I. (2013). Impacts of climate change on seabirds. *Marine Climate Change Impacts Partnership: Science Review*, pp. 125 – 133.

Daunt, F. (2023). *Black-legged Kittiwake Rissa tridactyla*. In: Burnell, D., Perkins, A.J., Newton, S.F., Bolton, M., Tierney, T.D. & Dunn, T.E. (2023). *Seabird Count: a census of breeding seabirds in Britain and Ireland (2015 – 2021)*. Lynx Nature Books.

Daunt, F., Wanless, S., Greenstreet, S.P.R., Jensen, H., Hamer, K.C. & Harris, M.P. (2008). The impact of the sandeel fishery closure on seabird food consumption, distribution and productivity in the northwestern North Sea. *Canadian Journal of Fisheries and Aquatic Sciences*, 63(3).

DEFRA. (2024). Consultation on spatial management measures for industrial sandeel fishing. Government response. Available online at https://www.gov.uk/government/consultations/consultation-on-spatial-management-measures-forindustrial-sandeel-fishing/outcome/government-response [Accessed 6 September 2024].

Dierschke, V., Furness, R.W. & Garthe, S. (2016). Seabirds and offshore wind farms in European waters: Avoidance and attraction. *Biological Conservation*, 202: 59-68.

DOSITS. (2021). Potential effects of sound on marine invertebrates. Available online at: https://dosits.org/animals/effects-of-sound/potential-effects-of-sound-on-marine-invertebrates/ [Accessed 12 November 2024].

Dunn, R.E.; Wanless, S.; Green, J.A.; Harris, M.P. & Daunt, F. (2019). Dive times and depths of auks (Atlantic puffin, common guillemot and razorbill) from the Isle of May outside the seabird breeding season. NERC Environmental Information Data Centre. Available online at: https://catalogue.ceh.ac.uk/documents/6ab0ee70-96f8-41e6-a3e3-6f4c31fa5372 [Accessed 15 November 2024].

Edwards, E.W., Quinn, L.R., Wakefield, E. D., Miller, P.I. & Thompson, P.M. (2013). Tracking a Northern fulmar from a Scottish nesting site to the Charlie-Gibbs Fracture Zone: evidence of linkage between coastal breeding seabirds and Mid-Atlantic Ridge feeding sites. *Deep Sea Research Part II: Tropical Studies in Oceanography, 98 (B)*, pp. 438 – 444.

ERM. (2024). *Salamander Offshore Wind Farm. Offshore EIA Report. Volume ER.A.3, Chapter 12: Offshore and Intertidal Ornithology*. Document no: 08420701.

Evans, P.G.H. & Waggitt, J.J. (2023). *Modelled Distribution and Abundance of Cetaceans and Seabirds in Wales and Surrounding Waters*. NRW Evidence Report, Report No: 646, 354 pp. Natural Resources Wales, Bangor.

Frederiksen, M., Harris, M.P., Daunt, F., Rothery, P. & Wanless, S. (2004). Scale-dependent climate signals drive breeding phenology of three seabird species. *Global Change Biology*, 10, pp. 1214 – 1221.

Furness, R.W. & 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. (2015). *Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS).* Natural England Commissioned Reports, No.164.

Furness, R.W., Wade, H.M., & Masden, E.A. (2013). Assessing vulnerability of marine bird populations to offshore wind farms. *Journal of Environmental Management*, 119, 56-66.

Garthe, S. & 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.

Garthe, S., Guse, N., Montevecchi, W.A., Rail, J-F. & Grégoire, F. (2014). The daily catch: Flight altitudes and diving behaviour of northern gannets feeding on Atlantic mackerel. *Journal of Sea Research*, 85, pp. 456 – 462.

Gilbert, G., Gibbons, D.W. & Evans, J. (1998). *Bird Monitoring Methods*. RSPB, Sandy.

Gilman, E., Musyl, M., Suuronen, P., Chaloupka, M., Gorgin, S., Wilson, J. & Kuczenski, B. (2021). Highest risk abandoned, lost and discarded fishing gear. *Scientific Reports*, 11(1).

Green Volt. (2023). *Green Volt Offshore Windfarm Report to Inform Appropriate Assessment, Annex 2: HRA Apportionment Annex.* Royal HaskoningDHV, January 2023, 506pp.

Harris, M.P., Heubeck, M., Shaw, D.N. & Okill, J.D. (2006). Dramatic changes in the return date of Guillemots Uria aalge to colonies in Shetland, 1962-2005. *Bird Study*, 53, pp. 247 – 252.

Hodges, S., Erikstad, K.E. & Reiertsen, T.K. (2022). Predicting the foraging patterns of wintering Auks using a sea surface temperature model for the Barents Sea. *Ecological Solutions and Evidence*, 3(4).

Horswill, C. and Robinson, R.A. (2015). *Review of seabird demographic rates and density dependence*. JNCC Report No. 552. Joint Nature Conservation Committee, Peterborough.

Inch Cape Offshore LTD. (2018). Offshore Ornithology Baseline Survey Report.

Jeglinskj, J.W.E., Lane, J.V., Votier, S.C., Furness, R.W., Hamer, K.C., McCafferty, D.J., Nager, R.G., Sheddan, M., Waness, S. & Matthiopoulos, J. (2024). HPAIV outbreak triggers short-term colony connectivity in a seabird metapopulation. *Scientific Reports, doi: 10.1038/s41598-024-53550-x.*

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 online: https://hub.jncc.gov.uk/f7892820-0f84-4e96-9eff-168f93bd343d [Accessed 5 September 2024].

JNCC. (2021) *Guillemot (Uria aalge*). Available online: https://jncc.gov.uk/our-work/guillemot-uria-aalge/ [Accessed 19 October 2024].

Jonston, D.T., Humphreys E.M., Davies J.G. & Pearce-Higgins J.W. (2021). Review of climate change mechanisms affecting seabirds within the INTERREG VA area. British Trust for Ornithology. Available online at: https://www.mpa-management.eu/wp-content/uploads/2021/11/Review-of-climate-change-mechanisms-affecting-seabirds-within-the-INTERREG-VA-area-v1.pdf [Accessed 25 August 2024].

Kober, K., Wilson, L.J., Black, J., O'Brien, S., Allen, S., Win, I., Bingham, C. & Reid, J.B. (2012). *The identification of possible marine SPAs for seabirds in the UK: The application of Stage 1.1–1.4 of the SPA selection guidelines*. JNCC Report No. 461, JNCC, Peterborough.

Lane, J.V., Pollock, C.J., Jeavons, R., Sheddan, M., Furness, R.W. & Hamer, K.C. (2021). Post-fledging movements, mortality and migration of juvenile northern gannets. *Marine Ecology Progress Series*, 671, pp. 207 – 218.

Lynam, C.P., Llope, M., Möllmann, C., Helaouët, P., Bayliss-Brown, G.A. & Stenseth, N.C. (2017). Interaction between top-down and bottom-up control in marine food webs. *Proceedings of the National Academy of Sciences*, 114(8).

MacArthur Green. (2023). *Beatrice Offshore Wind Farm Year 2 Post-construction Ornithological Monitoring Report.* MacArthur Green, July 2023, 146 pp.

MacDonald, A., Heath, M., Edwards, M., Furness, R., Pinnegar, J., Wanless, S., Speirs, D. & Greenstreet, S. (2015). Climate driven trophic cascades affecting seabirds around the British Isles. *Oceanography and Marine Biology - An Annual Review*, 53, pp. 55 – 80.

Masden, E.A., Haydon, D.T., Fox, A.D., Furness, R.W., Bullman, R. & Desholm, M. (2009). Barriers to movement: impacts of wind farms on migrating birds. *ICES Journal of Marine Science*, 66, pp. 746 – 753.

MD-LOT. (2023). *Scoping Opinion adopted by the Scottish Ministers under: The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 and The Marine Works (Environmental Impact Assessment) Regulations 2007.* Cenos Offshore Windfarm. Available at: https://marine.gov.scot/sites/default/files/cenos_offshore_windfarm_-_flotation_energy_ltd_-_eia_scoping_opinion.pdf [Accessed: March 2024].

MD-LOT. (2024). *Scoping Opinion adopted by the Scottish Ministers under: The Marine Works (Environmental Impact (Scotland) Regulations 2017), the Electricity Works (Environmental Impact Assessment (Scotland) Regulations 2017) and the Marine Works (Environmental Impact Assessment Regulations 2007*. Cenos Offshore Windfarm.

Mitchell, I., Daunt, F., Frederiksen, M. & Wade, K. (2020). Impacts of climate change on seabirds, relevant to the coastal and marine environment around the UK. *MCCIP Science Review*, pp. 382 – 399.

Mitchell, I., French, G., Douse, A., Foster, S., Kershaw, M., McCulloch, N., Murphy, M. & Hawkridge, J. (2018). Marine Bird Abundance. UK Marine Online Assessment Tool. Available online at: https://moat.cefas.co.uk/biodiversity-food-webs-and-marine-protected-areas/birds/abundance/ [Accessed 4 September 2024].

Montevecchi, W. & Myers, R.A. (1997). Centurial and decadal oceanographic influences on changes in northern gannet populations and diets in the north-west Atlantic: implications for climate change. ICES *Journal of Marine Science*, 54, pp. 608 – 614.

NatureScot (2020). *Seasonal Periods for Birds in the Scottish Marine Environment.* Available online at: Guidance note - Seasonal definitions for birds in the Scottish Marine Environment.pdf [Accessed 5 September 2024].

NatureScot. (2023a). *Guidance Note 1: Guidance to support Offshore Wind Applications: Marine ornithology overview*. Available online at: https://www.nature.scot/doc/guidance-note-1-guidance-support-offshore-wind-applications-marine-ornithology-overview [Accessed March 2024].

NatureScot. (2023b*). Guidance Note 2: Guidance to support Offshore Wind Applications: Advice for marine ornithology baseline characterisation surveys and reporting*. Available online at: https://www.nature.scot/doc/guidance-note-2-guidance-support-offshore-wind-applications-advice-marine-ornithology-baseline [Accessed March 2024].

NatureScot. (2023c). *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 online at: https://www.nature.scot/doc/guidance-note-3-guidance-support-offshore-wind-applications-marine-birds-identifying-theoretical [Accessed March 2024].

NatureScot. (2023d). *Guidance Note 4: Guidance to support Offshore Wind Applications: Ornithology – Determining connectivity of marine birds with Marine Special Protection Arteas and breeding seabirds from colony SPAs in the non-breeding season*. Available online at: https://www.nature.scot/doc/guidance-note-4-guidance-support-offshore-wind-applications-ornithology-determining-connectivity [Accessed March 2024].

NatureScot. (2023e). *Guidance Note 5: Guidance to support Offshore Wind Applications: Recommendations for marine bird population estimates*. Available online at: https://www.nature.scot/doc/guidance-note-5-guidance-support-offshore-wind-applications-recommendations-marine-bird-population [Accessed March 2024].

NatureScot. (2023f). *Guidance Note 6: Guidance to support Offshore Wind Applications: Marine ornithology impact pathways for offshore wind developments*. Available online at: https://www.nature.scot/doc/guidance-note-6-guidance-support-offshore-wind-applications-marine-ornithology-impact-pathways [Accessed March 2024].

NatureScot. (2023g). *Guidance Note 7: Guidance to support Offshore Wind Applications: Marine Ornithology – Advice for assessing collision risk of marine birds*. Available online at: https://www.nature.scot/doc/guidance-note-7-guidance-support-offshore-wind-applications-marine-ornithology-advice-assessing [Accessed March 2024].

NatureScot. (2023h). *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 online at: https://www.nature.scot/doc/guidance-note-8-guidance-support-offshore-wind-applications-marine-ornithology-advice-assessing [Accessed March 2024].

NatureScot. (2023i). *Guidance Note 9: Guidance to support Offshore Wind Applications: Marine ornithology advice for seasonal definitions for birds in the Scottish marine environment*. Available online at: https://www.nature.scot/doc/guidance-note-9-guidance-support-offshore-wind-applications-seasonal-periods-birds-scottish-marine [Accessed March 2024].

NatureScot. (2023j). *Guidance Note 10: Guidance to support Offshore Wind Applications: Marine ornithology advice for apportioning impacts to breeding colonies*. Available online at: https://www.nature.scot/doc/guidance-note-10-guidance-support-offshore-wind-applications-marine-ornithology-advice-apportioning [Accessed March 2024].

NatureScot. (2023k). *Guidance Note 11: Guidance to support Offshore Wind Applications: Marine Ornithology Overview; Marine ornithology – Recommendations for seabird Population Viability Analysis (PVA).* Available online at: https://www.nature.scot/doc/guidance-note-11-guidance-support-offshore-wind-applications-marine-ornithology-recommendations [Accessed March 2024].

NatureScot. (2023l). *NatureScot Scientific Advisory Committee Sub-Group on Avian Influenza Report on the H5N1 outbreak in wild birds 2020-2023*. Available online at: www.nature.scot/doc/naturescot-scientific-advisory-committee-sub-groupavianinfluenza-report-h5n1-outbreak-wild-birds [Accessed 4 September 2024].

Newell, M., Wanless, S., Harris, M.P. & Daunt, F. (2015). Effects of an extreme weather event on seabird breeding success at a North Sea colony. *Marine Ecology Progress Series*, 532, pp. 257 – 268.

NorthConnect (2018a). *HVDC Cable Infrastructure – UK Construction Method Statement. Available online at: HVDC Cable Infrastructure Construction Method Statement (northconnect.no)* Available online at: https://marine.gov.scot/data/northconnect-hvdc-cable-06771-construction-method-statement [Accessed 5 September 2024].

NorthConnect. (2018b). HVDC *Cable Infrastructure EIAR, Volume 3, Appendix F.1: Report on Ornithological Surveys*. Natural Research (Projects) Limited. Available online at: https://marine.gov.scot/data/northconnect-hvdc-cable-environmental-impact-assessment-report-volume-3 [Accessed 11 September 2024].

NorthConnect. (2018c). Chapter 17: Ornithology.

Oliveira, F., Monteiro, P., Bentes L., Henriques, N.S., Aguilar, R. & Goncalves, J.M.S. (2015). Marine litter in the upper Sao Vincente submarine canyon (SW Portugal): abundance, distribution, composition and fauna interactions. *Marine Pollution Bulletin*, 97(7).

OSPAR. (2024) Available online at: https://www.ospar.org/work-areas/bdc/species-habitats/list-of-threatened-declining-species-habitats/birds [Accessed 5 December 2024].

Ossian Offshore Wind Farm Limited (OWFLa). (2024). Ossian Offshore Wind Farm Environmental Impact Assessment Report, Volume 3, Appendix 11.1: Offshore Ornithology Baseline Report Array EIAR. RPS Energy, 88pp.

Owen, E., Steinfurth, A. & Hughes, R. (2023). *Atlantic puffin Fratercula arctica.* In: Burnell, D., Perkins, A.J., Newton, S.F., Bolton, M., Tierney, T.D. & Dunn, T.E. (2023). Seabird Count: a census of breeding seabirds in Britain and Ireland (2015 – 2021). Lynx Nature Books.

Ozsanlav-Harris, L., Inger, R., & Sherley, R. (2023). *Review of data used to calculate avoidance rates for collision risk modelling of seabirds*. JNCC Report 732, JNCC, Peterborough, ISSN 0963-8091.

Pavat, D., Harker, A.J., Humphries, G., Keogan, K., Webb, A. & 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.

Peschko, V., Mendel, B., Müller, S., Markones, N., Mercker, M. & Garthe, S. (2020). *Effects of offshore windfarms on seabird abundance: strong effects in spring and in the breeding season*. Marine Environmental Research, 162, p.105157.

Piatt, J.F. and Nettleship, D.N. (1985). Diving depths of four alcids. *The Auk*, 102 (2), pp. 293 – 297.
Pierce-Higgins, J.W. (2021). Climate change and the UK's birds. British Trust for Ornithology Report, Thetford.

Ramírez, I., Mitchell, D., Vulcano, A., Rouxel, Y., Marchowski, D., Almeida, A., Arcos, J.M., Cortes, V., Lange, G., Morkūnas, J., Oliveira, N. & Paiva, V.H. (2024). Seabird bycatch in European waters. *Animal Conservation*. Available online at: https://doi.org/10.1111/acv.12948 [Accessed 6 September 2024].

Renner, S.S. & Zohner, C.M., 2018. Climate change and phenological mismatch in trophic interactions among plants, insects, and vertebrates. *Annual review of ecology, evolution, and systematics*, 49(1), pp.165-182.

Ryan, P.G. (2018). Entanglement of birds in plastics and other synthetic materials. *Marine Pollution Bulletin*, *135*, pp.159 – 164.

Sadykova, D., Scott, B.E., De Dominicis, M., Wakelin, S.L., Wolf, J. & Sadykov, A. (2020). Ecological costs of climate change on marine predator–prey population distributions by 2050. *Ecology and Evolution*, 10(2), pp. 1069 – 1086.

Scottish Government (2024). The Sandeel (Prohibition Of Fishing) (Scotland) Order 2024: business and regulatory impact assessment – final. Available online at https://www.gov.scot/publications/sandeel-prohibition-fishing-scotland-order-2024-final-business-regulatory-impact-assessment/ [Accessed 6 September 2024].

Seagreen Wind Energy. (2018). Ornithology Technical Report for Seagreen Alpha & Bravo Firth of Forth Offshore Wind Farm Development 2018.

SEAPO.P (2022). Auk wreck last autumn struck mainly young common guillemots. Available online at: https://seapop.no/en/2022/02/unge-lomvier-rammet-av-omfattende-massedod-hosten-2021/ [Accessed 19 September 2024].

Searle, K. R., O'Brien, S.H., Jones, E.L., Cook, A.S.C.P., Trinder, M.N., McGregor, R.M., Donovan, C., McCluskie, A., Daunt, F. & Butler, A. (2023a). A framework for improving treatment of uncertainty in offshore wind assessments for protected marine birds. Available at: https://academic.oup.com/icesjms/advance-article/doi/10.1093/icesjms/fsad025/7065501 [Accessed March 2024].

Searle, K., Mobbs, D., Butler, A., Bogdanova, M., Freeman, S., Wanless, S. & Daunt, F. (2014). *Population consequences of displacement from proposed offshore wind energy developments for seabirds breeding at Scottish SPAs* (CR/2012/03). CEH Report to Marine Scotland Science (MSS).

Searle, K.R., Mobbs, D.C., Butler, A., Furness, R.W., Trinder, M.N. & Daunt. F. (2018). Finding out the fate of displaced birds (FCR/2015/19). Scottish Marine and Freshwater Science Volume 9 No: 08.

Searle, K.R., Regan, C.E., Perrow, M.R., Butler, A., Rindorf, A., Harris, M.P., Newell, M.A., Wanless, S. & Daunt, F. (2023b). Effects of a fishery closure and prey abundance on seabird diet and breeding success: Implications for strategic fisheries management and seabird conservation. *Biological Conservation*, 281.

Skov, H., Heinänen, S., Norman, T., Ward, R.M., Méndez-Roldán, S. & Ellis, I. (2018). ORJIP Bird Collision and Avoidance Study. Final report – April 2018. The Carbon Trust. United Kingdom, pp. 247. Skov, H., Heinänen, S., Norman, T., Ward, R.M., Méndez-Roldán, S. & Ellis, I. (2018). *ORJIP Bird Collision and Avoidance Study. Final report – April 2018.* The Carbon Trust. United Kingdom, 247.

SNCB. (2022). 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 (OWF) developments. Available online at: https://data.jncc.gov.uk/data/9aecb87c-80c5-4cfb-9102-39f0228dcc9a/joint-sncb-interim-displacement-advice-note-2022.pdf [Accessed 24 September 2024].

Sparling, C.E., Coram, A.J., McConnell, B., Thompson, D., Hawkins, K.R. & Northridge S.P. (2013). Wave & Tidal Consenting Position Paper Series: Marine Mammal Impacts. NERC. Available online at: https://tethys.pnnl.gov/sites/default/files/publications/NERC-2013-Marine-Mammal.pdf [Accessed 18 September 2024].

SSE Renewables. (2022). Berwick Bank Wind Farm Environmental Impact Assessment Report Volume 2, Chapter 11: Offshore and Intertidal Ornithology. Cork Ecology and Pelagica. November 2022.

Stanbury, A., Eaton, M., Aebischer, N., Balmer, D., Brown, A., Douse, A., Lindley, P., McCulloch, N., Noble, D. & Win, I. (2021). The status of our bird populations. *British Birds*, 114, pp. 723 – 747.

Thompson, P.M. & Ollason, J.C. (2001). Lagged effects of ocean climate change on fulmar population dynamics. *Nature*, *413*, pp. 417 – 420.

Tjørnløv, R.S., Skov, H., Armitage, M., Barker, M., Jørgensen, J.B., Mortensen, L.O., Thomas, K. & Uhrenholdt, T., (2023). *Resolving Key Uncertainties of Seabird Flight and Avoidance Behaviours at Offshore Wind Farms*. Vattenfall.

Tremlett, C.J., Morley, N. & Wilson, L.J. (2024). *UK seabird colony counts in 2023 following the 2021 – 22 outbreak of Highly Pathogenic Avian Influenza*. RSPB Research Report 76. RSPB Centre for Conservation Science.

Vanermen, N., Onkelinx, T., Courtens, W., Van de walle, M., Verstaete, H. & Stienen, E.W.M. (2014). Seabird avoidance/attraction at an offshore wind farm in the Belgian part of the North Sea. *Hydrobiologia*, 756: 51-61.

Vattenfall. (2023). Auk tagging project: final report. Available at: https://group.vattenfall.com/uk/contentassets/c65a13553f864f599431d69c8c6a57b4/auk-tagging-final-report-january-2023.pdf [Accessed: March 2024].

Wade H.M., Masden. E.A., Jackson, A.C. & Furness, R.W. (2016). Incorporating data uncertainty when estimating potential vulnerability of Scottish seabirds to marine renewable energy developments. *Marine Policy*, 70, pp. 108 – 113.

Waggit, J.J., Evans, P.G.H., Andrade, J., Banks, A.N., Boisseau, O., Bolton, M., Bradbury, G., Brereton, T., Jan Camphuysen, C., Durinck, J., Felce, T., Christiaan Fijn. R., Garcia-Baron, I., Garthe, S., Geelhoed, S.C.V., Gilles, A., Goodall, M., Haelters, J., Hamilton, S., Hartny-Mills, L., Hodgins, N., James, K., Jessopp, M., Kavanagh, A.S., Leopold, M., Lohrengel, K., Louzao, M., Markones, N., Martínes-Cedeira, J., Cadhla, O.Ó., Perry, S.L., Pierce, G.J., Ridoux, V., Robinson, K.P., Begonña Santos, M., 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. (2020). Distribution maps of cetacean and seabird populations in the North-East Atlantic. *Journal of Applied Ecology*, 57, pp. 253 – 269.

Wakefield, E.D., Owen, E., Baer, J., Carroll, M.J., Daunt, F., Dodd, S.G., Green, J.A., Guilford, T., Mavor, R.A., Miller, P.I., Newell, M.A., Newton, S.F., Robertson, G., Shoji, A., Soanes, L.M., Votier, S.C., Wanless, S. & Bolton, M. (2017). Breeding density, fine-scale tracking, and large-scale modelling reveal the regional distribution of four seabird species. *Ecological Applications*, 27 (7), pp. 2074 – 2091.

Wanless, S., Frederiksen, M., Daunt, F., Scott, B.E. & Harris, M.P. (2007). Black-legged kittiwakes as indicators of environmental change in the North Sea: evidence from long-term studies. *Progress in Oceanography*, 72(1), pp.30 – 38.

Wanless, S., Harris, M. P., Newell, M. A., Speakman, J. R. & Daunt, F. (2018). Community-wide decline in the occurrence of lesser sandeels (*Ammodytes marinus*) in seabird chick diets at a North Sea colony. *Marine Ecology Progress Series*, 600, pp. 193 – 206.

Wanless, S., Harris, M.P. & Murray, S. (2023). *Northern Gannet Morus bassanus*. In: Burnell, D., Perkins, A.J., Newton, S.F., Bolton, M., Tierney, T.D. and Dunn, T.E. (2023). Seabird Count: a census of breeding seabirds in Britain and Ireland (2015 – 2021). Lynx Nature Books.

Wildfowl & Wetlands Trust (Consulting) Ltd (WWT). (2014). *Strategic assessment of collision risk of Scottish offshore wind farms to migrating birds*. Scottish Marine and Freshwater Science Report Vol 5 No 12. Published by Marine Scotland Science ISSN: 2043-7722.

Woodward, I., Thaxter, C. B., Owen, E. & Cook, A.S.C.P. (2019). *Desk-based revision of seabird foraging ranges used for HRA screening*. BTO research report number 724.

Woodward. I. D., Franks. S., Bowgen. K., Davies. J. G., Green. R. M. W., Griffin. L. R., Mitchell. C., O'Hanlon. N., Pollock. C., Rees. E. C., Tremlett. C., Wright. L. & Cook, A. S. C.P (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. October 2023. 571pp.