TotalEnergies E&P North Sea UK Ltd

Culzean - Floating Offshore Wind Turbine Pilot Project

Environmental Impact Assessment Report – Chapter 11 - Ornithology

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REVISIONS & APPROVALS

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GLOSSARY

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

ACRONYMS AND ABBREVIATIONS

ACRONYM/ABBREVIATION	DEFINTIION
AOWFL	Aberdeen Offshore Wind Farm Ltd
BDMPS	Biologically Defined Minimum Population Scales
BTO	British Trust for Ornithology
CAA	Civil Aviation Authority
CNS	Central North Sea
CRM	Collision Risk Modelling
CV	Coefficient of Variation
DAS	Digital Aerial Survey
DTU	University of Denmark
EEA	European Economic Area
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMP	Environmental Management Plan
ERRV	Emergency Response and Rescue Vessel
HPAI	Highly Pathogenic Avian Influenza
HRA	Habitats Regulations Appraisal
INNS	Invasive Non-Native Species
km	Kilometre
km^2	Kilometres Squared
m	Metres
MARPOL	International Convention for the Prevention of Pollution from Ships
MASTS	Marine Alliance for Science and Technology for Scotland
MCA	Maritime and Coastguard Agency
MD-LOT	Marine Directorate – Licensing Operations Team

ACRONYM/ABBREVIATION	DEFINTIION
MMFR	Mean Maximum Foraging Range
MMFR+1SD	Mean Maximum Foraging Range plus 1 Standard Deviation
MSL	Mean Sea Level
MW	Megawatt
NS	North Sea
PDE	Project Design Envelope
PEMP	Project Environmental Monitoring Plan
R&D	Research and Development
RIAA	Report to Inform Appropriate Assessment
RSPB	Royal Society for the Protection of Birds
SAR	Search and Rescue
SD	Standard Deviation
SNCB	Statutory Nature Conservation Body
SPA	Special Protection Area
TEPNSUK	TotalEnergies Exploration and Production North Sea UK Limited
UK	United Kingdom
UKCS	United Kingdom Continental Shelf
VMP	Vessel Management Plan
WTG	Wind Turbine Generator
ZoI	Zone of Influence

11 ORNITHOLOGY

11.1 Introduction

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

There is now a large body of theoretical and empirical information on the potential effects of offshore wind developments on seabird populations to. Concerns have focussed on the potential for flying seabirds to be killed by collision with turbine rotor blades, habitat displacement and barrier effects and the potential for birds to be disturbed by wind farm vessels.

In comparison to other offshore wind developments in Scotland, the Project is highly unusual from a ornithological perspective in two respects. First, it consists of a single modest-sized wind turbine only (compared to the vast majority of offshore wind applications which consider larger numbers of turbines), and second it is located very far offshore, approximately 222 km from the nearest coastline. Both these features of the Project greatly reduce the potential for impacts on seabirds compared to large scale developments closer to the coast. For example, the large distance from seabird breeding colonies means that in the breeding season months, the Project Area lies beyond the usual foraging range of many (but not all) of the seabird species breeding along the east coast of Scotland. Indeed, the programme of baseline surveys undertaken to inform the Project's EIA, recorded only a limited range of common seabird species and these were generally present in rather low densities, especially in the breeding season. The only exceptions to this were the relatively large numbers of common guillemot and razorbill recorded in the early part of the non-breeding season.

Atlantic Ecology Ltd have drafted and carried out the impact assessment. Further competency details of the Project Team including lead authors for each chapter are provided in Chapter 1: Introduction. Table 11-1 below provides a list of all the supporting studies which relate to and should be read in conjunction with the Ornithology impact assessment.

Table 11-1 Supporting studies

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

DETAILS OF STUDY	LOCATIONS OF SUPPORTING STUDY
Atlantic Ecology Displacement Analysis and Collision Risk Modelling for the Culzean Floating Offshore Wind Pilot Project	Appendix H: Displacement Analysis and Collision Risk Modelling

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

11.2 Legislation, policy and guidance

The following legislation, policy and guidance are relevant to the assessment of impacts from the Project on Ornithology:

11.2.1 Legislation

Birds are afforded varying levels of protection under international and national legislation. Within UK waters, birds are protected through the following:

- Convention for the Protection of the Marine Environment of the North-East Atlantic (the 'OSPAR Convention')
- The Wildlife and Countryside Act 1981 (as amended);
- The Conservation (Natural Habitats, &c.) Regulations 1994 (Scottish Government, 1994) (as amended);
- The Conservation of Habitats and Species Regulations 2017 (HM Government, 2017) (as amended);
- The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019;
- Conservation of Offshore Marine Habitats and Species Regulations 2017;
- Marine and Coastal Access Act (MCAA) 2009 (HM Government, 2009).

11.2.2 Policy and Guidance

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

- UK Marine Policy Statement (MPS) (HM Government, 2011);
- Scottish National Marine Plan (2015) (Scottish Government, 2015);
- NatureScot (2018). Environmental Impact Assessment Handbook. V5;
- NatureScot Guidance to support Offshore Wind Applications: Marine Ornithology. Guidance Notes 1 to 11;
- Joint Statutory Nature Conservation Bodies (SNCB) Interim Displacement Advice Note (SNCB, 2022); and
- CIEEM (2018). Guidelines for Ecological Impact Assessment in Britain and Ireland: Marine and Coastal. Winchester, Institute of Ecology and Environmental Management.

11.3 Scoping and consultation

Stakeholder consultation has been ongoing throughout the 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 Scoping Report was submitted to Scottish Ministers (Via Marine Directorate – Licensing Operations Team (MD-LOT)), on 14th April 2023, who then circulated the report to relevant consultees. The Scoping Opinion was received on 20th July 2023. Relevant comments from the Scoping Opinion and other consultations specific to ornithology are provided in Table 11-2 below, which provides a high-level response on how these comments have been addressed within the EIAR.

Further pre-application consultation with NatureScot was undertaken on the 29th January 2024, primarily in relation to the scope of assessment conducted under the Habitats Regulations. Nonetheless, specific advice received from NatureScot following this consultation, which is relevant to the EIA, is also detailed below in Table 11-2. .

Table 11-2 Summary of consultation responses specific to Ornithology

CONSULTEE	COMMENT	RESPONSE
Scoping Opinion		
Scottish Ministers (Via MD-LOT) & NatureScot	Section 7.4.1 of the Scoping Report provides information on the scope of the Study Area, with a focus on the foraging ranges of seabirds during breeding season only. The Scottish Ministers advise the Developer to consider the inclusion of the non-breeding season, as well as other marine bird species. This is in line with the NatureScot representation.	The characterisation of the existing ornithology baseline presented in Section 11.5.2.2 includes consideration of seabird non-breeding season and the occurrence of overflying migratory landbirds. The detailed impact assessments undertaken for collision risk and disturbance/displacement include consideration of the non-breeding season.
	The Scottish Ministers agree with the approach detailed in Section 7.4.5 of the Scoping Report to use the mean-maximum range of +1 Standard Deviation to obtain theoretical connectivity and highlight the NatureScot guidance note 3 which specifies the recommended foraging range values, as well as the three key exceptions to the recommended ranges.	Noted, NatureScot Guidance Note 3 foraging ranges (as devised from Woodward *et al.*, 2019) have been used to assess theoretical connectivity for the Project within this Chapter and within the Combined HRA Screening and RIAA Report, submitted alongside this application (Document Reference GB-CZN-00-XODUS-000023).
	The Scottish Ministers are broadly content with the data sources in Table 7-13 however, advise the Developer to include additional reports identified by NatureScot in its representation. Once available, the Developer should also utilise the updated Wildfowl and Wetlands Trust and MacArthur Green (2014) report and the stochastic migration collision risk modelling ("CRM") tool and undertake quantitative assessment of risks to migratory special protection area ("SPA") species. However, if there is no overlap in migration fronts, the quantitative migratory CRM is not required and can instead be assessed qualitatively. This is supported by the NatureScot representation.	Examination of Wildfowl and Wetlands Trust and MacArthur Green (2014) report indicates that wildfowl and wader species that migrate across the North Sea (and potentially through the Project Area) do so on migration fronts of between approximately 250 and 550 km wide (depending on species). It is not plausible that a single WTG with a rotor diameter of 112 m could pose more than a negligible collision risk to populations of these migratory wildfowl and wader species. Therefore, no detailed assessment of the potential for collision risk from the Project to these receptors is undertaken.

CONSULTEE	COMMENT	RESPONSE
	Regarding baseline characterisation, the Scottish Ministers advise the Developer to consider the NatureScot representation. Additionally, concerning establishing SPA connectivity, the NatureScot representation must be fully addressed by the Developer in the EIAR. The Developer should prepare and submit a Habitats Regulations Appraisal to determine theoretical connectivity prior to submission of the EIAR, for consideration by NatureScot and the Scottish Ministers.	Draft HRA Screening results and approach to the assessment were discussed with NatureScot on 29 January 2024. The final Combined HRA Screening and RIAA Report (Document Reference GB-CZN-00-XODUS-000023) has been submitted alongside this application. Full details of the advice provided from NatureScot in relation to this consultation are discussed in detail below.
	The Scottish Ministers, in line with the NatureScot representation, broadly agree with the impacts proposed to be scoped in and out of the assessment, as detailed in Table 7-16 of the Scoping Report. However, in the absence of 12 months of digital aerial surveys, the Scottish Ministers advise that vessel activity, construction noise, lighting, and the presence of the WTG leading to the disturbance or displacement of species cannot be scoped out of the EIAR and must be scoped in.	The potential for disturbance/displacement during all phases of the Project are assessed in detail in Section 11.9 following SNCB recommended methods.
	The Scottish Ministers further advise that the transboundary impacts should remain scoped in to the EIAR, in line with the NatureScot representation.	The potential for transboundary effects is considered in in Section 11.13.
	The Scottish Ministers, in line with the NatureScot representation, are content with the cumulative impact approach outlined in 7.4.10 of the Scoping Report and encourage the use of the Cumulative Effects Frameworks.	The Cumulative Effects Framework is not currently available for use. Through EIA Scoping it was agreed that detailed cumulative impact assessment would be limited to species receptors for which for the predicted collision risk for the Project in isolation exceeds one collision death per annum. Collision rate modelling predicts well below one collision death per year for all species as such a detailed cumulative assessment has not been undertaken, as shown in Section 11.11.
	Regarding the impact assessment approach, the Scottish Ministers advise that the impact on seabird populations in Scotland from Highly Pathogenic Avian Influenza is still under review and the impact from the mass mortality cannot yet be quantified. In line with the NatureScot representation, NatureScot will be able to provide more detail and advice on this as it develops.	In the absence of guidance, the effects of HPAI on seabird receptors has been incorporated into to the EIA assessment by factoring in additional sensitivity for relevant species. In particular, to reflect the recent high HPAI mortality at North Sea gannet colonies, the gannet receptor is rated as having 'High' rather than 'Medium' sensitivity with respect to potential collision mortality.

CONSULTEE	COMMENT	RESPONSE
	The Scottish Ministers, in line with the NatureScot representation, are content with the mitigation measures outlined in Table 7-15 of the Scoping Report, however, advise that further details on these should be provided in the EIAR.	Details of mitigation relevant to bird receptors is described in Section 11.8.
Relevant advice received following consultation with NatureScot on HRA Screening (29th January 2024)		
NatureScot	Ornithology We have reviewed the Culzean Ornithological and Marine Mammal Baseline Characterisation Surveys Final Report (version 1.2, provided by email on 17 January 2024). Due to the scale of the project and the generally low numbers of birds present we consider a single year of surveys to be adequate. Our advice on the final Digital Aerial Survey (DAS) findings and Baseline Characterisation Surveys Final Report is provided in Annex 1 of this letter. At the meeting on 29 January slides were presented showing the approach taken for HRA screening for ornithology. Slides 9 to 13 included information on bird densities and collision risk modelling (CRM) used to inform the approach - with regard to these slides we note the following: • Slide 11 presented the conclusions from CRM. We note that rates used were different from those in our Guidance Note 7 we advise all input parameters are checked to ensure those identified in our guidance are used. • A matrix table is used to consider potential connectivity and determine LSE (as per slide 12). This approach to screening LSE using a matrix is not an approach we endorse. Please see our published suite of ornithology guidance notes 'Guidance to Support Offshore Wind Applications: Marine Ornithology' which is available online for further information.	Noted. CRM has been updated within the assessments to ensure alignment with the recommended avoidance rates specified in the NatureScot guidance. See Appendix H, of the EIAR for details. The contingency table used to provisionally assess the potential strength of theoretical breeding season connectivity to SPA breeding colonies has been simplified in accordance with NatureScot guidance. Potential impact pathways and site utilisation (based on APEM baseline DAS results) are also taken into consideration in screening for LSE, as per NatureScot guidance. See the Combined HRA Screening and RIAA Report (Document Reference GB-CZN-00-XODUS-000023) which has been submitted alongside this application.
NatureScot	Non-breeding season – Guillemot Guillemot numbers recorded in the Baseline Characterisation Surveys Final Report were high in the non-breeding season, especially in October with a peak abundance of 4677 birds.	Noted, no further response required.
NatureScot	Non-breeding season – Guillemot: EIA requirements A basic displacement assessment using the UK North Sea & Channel BDMPS population, without SPA apportionment, should be presented with justification for any conclusions	Noted, a basic displacement assessment of non-breeding season impacts on guillemot have been considered in this EIA Chapter within Section 11.9.1 and Section 11.9.2, in line with the advice provided.

CONSULTEE	COMMENT	RESPONSE
NatureScot	Non breeding season – Razorbill: EIA requirements Razorbill are present throughout the non-breeding season with a peak abundance in October of 289 birds. As such, we advise a basic displacement assessment using the UK North Sea & Channel BDMPS population should be presented with justification for any conclusions.	Noted, a basic displacement assessment of non-breeding season impacts on razorbill have been considered in this EIA Chapter within Section 11.9.1 and Section 11.9.2, in line with the advice provided.
NatureScot	Annex 1: NatureScot advice on Ornithological and Marine Mammal Baseline Characterisation Surveys Final Report – Culzean Platform We have reviewed the Ornithological and Marine Mammal Baseline Characterisation Surveys Final Report (project reference: P00010265, version: 12/01/24, V1.2) and provide advice below.	Noted, the advice below has been considered where appropriate.
NatureScot	Ornithology: Methodology • APEM were contracted to carry out Digital Aerial Surveys (DAS), their standard practices have been followed which are generally acceptable. We have the following comments: • A full year of monthly surveys have been carried out, with no missed months. The dates, timings and weather conditions were all appropriate. • Due to the scale of the project and the generally low numbers of birds/species present we consider a single year of surveys to be adequate. • 10% of data has been analysed - this is at the lower limit of our requirements. • Within the analysis presented, unidentified birds have been apportioned and availability bias for auks has been included. Density estimates are design-based. As bird numbers are generally low it would not be possible to use a model-based, MRSea, approach. • Flight heights have been calculated from the survey data, current generic data from Johnston et al (2014) are also presented, which we recommend. APEM acknowledge that the sample size of suitable flying birds captured within these surveys is small and unlikely to be indicative of the wider population, therefore limiting the usability of the calculated flight heights. • Seasonal definitions do not follow our guidance note.	Noted, in terms of the seasonality definitions, within this report, the breeding seasons for all species, with the exception of guillemot and razorbill, has been aligned with NatureScot (2020) *Guidance Note 9: Guidance to support Offshore Wind Applications: Seasonal periods for Birds in the Scottish Marine Environment*. For both razorbill and guillemot, the month of August has been omitted from the breeding season, as at the time of the survey during this month, both species have long since vacated their colonies.

CONSULTEE	COMMENT	RESPONSE
NatureScot	Survey results The number of species present and the number of birds recorded were generally low, this is not unexpected for a project so far offshore (222km east of the Scottish coastline). The most abundant species recorded were guillemot, fulmar, razorbill, great-black backed gull and kittiwake. There was a notable peak in guillemot numbers in October/November. We note that a survey of breeding birds on the Culzean platform was carried out in July 2023 (Culzean Ornithology Surveys 2023, Document Number: A-303826-S00-A-REPT-001). Surveys took place across three days in mid-July and no nesting birds were found.	Noted, abundance densities for key species sighted within the APEM DAS and Culzean Platform Surveys are summarised in Section 11.5.2.

In line with the Scoping Opinion, aspects relevant to ornithology scoped out for further assessment in this EIAR include:

- Potential change to seabird prey availability (e.g., small fish and squid);
- Potential increase in suspended sediment, leading to reduced visibility and potential for reduced seabird foraging success; and
- Potential accidental release of pollutants, leading to lethal and sub-lethal effects on seabirds.

11.4 Study Area

The Ornithology Study Area is defined at two at two spatial scales.

- At the smaller scale is the location of the proposed WTG and its nearby surrounds used to characterise baseline conditions by the one-year DAS survey undertaken by APEM (Appendix F), this is referred to as the Culzean Survey Area in this chapter (see Figure 11-1). The Culzean Survey Area covered 134 km^2 and was defined by a 4 km buffer around the proposed turbine location and the nearby Culzean platforms, in line with best practise of offshore windfarm bird surveys. The centre of the Culzean Survey Area lies approximately 222 km off the coast of Aberdeenshire; and
- A much larger wider area defined by the breeding season foraging ranges of the seabird species that commonly utilise the Culzean site. For practical purposes this wider Study Area translates to marine areas and coasts up to approximately 500 km of the Culzean site (for example the Mean Maximum Foraging Range plus 1SD (MMFR+1SD) for gannet is 509 km (Woodward *et al*, 2019)). This effectively takes in the coastlines of north-east England, eastern and northern Scotland, Orkney and Shetland, together with the whole of the central part of the North Sea as far as the coast of southern Norway, as shown in Figure 11-2.

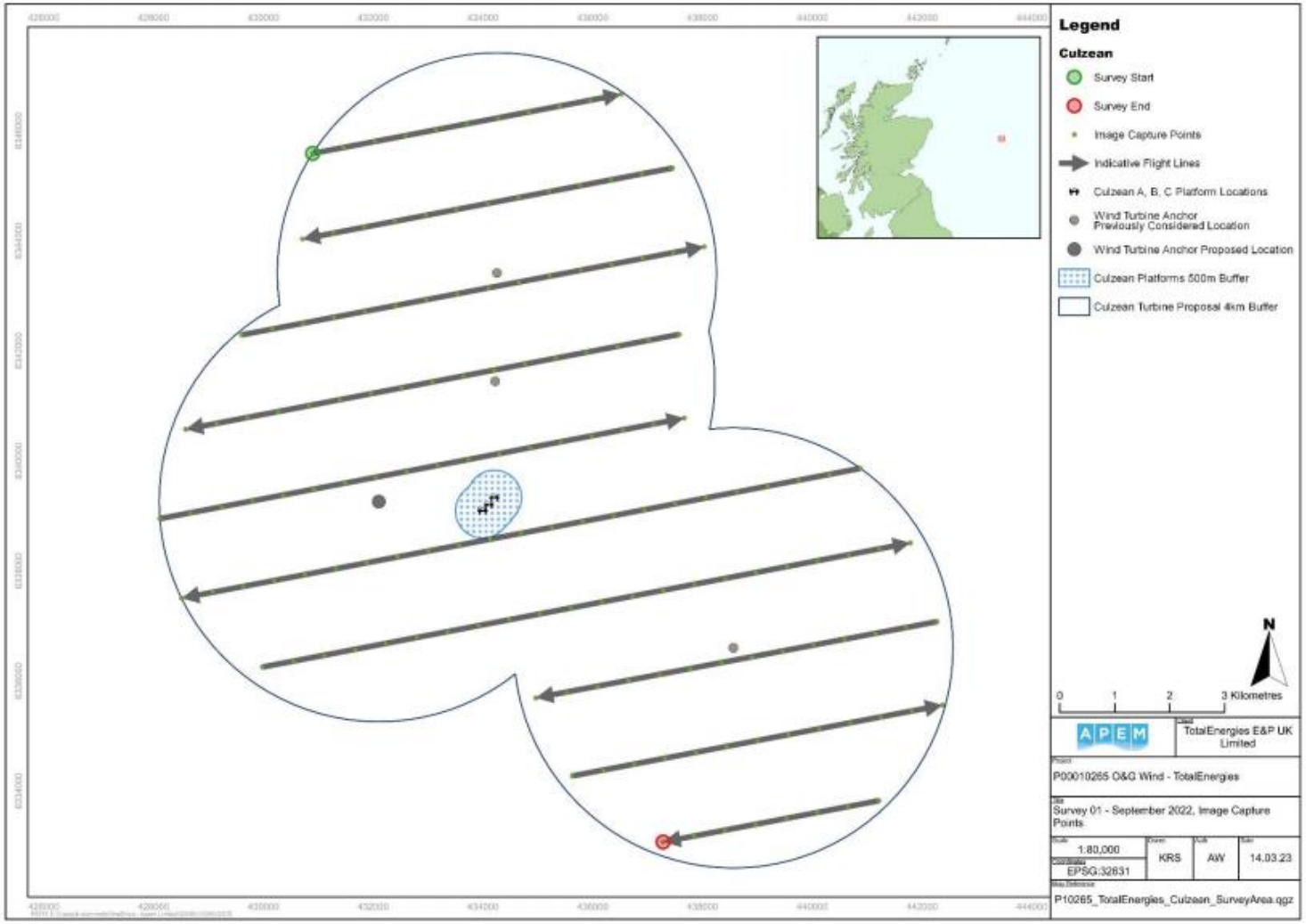

Figure 11-1 DAS aircraft flight lines and image capture points for the Culzean Survey Area (APEM, Appendix F)

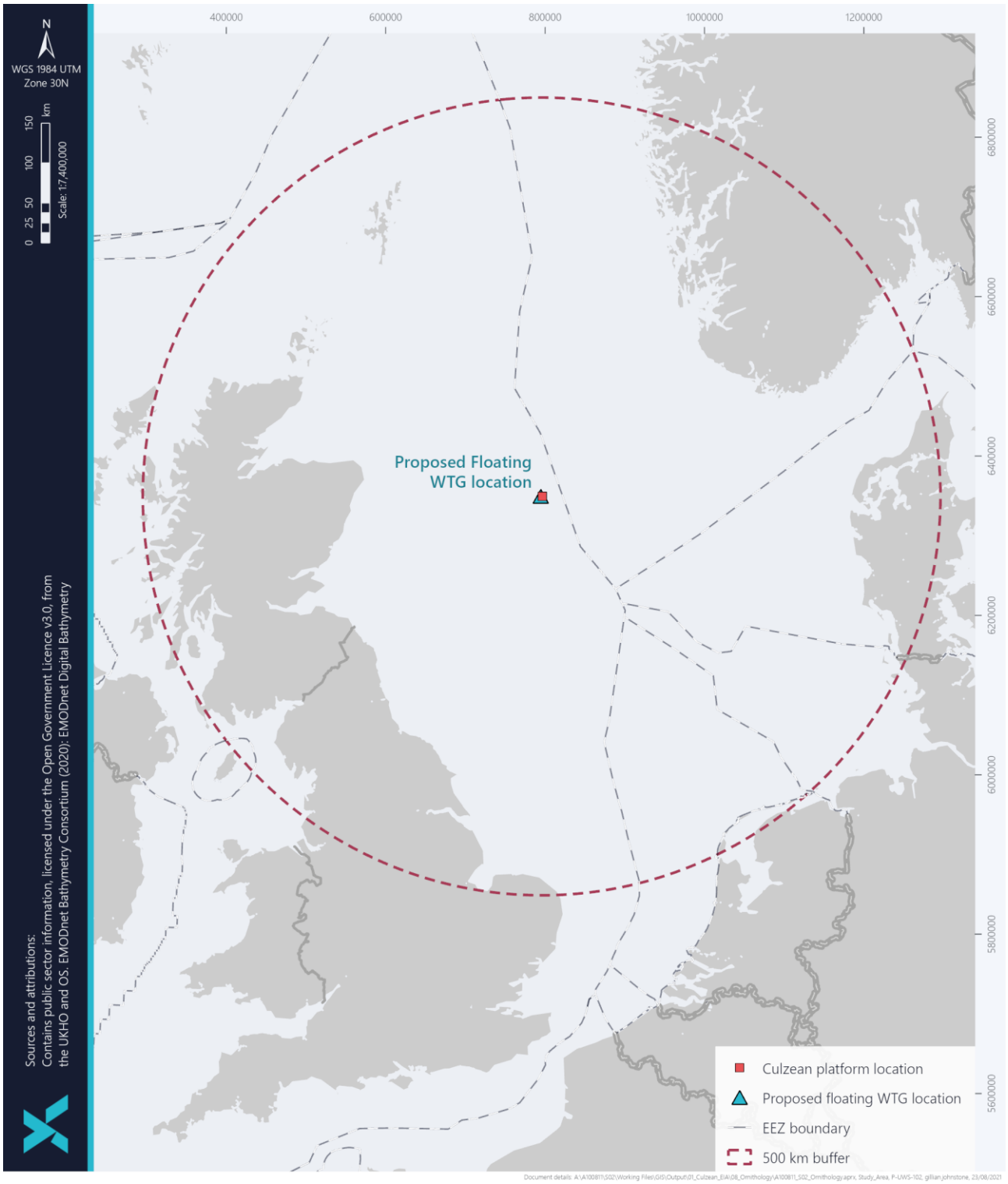

Figure 11-2 Larger Ornithology Study Area

11.5 Baseline Environment

This Section assesses the ornithology receptors that may be present within the Study Area. To understand habitat use by birds within the Study Area a desk-based review of available data has been undertaken. The data are supplemented by site-specific aerial surveys. The output of this review is presented in the sections below.

11.5.1 Data sources

The existing data sets and literature with relevant coverage to the Project, which have been used to inform the baseline characterisation for Ornithology are outlined in Table 11-3 Summary of key datasets and reports.

Table 11-3 Summary of key datasets and reports

TITLE	SOURCE	YEAR	AUTHOR
An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs.	JNCC Report No. 431;	2010	Kober et al.
Seabirds Count - A census of breeding seabirds in Britain and Ireland (2015–2021)	Lynx Publications	2023	Burnell *et al.*
Desk-based revision of seabird foraging ranges used for HRA screening.	BTO Research Report No. 724	2019	Woodward *et al.*
Distribution maps of cetacean and seabird populations in the North-East Atlantic.	Journal of Applied Ecology 57: 253-269	2020	Waggitt *et al.*
Assessing vulnerability of marine bird populations to offshore wind farms.	Journal of Environmental Management 119 (2013) 56-66.	2013	Furness, Wade and Masden.
Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS).	Natural England Commissioned Report	2015	Furness
Important Bird Areas for seabirds in the North Sea. Sandy, UK: RSPB.	BirdLife International	1995	Skov *et al.*
The Migration Atlas: movements of the birds of Britain and Ireland.	BTO (published by T. & A.D. Poyser, London)	2002	Wernham *et al.*

11.5.2 Project site-specific surveys

11.5.2.1 APEM DAS surveys

A one-year DAS study was undertaken of the Culzean Survey Area between October 2022 and September 2023 (Appendix F), with 13 survey visits completed. The purpose of the DAS study was to provide baseline information on the abundance, distribution and behaviour of birds and marine mammals within the defined Culzean Survey Area. The survey design followed current NatureScot Guidance Note 2 (NatureScot, 2023) for offshore windfarm aerial bird surveys. It comprised a series of 10 parallel transect lines regularly spaced across the Survey Area. The survey method was designed to optimise the data collection for all bird and marine mammal species using a grid-based survey design. Still imagery with 1.5-centimetre (cm) resolution was collected using cameras mounted on an aircraft flying at an altitude of approximately 395 m and a speed of approximately 120 knots. A total image-captured coverage of 48% was achieved, with all images spatially referenced by associate GPS measurements.

In keeping with normal practice, a representative selection of images (approximately 155 images for each survey) were later selected for examination to identify and count birds and other fauna. The selected images corresponded to slightly over 10% coverage of the Survey Area. The total number of each bird species seen on each survey visit was determined together with information of behaviour (e.g., sitting on the sea or flying, and flight direction). For each survey visit, species-specific abundance and density estimates for Culzean Survey Area were calculated, with upper and lower confidence limits and precision (Coefficient of Variation; CV). Maps showing the distribution of each species across the Culzean Survey Area were also produce based on the geo-referenced locations of individual birds contained within each analysed digital still image.

Full details of the APEM DAS, including the seabird species distribution maps, are presented in Appendix F: *Ornithological and Marine Mammal Baseline Characterisation Surveys (2024)*. A summary of the results is presented in the description of the existing baseline in Section 11.5.3.

11.5.2.2 Culzean platform survey

Xodus undertook a bird census on the Culzean platforms for three days in July 2023 (18 – 20 July 2023) in order to identify which species utilise the asset. The purpose of the survey was to locate potential nest sites or bird hotspots (areas of increased bird activity – identified by large amounts of guano, food remains and or roosting sites). Each accessible deck was systematically studied over the three days. Full details of the Culzean Platform Surveys is provided in Appendix G: *Culzean Topsides Ornithology (Nesting Bird) Surveys (2023)*. A summary of the results is presented in the description of the existing baseline in Section 11.5.3.2.

11.5.3 Existing baseline

11.5.3.1 Bird utilisation within the Study Area

The description below of the existing baseline Ornithology describes the range species of that utilise the Project Area and their abundance and is primarily based on the results of the one-year DAS study (Appendix F). Additional information on the seabird distribution and abundance in the central North Sea, and on relevant seabird receptor populations and connectivity to breeding colonies is taken from published literature (see Table 11-3). A summary of the Culzean platform census surveys is also provided (see full report in Appendix G).

The DAS showed that the Project Area is regularly used by only seven species: fulmar, gannet, kittiwake, great black-backed gull *Larus marinus*, herring gull *Larus argentatus*, common guillemot and razorbill. Typically, these species occurred at very low or low densities (Table 11-4 and Table 11-5), for example compared to densities reported from coastal waters off eastern Scotland (e.g., Kober *et al*., 2010). However, outside the breeding season common guillemot and razorbill were sometimes present in reasonably high densities (Table 11-5). A number of other species were also occasionally recorded in the DAS study: puffin (2 birds recorded in November), tern species (1 bird recorded in June) and shearwater species (1 bird recorded in October).

Although most individuals recorded from the surveys were identified to species level, a number remained identified to group level only. These groups were:

- Guillemot / razorbill
- Shearwater species
- 'Commic' tern

To account for unidentified individuals, the monthly abundance/density estimates for common guillemot and razorbill include an attribution for birds identified to the group level 'common guillemot/razorbill' using the method proposed by Maclean *et al.* (2009). This is based upon an apportionment of the group level identified individuals between those species within that group that were identified to species level within each individual monthly abundance estimate. The number of unidentified individuals in a group is proportioned to the specific species that are contained within that group based on the relative abundance of the positively identified species in that month's survey.

The results of the DAS study survey generally show a high degree of similarity with published estimates of seabird densities for this part of the North Sea (e.g. Skov *et al*., 1995; Kober *et al.* 2010; Waggit *et al*., 2020). The density of guillemots recorded in Survey Area during the autumn months (October to December) was relatively high but within expectations. For example the density distribution maps produced by Kober *et al.* (2010) indicate that localised hot-spots of relatively high guillemot density occur in the central North Sea in the non-breeding months. It is likely that these hot-spots of are transitory (lasting a week or a few months only) aggregations driven by spatial variation in prey availability, and that the location of hot-spot changes both through a non-breeding period and year-to year. It is also relevant to point out that that common guillemot is by far the most abundant seabird species utilising the North Sea, and therefore it is not surprising that densities of this species tend to be higher than those of other species.

The level of DAS survey effort was insufficient to detect seabird species that only rarely use the Culzean Survey Area. Based on breeding season seabird foraging range metrics (Woodward *et al*., 2019), results from other survey work (Kober *et al*., 2010; Waggit *et al*., 2020; Burnell *et al*., 2023) and information of seabird movements (Wernham *et al*., 2003) it is likely that a few other seabird species occasionally use the Culzean Survey Area in small numbers, but at well below the level of use that would give rise to potential EIA impact concerns. These include great skua *Stercorarius skua* (breeding season and passage), European storm-petrel *Hydrobates pelagicus* (breeding season and passage) and little auk *Alle alle* (winter). The seabed depth at the Project Area is approximately 90 m, a depth which is well beyond the reach of diving seabird species that target benthic and demersal habitats for foraging.

The only surface features in the vicinity of the Study Area are the three Culzean platforms, located approximately 2 km to the east of the proposed WTG location.

Although no landbird species (e.g., passerines, shorebirds and wildfowl) were recorded in the DAS study, as with any location in the North Sea, the Project Area will be overflown by a wide range of land birds that cross the North Sea on their migration flights, especially at night. These migrant land birds deploy a broad-front migration strategy when crossing the North Sea (Wernham *et al.*, 2002; Wildfowl and Wetlands Trust, 2014) and therefore it is not likely that the flux of migrating land birds would be disproportionately concentrated in the vicinity of the Project.

The close proximity (approximately 2 km) of the Project Area to the operational Culzean platforms means that under baseline conditions the Project Area is subject to regular activity by rig supply vessels (mostly operating out of Aberdeen) and helicopters servicing the platform. These activities will mean that under baselined conditions seabirds using the vicinity of the Project will experience potential disturbance and displacement effects from these platform-operation activities.

Table 11-4. Baseline utilisation of the Project Area during the seabird breeding season based on the results DAS survey (Appendix F). Estimates of density and abundance within the 2 km buffer around the WTG are derived from the numbers of birds recorded in flight and sitting on the sea in the wider Culzean Survey Area. Abundance values are rounded to nearest integer value.

SPECIES	ESTIMATED PEAK DENSITY (Birds/km^2)	ESTIMATED PEAK ABUNDANCE WITHIN 2 KM BUFFER (No. birds)	ESTIMATED AVERAGE DENSITY (Birds/km^2)	ESTIMATED AVERAGE ABUNDANCE WITHIN 2 KM BUFFER (No. birds)	ESTIMATED ABUNDANCE/ DENSITY CATEGORY*
Fulmar	1.29	16	0.31	4	Low
Gannet	0.13	2	0.03	<1	Negligible
Kittiwake	0.25	3	0.13	2	Low
Great b-b. gull	0.19	2	0.06	<1	Very Low
Herring gull	*Not Recorded*				Negligible
Common Gull	0.13	2	0.03	<1	Negligible
Common guillemot	1.26	16	0.62	8	Moderate
Razorbill	0.07	1	0.02	<1	Negligible
Puffin	*Not Recorded*				Negligible
Arctic/common tern	0.06	1	0.012	<1	Negligible
Unidentified shearwater species	*Not Recorded*				Negligible

Average density across breeding season:
***Negligible** = Not Recorded- <0.05/km^2; **Very Low** = 0.05-0.1/km^2; **Low** = 0.1 -0.5/km^2; **Moderate** = 0.5-5/km^2; **High** = >5/km^2*

Table 11-5. Baseline utilisation of the Project Area during the seabird non-breeding season based on the results DAS survey (Appendix F). Estimates of density and abundance within the 2 km buffer around the WTG are derived from the numbers of birds recorded in flight and sitting on the sea in the wider Culzean Survey Area. Abundance values are rounded to nearest integer value.

SPECIES	ESTIMATED PEAK DENSITY (Birds/km^2)	ESTIMATED PEAK ABUNDANCE WITHIN 2 KM BUFFER (No. birds)	ESTIMATED AVERAGE DENSITY (Birds/km^2)	ESTIMATED AVERAGE ABUNDANCE WITHIN 2 KM BUFFER (No. birds)	ESTIMATED ABUNDANCE/ DENSITY CATEGORY*
Fulmar	0.31	4	0.14	2	Low
Gannet	not recorded				Negligible
Kittiwake	0.13	2	0.02	<1	Negligible
Great b-b. gull	0.19	2	0.11	1	Low
Herring gull	0.19	2	0.05	1	Very low
Common gull	*Not recorded*				Negligible
Common Guillemot	21.7	273	5.96	75	High
Razorbill	1.11	14	0.25	3	Low
Puffin	0.15	2	0.02	<1	Negligible
Arctic/common tern	*Not recorded*				Negligible
Unidentified shearwater species	0.07	1	0.012	<1	Negligible

Average density across breeding season:
***Negligible** = Not Recorded- <0.05/km^2; **Very Low** = 0.05-0.1/km^2; **Low** = 0.1 -0.5/km^2; **Moderate** = 0.5-5/km^2; **High** = >5/km^2*

Table 11-6. Definition and size of seabird receptor populations

SPECIES	BREEDING SEASON		NON-BREEDING PERIOD	
	REGIONAL POPULATION[1] (NO. ADULTS)	DEFINITION, NO. BREEDING WITHIN SPECIFIED FORANGING DISTANCE FROM CULZEAN[2]	BDMPS POPULATION[3] (NO. BIRDS)	DEFINITION, NO. OF BIRDS IN SPECIFIED BDMPS MARINE AREA
Fulmar	517,290	MMFR (542 km)	957,502 568,736	UK North Sea (Sept – Mar, excl. Nov) (Nov)
Gannet	333,914	MMFR+1SD (509 km)	248,385	UK North Sea & Channel (Dec-Mar)
Kittiwake	125,882	MMFR+1SD (301 km)	829,937 627,816	UK North Sea (Aug-Dec) (Jan-Apr)
Great black-backed gull	Does not breed within MMFR+1SD	MMFR+1SD (73 km)	91,299	UK North Sea (Sept-Mar)
Herring gull	Does not breed within MMFR+1SD	MMFR+1SD (86 km)	466,511	North Sea & Channel (Sept-Mar)
Common guillemot	Does not breed within MMFR+1SD	MMFR+1SD (154 km)	1,617,306	North Sea & Channel (Aug-Feb)
Razorbill	Does not breed within MMFR+1SD	MMFR+1SD (165 km)	591,874 218,622	North Sea & Channel (Aug-Oct & Jan-Mar) (Nov-Dec)
Puffin	846	MMFR+1SD (265 km)	231,957	North Sea & Channel (Aug-Mar)

11.5.3.2 Culzean Platform Nesting Bird Survey

A bird census was undertaken by a trained ornithologist on the Culzean platforms in July 2023 over a period of three days to identify which bird species utilise the asset and to locate potential nest sites. Each accessible deck was systematically studied over the three days.

The Culzean Platform survey showed that small numbers of great black-backed gull were utilising the Culzean platform for resting. Nonetheless, no evidence was found during the surveys of nesting on the platforms by great black backed gull or any other bird species.

No other species of bird were recorded on the platforms during the survey period. One passerine was noted but not identified due to distance. Given the timing of the survey, it is not expected that migrant birds would be present on the platforms during the survey period.

[1] *Numbers of breeding adults in regional population are derived from Seabird Counts census summary data (Burnell, 2023).*
[2] *Breeding season foraging ranges are taken from 'Desk-based revision of seabird foraging ranges used for HRA screening' (Woodward et al., 2019).*
[3] *Non-breeding population size and definition taken from 'Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS).' (Furness, 2015).*

Full details of the survey are provided within the EIAR; Appendix G: Culzean Topsides Ornithology (Nesting Bird) Surveys (2023), submitted alongside the application.

11.5.3.3 Connectivity to Breeding Colonies

This extreme remoteness of the Project from the nearest land (well over 200 km) has a profound effect on the number of seabird species that occur there and their abundance. This is especially so during the seabird breeding season when adult seabirds are spatially constrained by the need to attend coastal breeding colonies. For example, for many seabird species, the Project Area lies further from the nearest breeding colonies than their typical breeding season upper foraging range distance (Woodward *et al.*, 2019). NatureScot recommends use of the MMFR+1SD in EIA assessments to define breeding season receptor population size and to estimate theoretical connectivity between breeding colonies and a development site (NatureScot, 2023a; 2023b; 2023c). The Project Area lies within the NatureScot approved MMFR+1SD distances (Woodward et al., 2019) for fulmar Fulmarus glacialis, gannet *Morus bassanus*, kittiwake *Rissa tridactyla* and puffin *Fratercula arctica* breeding at colonies in northern and eastern Scotland and north-east England. The Project Area lies well beyond the MMFR+1SD distance of common guillemot *Uria aalge* and razorbill *Alca torda* from all breeding colonies. However, colonies in eastern Scotland and north-east England are within the maximum foraging range distance of common guillemot (maximum 338 km) and razorbill (maximum 313 km) (Woodward *et al.*, 2019).

11.5.3.4 Protected Sites

As shown in Figure 11-3, a number of Special Protection Areas (SPAs) lie within the wider Study Area. The subject of the potential for theoretical connectivity between the Project Area and seabird colonies designated as SPAs, in line with the applicable NatureScot Guidance Notes, is examined in detail in the Project's HRA Report, submitted alongside the application (Document Reference: GB-CZN-00-XODUS-000023).

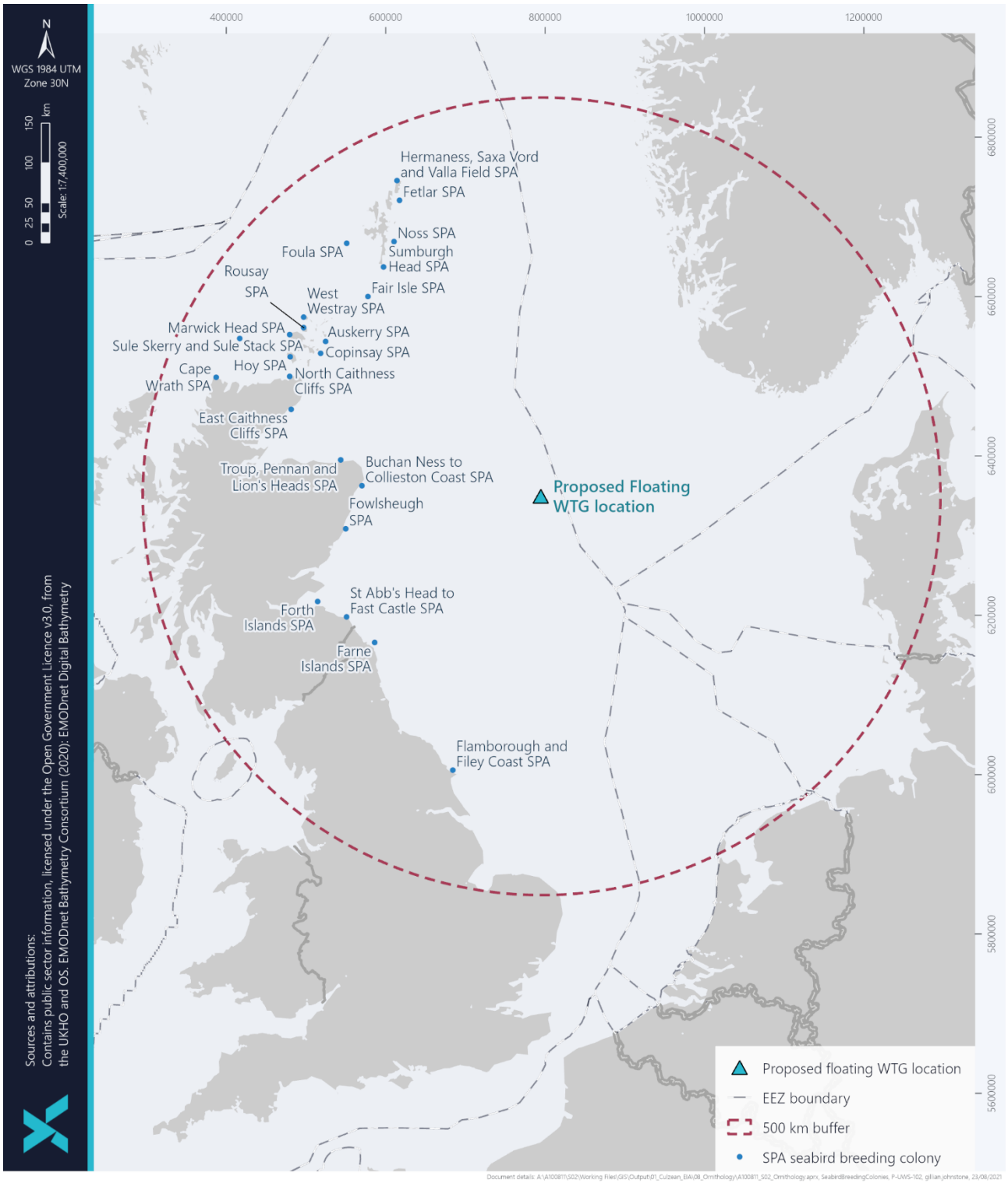

Figure 11-3 SPAs within the wider Study Area

11.5.4 Future baseline

The EIA Regulations require that a 'description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without development as far as natural changes from the baseline scenario can be assessed with reasonable effort, on the basis of the availability of environmental information and scientific knowledge', be included within EIA.

The baseline environment is not constant, it will undergo some degree of natural change over time due to naturally occurring cycles and processes and anthropogenic environmental changes, for example climate change and commercial fishing. The future baseline is also anticipated to potentially change in response to the various energy related developments in the North Sea, for example future offshore wind farms, hydro-carbon extraction developments and subsea electricity links. Changes to fishing industry practices could also lead to changes that effect seabirds through effects on food availability. For example, the recent policy change that will result in the closure of North Sea to sand eel fishery in English and Scottish waters is predicted to benefit several seabird species including kittiwake and puffin (RSPB, 2024).

North Sea waters are facing an increase in sea surface temperature (Marine Scotland, 2011) and changes in sea temperature have been implicated in declines in fish prey for seabirds, leading to reduced breeding success and population decline (Carroll, *et al.*, 2015). Continuing sea temperature increases are anticipated for the North Sea over the decades ahead and further prey-mediated adverse impacts on seabird populations are considered likely.

The effects of climate change extend globally, with Arctic/sub-Arctic regions particularly severely affected, for example through the extent and prevalence of sea ice and snow cover. Climate change is causing, and is anticipated to continue to cause, profound long-term changes to Arctic/sub-arctic ecosystems. As many of the birds that overwinter in the North Sea are from Arctic/sub-arctic breeding grounds, there is obvious potential for climate change effects to impact (both negatively and positively) on the future population size and distribution of these species.

Highly Pathogenic Avian Influenza (HPAI) has recently caused widespread significant mortality and reduced breeding success in several seabirds. Of particular relevance to the Project is the high mortality (up to approximately 50%) of adults and low breeding success reported in 2022 for gannets breeding in eastern Scotland (Lane *et al.*, 2023). It is not known how long the HPAI current outbreak will persist, nor how long population recovery will take (Pearce-Higgins *et al.*, 2022).

11.5.5 Summary and key issues

Table 11-7 Summary and key issues for Ornithology

KEY AND SUMMARY ISSUES	PROJECT AREA
	• Regular use of the Project Area by four species of seabird that are considered to be vulnerable to collision risk effects (gannet, kittiwake, great-black-backed gull and herring gull); • Regular use of the Project Area by three species of seabird that are considered to be vulnerable to disturbance/displacement effects (kittiwake, common guillemot and razorbill); and, • The relatively low seabird species diversity at the Project Area combined with generally very low or low levels of site utilisation, a reflection of the site's remoteness from land, are a positive characteristic that greatly reduce the potential for the Project to have adverse effects on seabird receptors.

11.5.6 Data gaps and uncertainties

The commissioned one-year DAS study (Appendix F) does not provide information on year-to-year variation in the utilisation of the Project Area by seabirds. However, the results of the DAS study strongly agree with the results on seabird utilisation of this part of the North Sea reported in published studies, both in terms of the range of species and their seasonal density (Kober *et al.*, 2010; Cleasby *et al.* 2018; Waggit *et al.*, 2020). Therefore, the DAS results together with the additional information from published literature provide a robust baseline for assessment purposes.

There is a lack of site-specific information on the flux of migrant land birds (e.g., passerines, shorebirds and wildfowl) that fly over the Project Area. This data gap is not considered important because migrant birds cross this part of the North Sea on a broad migration fronts, and mostly at altitudes that do not coincide with Project's WTG rotors. Examination of Wildfowl and Wetlands Trust and MacArthur Green (2014) report indicates that wildfowl and wader species that migrate across the North Sea (and potentially through the Project Area) do so on migration fronts of between approximately 250 and 550 km wide (depending on species). Therefore, it is not plausible that a single modest-sized turbine could pose more than a negligible collision risk to migrant landbird receptor populations, and as such impacts on these species have not been considered further. No data gaps or limitations beyond those addressed above have been identified.

11.6 Key Parameters for Assessment

As detailed in Chapter 6: EIA methodology, this assessment considers the worst case scenario for the Project parameters which are predicted to result in the greatest environmental impact, known as the 'realistic worst case scenario'. The worst case scenario represents, for any given receptor and potential impact on that receptor that 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 11-8Table 11-8 presents the worst case scenario for potential impacts on Ornithology during construction, operation and maintenance and decommissioning.

Table 11-8 Worst case scenario specific to Ornithology receptor impact assessment

POTENTIAL IMPACT	WORST CASE SCENARIO	JUSTIFICATION
Construction		
Disturbance/displacement	• One month for the pre-construction, construction and installation of the WTG, moorings and cable Installation activities which are proposed to take place in Q3, 2025. Construction to occur over a 1-month period, currently anticipated to overlap with the seabird breeding season. • Construction schedule of 24 hours a day, 7 days a week • A maximum of four vessels working simultaneously at any time with a total of 54 vessel days across the vessel spread.	• Maximum number of vessels and the longest construction schedule would cause the greatest disturbance/displacement. • The extent and frequency of seabird disturbance events potentially leading to displacement are anticipated to increase approximately in proportion to the number of vessels operating at the site and the duration they are present.
Operation and maintenance		
Collision risk	• A single 3MW floating WTG with a rotor diameter of 112m. • A surface clearance (lowest sweep of rotor to sea level distance) of 22 m, the minimum in the design window. • Design life of 10 years	• Seabird flight activity is disproportionately concentrated closer to the sea surface therefore assuming the minimum surface clearance (one of the input parameters in CRM) leads to cautious conclusions regarding collision. Full design inputs for the CRM are provided in Appendix H.
Disturbance/displacement	• A single turbine with a rotor diameter of 112 m and tip height of 134 m above mean sea level (MSL). • One operation and maintenance vessel on-site (Emergency Response and Rescue Vessel (ERRV) for Culzean Oil Field). • Lighting of the WTG will be designed and constructed to satisfy the safety requirements of the Maritime and Coastguard Agency (MCA) Civil Aviation Authority (CAA) and the Northern Lighthouse Board (NLB). • Design life of 10 years.	• Maximum number of vessels would cause the greatest disturbance/displacement

POTENTIAL IMPACT	WORST CASE SCENARIO	JUSTIFICATION
Decommissioning		
Disturbance/displacement	• It is assumed that the potential for disturbance/displacement of seabirds resulting from decommissioning activities is no greater than those occurring from construction activities.	• The decommissioning of the WTG is anticipated to be approximate to the reverse of the construction procedures. Therefore, it is reasonable to assume that the potential for decommissioning activities to result in seabird disturbance/displacement will be analogous with the construction phase.

11.7 Methodology for Assessment of Effects

An assessment of potential impacts is provided separately for the construction, operation and maintenance and decommissioning stages.

The assessment for Ornithology is undertaken following the principles set out in Chapter 6: EIA methodology. The sensitivity of the receptor is combined with the magnitude to determine the impact significance. Topic-specific sensitivity and magnitude criteria are assigned based on professional judgement, as described in Table 11-9 and Table 11-10.

The criteria for the assessment for Ornithology differ from those set out in Chapter 6: EIA methodology. Impact(s) on Ornithology are assessed in terms of predicted effects on regional receptor populations, in particular their conservation status and long-term viability. Species regional receptor populations are defined according to NatureScot recommendations (NatureScot, 2023c). Breeding populations are defined according to the number of birds breeding within a species' 'MMFR + 1 SD' distance from the Project Area (Woodward *et al*, 2019). Species non-breeding receptor populations are based on the geographically appropriate Biologically Determined Minimum Population Size (BDMPS) estimates (Furness, 2015).

Sensitivity criteria presented in Table 11-9 attempt to combine considerations of the vulnerability of individual birds that use the vicinity of the Project Area to a particular effect (e.g. disturbance/displacement and collision risk), and considerations of the potential for the receptor population to show a response to the effect. The categorisation of species sensitivity is informed by published studies, in particular the review study by Furness *et al.*, (2013) that examines the vulnerability of Scottish seabird species to offshore wind farms.

Table 11-9 Sensitivity criteria

SENSITIVITY OF RECEPTOR	DEFINITION
High	Species receptor population has low tolerance of the effect under consideration, with individuals showing strong response, or subject to a high likelihood of experiencing serious harm (e.g. mortality). For effects that may extend beyond the source location (e.g. disturbance), some individuals more than 2 km of the source are likely to show a response. Small population size, low reproductive rate and unfavourable conservation status all increase a receptor's sensitivity.
Medium	Species receptor population has moderate tolerance of the effect under consideration, with individuals showing moderate response, or subject to a moderate likelihood of experiencing serious harm (e.g. mortality). For effects that may extend beyond the source location (e.g. disturbance), some individuals up to *ca*. 2km of the source are likely to show a response. Small population size, low reproductive rate and unfavourable conservation status all increase a receptor's sensitivity.
Low	Species receptor population has high tolerance of the effect under consideration, with individuals showing a weak response, or subject to a low likelihood of experiencing serious harm (e.g. mortality). For effects that may extend beyond the source location (e.g. disturbance), only individuals in the very close vicinity (within *ca*. 300 m) of the source are likely to show a response. Small population size, low reproductive rate and unfavourable conservation status all increase a receptor's sensitivity.

SENSITIVITY OF RECEPTOR	DEFINITION
Negligible	Species receptor population has very high tolerance of the effect under consideration, with individuals showing either no or negligible response, or subject to no or negligible likelihood of experiencing serious harm. Small population size, low reproductive rate and unfavourable conservation status all increase a receptor's sensitivity.

Table 11-10 Magnitude criteria

MAGNITUDE CRITERIA	DEFINITION
High	**The Project would affect the conservation status of receptor population.** A change in the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site that is predicted to irreversibly alter the population in the short-to-long term and to alter the long-term viability of the population and/or the integrity of the protected site. Recovery from that change predicted to be achieved in the long-term or irreversible following cessation of the project activity. Guide: Predicted increase to baseline mortality rate is above 10%.
Medium	**Conservation status would not be affected, but the impact is likely to be significant in terms of ecological objectives or populations.** A change in the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site that occurs in the short and long term, but which is not predicted to alter the long-term viability of the population and/or the integrity of the protected site. Recovery from that change predicted to be achieved in the medium-term (i.e. no more than five years) following cessation of the project activity. Guide: Predicted increase to baseline mortality rate is above 5%.
Low	**Minor shift away from baseline but the impact is of limited temporal or spatial extent.** A change in the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site that is sufficiently small-scale or of short duration to cause no long-term harm to the feature/population. Recovery from that change predicted to be achieved in the short-term (i.e. no more than one year) following cessation of the project activity. Guide: Predicted increase to baseline mortality rate is between 1% and 5%
Negligible	**Very slight change from baseline condition, impact is highly localised / short term and any recovery expected to be rapid following cessation of activity**. Very minor change from the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site. Recovery from that change predicted to be rapid (i.e. no more than circa six months) following cessation of the project related activity. Guide: Predicted increase to baseline adult mortality rate is less than 1%.

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

11.8 Embedded Mitigation

As described in Chapter 6: EIA methodology, certain measures have been adopted as part of the Project development process in order to reduce the potential for impacts to the environment, as presented in Table 11-11. These have been accounted for in the assessment presented below. The requirement for additional mitigation measures (secondary mitigation) will be dependent on the significance of the effects on Ornithology receptors.

Table 11-11 Embedded mitigation measures relevant to Ornithology

MITIGATION MEASURE	DESCRIPTION	FORM (PRIMARY OR TERTIARY)	HOW MITIGATION WILL BE SECURED
Minimum air gap	Minimum air gap from sea level will be equal to or greater than the minimum 22 metres (m) required to comply with Search and Rescue (SAR) requirements. This will also reduce collision risk for ornithology features.	Primary	Secured through conditions attached within the Marine Licence.
Adherence to the International Convention for the Prevention of Pollution from Ships (MARPOL)	All vessels will operate in adherence with MARPOL requirements. Accordance with this will help to ensure that the potential for release of pollutants is minimised during operations.	Primary	Secured through conditions attached within the Marine Licence.
Environnemental Management Plan (EMP)	The EMP will provide the over-arching framework for on-site environmental management during the phases of development as follows: • All construction as required to be undertaken before the commissioning of the Project • The operational lifespan of the Project from Commissioning until the cessation of electricity generation (environmental management during decommissioning is addressed by the Decommissioning Programme). The EMP will be in accordance with the Application insofar as it relates to environmental management measures. The EMP will set out the roles, responsibilities and chain of command in respect of environmental management for the protection of environmental interests during the construction and operation of the Project. It will address (but not be limited to) the following overarching requirements for environmental management during construction: • Mitigation measures as identified in the Application, pre-consent and pre-construction monitoring or data collection • A pollution prevention and control method statement, including contingency plans;	Tertiary	Secured through conditions attached within the Marine Licence.

MITIGATION MEASURE	DESCRIPTION	FORM (PRIMARY OR TERTIARY)	HOW MITIGATION WILL BE SECURED
	• Management measures to prevent the introduction of Invasive Non-Native Species (INNS); • A site waste management plan (dealing with all aspects of waste produced during the construction period), including details of contingency planning in the event of accidental release of materials which could cause harm to the environment. Wherever possible the waste hierarchy of reduce, reuse and recycle will be referred to; and • The reporting mechanisms that will be used to provide the Scottish Ministers and relevant stakeholders with regular updates on construction activity, including any environmental issues that have been encountered and how these have been addressed. The EMP will be regularly reviewed by the Company at intervals agreed by the Scottish Ministers and will be updated based on current information on construction methods and operations. The EMP will be informed, so far as is reasonably practicable, by the baseline monitoring or data collection undertaken as part of the Application and the Project Environmental Monitoring Programme (PEMP) to ensure that all construction and operation activities are carried out in a manner that minimises their impact on the environment, and that mitigation measures contained in the Application, or as otherwise agreed are fully implemented.		
Project Environmental Monitoring Programme (PEMP)	A PEMP will be developed to provide further evidence to support these conclusions of the EIA and to provide information on the environmental research initiatives for the Project to allow information to be obtained for future offshore wind farm developments.	Tertiary	Secured through conditions attached within the Marine Licence.
Vessel Management Plan (VMP)	A VMP will be prepared for the Project which will detail the number, type and specification of vessels utilised during construction and operation. This will also detail how vessel management is coordinated and the ports and transit corridors proposed. The VMP will also include measures designed to reduce disturbance to seabirds. As far as is reasonably practical, these will follow (or be adapted from) the appropriate measures set out in the Scottish Marine Wildlife Watching Code (SNH, 2016).	Tertiary	Secured through conditions attached within the Marine Licence.
Decommissioning Programme	A Decommissioning Programme will be provided pre-construction to address the principal decommissioning measures for the Project, this will be written in accordance with applicable guidance and detail the management, environmental management, and schedule for decommissioning.	Tertiary	Secured through conditions attached within the Marine Licence.

11.9 Assessment of Impacts

The following impact pathways have been scoped into the assessment, as agreed through the Scoping process and follow up consultation with consultees:

- Disturbance and displacement as a result of construction and decommissioning activities (including, vessel activity, noise and lighting);
- Disturbance and displacement as a result of operation and maintenance activities (including, WTG presence, vessel activity, noise and lighting); and,
- Collision risk to flying birds as a result of WTG operation.

11.9.1 Potential effects during construction

11.9.1.1 Disturbance and displacement

Receptors assessed

The detailed assessment of construction disturbance and displacement presented below is limited to species receptors for a likely significant effect is plausible. These are species that have at least a moderate vulnerability to disturbance/displacement and regularly utilise the Project Area in either the breeding or non-breeding season or both. These are kittiwake, common guillemot and razorbill.

Impact description

Construction phase activity has the potential to affect seabird receptors through disturbance which in turn may lead to displacement of birds from the vicinity of construction activities (Furness *et al.*, 2013). Displacement from areas that birds would otherwise use, for example for foraging, is akin to habitat loss.

Disturbance could arise from the operation of construction vessels and associated on board activities of construction personnel and machinery, noise and lighting. The construction activity will occur over a month during which vessel movements and other construction activity could occur at all times of day. It is anticipated that no more than four vessels would be present at the Project Area at any one time. Disturbance to birds from construction activity would last only for the duration of construction work, after which bird utilisation at the locality is expected to quickly return (within hours) to baseline conditions.

Receptor sensitivity

The sensitivity of Scottish seabird species to disturbance and displacement effects from offshore wind developments was reviewed by Furness *et al.* (2013). Building on the results of a previous study (Garthe and Hüppop, 2004), together with more recent published scientific and 'grey' literature and expert opinion, Furness *et al.* developed an index that rates the sensitivity of each seabird species to disturbance and displacement (and a separate index for collision risk sensitivity). The index values were derived by combining a species' ratings for vulnerability to disturbance (i.e., the opposite of tolerance), habitat flexibility and conservation importance. The disturbance/displacement sensitivity index develop by Furness *et al.* is considered relevant to the categorisation of receptor sensitivity for the assessment presented below.

Furness *et al*. give kittiwake a disturbance/displacement sensitivity index score of 6 out of 50. Although this is towards the lower end of the range of values for all species examined, UK breeding kittiwakes currently have a very poor conservation status (Stanbury *et al*., 2021; Burnell *et al*., 2023). It is therefore considered that the category of medium sensitivity (Table 11-9) is appropriate for kittiwake.

Common guillemot and razorbill have heightened sensitivity to vessel disturbance during summer and early autumn (approximately July to October). At this time of year adult undergo their annual wing feather moult, a process that causes birds to become temporarily flightless. It is also the time of year that male adults continue to rear their chicks at sea (guillemot and razorbill chicks leave breeding colonies when about 3-weeks old (Harris *et al*., 2020) and then continue to be reared at sea for several weeks until independence).

Furness *et al*. give both common guillemot and razorbill disturbance/displacement sensitivity index scores of 14 out of 50, this is considered to correspond to the Medium sensitivity category (Table 11-9).

Evaluation of magnitude

In the evaluation of displacement magnitude, it is assumed that the embedded mitigation measures in the Project's VMP relating to seabirds (in particular relating to vessels reducing speed if concentration of seabirds sitting on the sea are encountered) are followed (Table 11-11).

SNCBs advise the use of a matrix method to quantify the potential displacement of seabirds from offshore wind warm developments (SNCB, 2022). This method is based on theoretical considerations and assumptions about the biological effects of displacement to the individuals affected (Searle *et al*., 2014; SNCB, 2022). The recommended matrix approach expresses displacement in terms of additional mortality. This has the advantage of making it comparatively easy to quantitatively assesses the impact of displacement on receptor population processes, both in isolation and together with other impacts such as collision mortality. To interpret a displacement matrix, NatureScot advises the use of recommended species-specific values for displacement rate and the proportion of the displaced birds that are assumed to die (see matrices presented in Appendix H) (NatureScot, 2023d). For all the seabird species relevant to the Project, NatureScot advise that for assessment purposes the Zone of Influence (ZoI) for displacement be assumed to extend to 2 km beyond the development footprint. For the three species assessed here, a zone of influence of 2 km is considered to be extremely cautious. For practical purposes the zone of influence is taken to be a 2km radius around the turbine location.

NatureScot advise the use of displacement rates of 30% and 60% from the ZoI for kittiwake and auk species, respectively (NatureScot, 2023d). They also cautiously advise that mortality rates of both 1% and 3% should be assumed for breeding kittiwakes and non-breeding auk species receptors, and of both 3% and 5% for breeding season auk species receptors (NatureScot, 2023d). NatureScot guidance also states that the evaluation of impacts of displacement are based on the peak monthly density of a species recorded during baseline surveys in the Culzean Survey Area and that separate evaluation are undertaken for different seasons.

Based on the SNCB displacement matrix method using NatureScot recommended values for % displacement and % mortality, it is estimated that there would no displacement mortality of kittiwake, razorbill or guillemot during the breeding season (see matrices presented in Appendix H). It is also estimated that there would be no displacement mortality of kittiwake or razorbill during the non-breeding season and only very low displacement mortality of

guillemot (see matrices presented in Appendix H). Assuming a mortality rate of 3% (the higher of the two figures recommended in NatureScot guidance (NatureScot, 2023d) for the non-breeding season guillemots affected by displacement, the matrix method estimates annual displacement mortality of five birds. This is a negligible proportion of the relevant BDMPS non-breeding guillemot population (North Sea and Channel), estimated to number in excess of 1,600,000 birds (Furness *et al,* 2015).

In conclusion, for all the seabird receptors examined, the disturbance/displacement effect from construction activities is evaluated as being of negligible magnitude.

Evaluation of significance

The kittiwake, common guillemot and razorbill receptors assessed are all categorised as having medium sensitivity to disturbance/displacement. The anticipated disturbance/displacement effect on these receptors is evaluated as being of negligible magnitude. The consequence of disturbance/displacement during construction is considered to be negligible and not significant in EIA terms for all receptors.

SENSITIVITY	MAGNITUDE OF IMPACT	CONSEQUENCE
Medium	Negligible	Negligible
	Impact significance - NOT SIGNIFICANT	

11.9.2 Potential effects during operation and maintenance

11.9.2.1 Disturbance and displacement

Impact description

The description of how disturbance and displacement could affect birds presented above for the construction phase also applies to the operation and maintenance phase. The potential for disturbance/displacement in the operation and maintenance phase caused by Project vessel activity is anticipated to be much lower than in the construction phase due to large reduction in vessel activity; only occasional maintenance visits, usually by a single vessel, are anticipated. During the operation and maintenance phase there will also be the potential for seabirds to show a fixed-structure displacement response, i.e., to the presence of the floating wind turbine. These disturbance/displacement effects will persist through the operation and maintenance phase and are thus considered to be long-term effects; however it is possible that some birds could show a degree of habituation with time.

Operation and maintenance phase disturbance/displacement is assessed for same three species examined for the construction phase: kittiwake, common guillemot and razorbill.

Receptor sensitivity

The sensitivity of seabird receptors to disturbance/displacement effects during the operation and maintenance phase is considered to be the same as during the construction phase. Therefore, the rationale presented earlier for

categorising receptor sensitivity during construction equally applies to the operation and maintenance phase. On this basis the three receptor species (kittiwake, common guillemot and razorbill) assessed for disturbance/displacement effects during the operation and maintenance phase are all considered to have **medium sensitivity** (Table 11-9).

Evaluation of magnitude

In the evaluation of displacement magnitude, it is assumed that the embedded mitigation measures in the Project's VMP relating to seabirds (in particular relating to vessels reducing speed if concentration of seabirds sitting on the sea are encountered) are followed.

The magnitude of the operation and maintenance disturbance/displacement effect is quantified in the exactly the same way as described earlier for the construction phase assessment, i.e., using the SNCB recommended matrix method and the NatureScot recommended species-specific displacement and mortality rates. On this basis the operation and maintenance disturbance/displacement effect is evaluated as **negligible magnitude** for all species receptors.

Evaluation of significance

The kittiwake, common guillemot and razorbill receptors assessed are all categorised as having **medium sensitivity** to disturbance/displacement. The anticipated disturbance/displacement effect on these receptors is evaluated as being of **negligible magnitude**. The consequence of disturbance/displacement during the operation and maintenance phase is considered to be **negligible** and **not significant** in EIA terms for all receptors.

SENSITIVITY	MAGNITUDE OF IMPACT	CONSEQUENCE
Medium	Negligible	Negligible
	Impact significance - NOT SIGNIFICANT	

11.9.2.2 Collision risk

Receptors assessed

The detailed assessment of operation and maintenance seabird collision risk presented below is limited to species receptors where the potential for a significant effect due to collision mortality is plausible. These are species that have at least a moderate vulnerability to collision risk and regularly utilise the Project Area in either the breeding or non-breeding season, or both. These species are gannet, kittiwake, great-black-backed gull and herring gull.

Impact description

Of all the potential effects that offshore wind developments could have on birds, the potential for mortality caused by flying birds colliding with turbine rotor blades is perhaps the most serious effect. For this reason, the issue of wind turbine avian collision risk and has been, and continues to be, the focus of considerable research effort. There is now

a good understanding of the subject, with a well-developed theoretical collision risk modelling (CRM) framework (Band, 2012; Masden, 2015) increasingly validated by results from empirical monitoring studies using sophisticated collision detection methods such as radar and thermal cameras (Skov *et al.*, 2018, Aberdeen Offshore Wind Farm Ltd (AOWFL), 2023). On the back of this research, SNCBs (e.g., NatureScot) have produce detailed best practice guidance on how avian collision risk from offshore wind developments should be quantified and assessed for EIA (NatureScot, 2023e). The aim of this process is to predict how many birds of each species might be killed by the development, and then to examine how the collision mortality would effect the population dynamics of the relevant receptor populations.

Receptor sensitivity

The sensitivity of Scottish seabird species to collision risk from offshore wind turbines was reviewed by Furness *et al.* (2013). Building on the results of a previous study (Garthe and Hüppop, 2004), together with more recent published scientific and 'grey' literature and expert opinion, Furness *et al.* (2013) developed an index that rates the sensitivity of each seabird species to collision risk (and a separate index for disturbance and displacement sensitivity). The collision risk index values for a species were derived from combining a species' ratings for proportion of flight height activity at rotor height, flight agility, proportion of time spent flying, night-time flight activity and conservation importance. The collision risk index scores develop by Furness *et al.* (2013) are considered relevant to the categorisation of receptor sensitivity for the assessment presented below.

Furness *et al.* (2013) give herring gull and great-black-backed gull collision risk index scores of 1,306 and 1,225 respectively, the highest scores for any of the seabird species they examined. These are also the only species with index scores greater than 1000. It is therefore considered that the category of high sensitivity (Table 11-9) to collision risk is appropriate for herring gull and great-black-backed gull.

Furness *et al.* (2013) give gannet and kittiwake collision risk index scores of 725 and 523 respectively, values that are towards the upper end of the range of values for all species, but well below the values for large gull species. UK breeding kittiwakes currently have a very poor conservation status (Stanbury *et al.*, 2021; Burnell *et al.*, 2023). Gannets breeding at many (probably all) of the colonies with potential connectivity to the Project Area underwent very high levels of mortality and reduced breeding success in 2022 as result of Highly Pathogenic Avian Influenza (Lane *et al.*, 2023: Burnell *et al*, 2023). It is therefore reasonable to conclude that gannet also currently has a poor conservation status. After taking the current conservation status into account, it is considered that the category of high sensitivity (Table 11-9) to collision risk is appropriate for both gannet and kittiwake.

Evaluation of magnitude

The evaluation of the magnitude of collision risk is informed by the results of collision risk modelling (CRM) and follows best practice guidance (NatureScot; 2023e). The Stochastic CRM shiny app (Caneco, 2022) was used estimate collision risk. This is an online Graphical User Interface developed especially for seabird collision modelling. It is based on the stochastic model developed by Masden (2015), which in turn was developed from the deterministic model developed by Band (2012). The Masden and Band CRM calculate outputs for three model variations termed Option 1, Option 2 and Option 3. The Option 2, the basic model using generic flight height distribution data, (i.e., Johnstone *et al.*, 2014) is considered to be the most appropriate model option for informing the Project's EIA collision risk assessment. Although Option 3 (extended model using generic height distribution data) takes a more sophisticated

approach to accounting for flight height distribution, application of this model to EIA is limited by uncertainty regarding the appropriate avoidance rates. The shiny app was used to predict the number of annual and seasonal collisions for four collision-vulnerable species: gannet, kittiwake, great black-backed gull and herring gull. Predictions were produced from the shiny app CRM run in both deterministic and stochastic modes, as recommended by guidance (NatureScot, 2023e).

The CRM requires input parameters specifying the characteristic of the wind farm. The main parameter values describing the characteristics of wind farm used in the models are as follows:

- A development comprising a single turbine;
- A rotor diameter of 112m,
- A surface clearance of 22 m;
- Maximum rotor blade width of 4.0m; and
- A mean rotation rate of 13 rpm.

The CRM also requires input parameters detailing characteristics for each bird species examined. These include monthly estimates of the density of birds in flight (flying bird/km^2), average bird length and wingspan, the type of flight behaviour (gliding or flapping), flight velocity, an adjustment factor for nocturnal activity and flight height frequency distribution (proportion of flying activity for each of a series of 1-metre height bands above sea level). Flight height frequency distribution data for each species were sourced from Johnson *et al.*, 2014. Parameter values for each species' monthly flying bird density were derived from the results of the baseline DAS (Appendix F). The parameter values used for species size, flight type, flight velocity and nocturnal activity are the values recommended in NatureScot guidance (NatureScot, 2023e). A full list of wind farm and bird parameters and the values used in the CRMs is presented in Appendix H.

CRM predicts the number of collisions that would occur each year if birds took no avoidance behaviour. However studies have shown that seabirds show strong and highly effective avoidance behaviour to wind turbines (Skov *et al.*, 2018; Bowgen and Cook, 2018; AOWFL, 2023). CRM predictions therefore need to be adjusted downwards by an appropriate avoidance rate to give a realistic estimate of the number of birds likely to be killed. Avoidance rates have been derived by a number of studies and these studies have informed the avoidance rates recommended for EIA assessments by NatureScot (GN7).

The NatureScot recommended avoidance rates relevant to stochastic CRM Option 2 are:

- 0.993 (SD 0.0003) for gannet and kittiwake.
- 0.994 (SD 0.0004) for herring gull and great black-backed gull.

CRM Option 2 outputs are summarised in Table 11-13, full details, including predictions for each season, are provided in Appendix H. Due to the combination of the development comprising only a single modest-sized wind turbine and low to very low flying bird densities, the CRM prediction for all four species examined are very low. Indeed, after applying the recommended avoidance rates, the predictions for all species are well below one death per year. For this reason, predictions are also expressed in terms of the number of years the wind turbine would need to operate for one collision to occur (Table 11-12).

Table 11-12. Summary of collision risk predictions from Stochastic CRM Option 2

SPECIES	AVOIDANCE RATE	MEAN NUMBER OF FATAL COLLISIONS PER YEAR	AVERAGE NUMBER OF OPERATIONAL YEARS FOR ONE MORTALITY EVENT
Gannet	0.993	0.030 (SD 0.017)	33
Kittiwake	0.993	0.075 (SD 0.022)	14
Great black-backed gull	0.994	0.300 (SD 0.081)	3
Herring gull	0.994	0.022 (SD 0.014)	45

Given the large size of receptor populations under consideration (Table 11-6), it is not plausible that additional mortality of less than one bird per annum would lead to more than a trivial change to baseline population mortality rates of the species receptors examined (baseline mortality rates for these species are reviewed in Horswill and Robinson (2015). In conclusion, for all the seabird receptors examined, collision risk during the operation and maintenance phase is evaluated as being of **negligible magnitude**.

11.9.2.3 Evaluation of significance

The gannet, kittiwake, herring gull and great-black-backed gull receptors assessed are all categorised as having **high sensitivity** to collision risk. The anticipated collision risk effect on these receptors is evaluated as being of **negligible magnitude**. The consequence of collision mortality during the operation and maintenance phase is considered to be **negligible** and **not significant** in EIA terms for all receptors.

SENSITIVITY	MAGNITUDE OF IMPACT	CONSEQUENCE
High	Negligible	Negligible
	Impact significance - NOT SIGNIFICANT	

11.9.3 Potential effects during decommissioning

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

The targeted scenario for decommissioning is a clear seabed. Given the nature of the decommissioning activities, which will largely be a reversal of the installation process, the impacts during decommissioning are expected to be similar to or less than those assessed for the construction stage. It should be noted that the decommissioning options for the export cable removal will be subject to comparative assessment of options at the end of the installation life. This will involve assessing the potential removal of artificial hard structures associated with the Project. Therefore it is reasonable to assume that the potential for decommissioning activities to result in seabird disturbance/displacement will be much the same as for the construction phase.

No seabird collision risk is anticipated during decommissioning because the wind turbine rotor will be shut down between the end of the operational phase and the time the wind turbine is towed off site to a coastal port for dismantling.

11.9.4 Summary of potential effects

A summary of the outcomes of the assessment of potential effects from the construction, operation and maintenance and decommissioning of the Project is provided in Table 11-13.

No significant effects on Ornithology receptors were identified. Therefore, mitigation measures in addition to the embedded mitigation measures listed in Section 11.8 are not considered necessary.

Table 11-13 Summary of potential effects

POTENTIAL EFFECT	RECEPTORS	SENSITIVITY OF RECEPTOR	MAGNITUDE OF IMPACT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANCE OF EFFECT)
Construction						
Disturbance/ displacement	Kittiwake	Moderate	Negligible	Negligible (not significant)	None required above existing embedded mitigation measures.	Negligible (not significant)
	Guillemot	Moderate	Negligible	Negligible (not significant)	None required above existing embedded mitigation measures.	Negligible (not significant)
	Razorbill	Moderate	Negligible	Negligible (not significant)	None required above existing embedded mitigation measures.	Negligible (not significant)
Operation and maintenance						
Disturbance/ displacement	Kittiwake I	Moderate	Negligible	Negligible (not significant)	None required above existing embedded mitigation measures.	Negligible (not significant)
	Guillemot	Moderate	Negligible	Negligible (not significant)	None required above existing embedded mitigation measures.	Negligible (not significant)
	Razorbill	Moderate	Negligible	Negligible (not significant)	None required above existing embedded mitigation measures.	Negligible (not significant)
Collision Risk	Kittiwake	High	Negligible	Negligible (not significant)	None required above existing embedded mitigation measures.	Negligible (not significant)

POTENTIAL EFFECT	RECEPTORS	SENSITIVITY OF RECEPTOR	MAGNITUDE OF IMPACT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANCE OF EFFECT)
	Gannet	High	Negligible	Negligible (not significant)	None required above existing embedded mitigation measures.	Negligible (not significant)
	Great b-b. gull	High	Negligible	Negligible (not significant)	None required above existing embedded mitigation measures.	Negligible (not significant)
	Herring gull	High	Negligible	Negligible (not significant)	None required above existing embedded mitigation measures.	Negligible (not significant)
Decommissioning						
Disturbance/ displacement	Kittiwake	Moderate	Negligible	Negligible (not significant)	None required above existing embedded mitigation measures.	Negligible (not significant)
	Guillemot	Moderate	Negligible	Negligible (not significant)	None required above existing embedded mitigation measures.	Negligible (not significant)
	Razorbill	Moderate	Negligible	Negligible (not significant)	None required above existing embedded mitigation measures.	Negligible (not significant)

11.10 Proposed Monitoring

No monitoring is proposed as no significant effects are predicted. Furthermore, given the low densities of birds present and the negligible magnitude of predicted effects it is unlikely that any monitoring would be sensitive enough to reliably detect any change to seabird receptor populations that could be confidently attributed to the Project.

Although no monitoring is required to measure the response of birds to the Project, for EIA purposes, as part of the scientific Research and Development (R&D) programme for the Project (as described in Chapter 1: Introduction), TEPNSUK are exploring environmental research initiatives, including those for birds. The initiatives under consideration include the deployment of camera and radar technologies to better understand how flying birds respond to the Project's floating WTG. The initiatives will be agreed to align with the Technical University of Denmark (DTU) and the Marine Alliance for Science and Technology for Scotland (MASTS) research aims.

11.11 Cumulative Effects Assessment

Given the negligible magnitude of potential disturbance/displacement and collision impacts it is not plausible that the Project would materially contribute to a wider regional cumulative disturbance impact for any bird species receptor. For these reasons the potential for the Project to contribute to a cumulative regional disturbance effects on bird receptors is not considered further.

11.12 Inter-Related Effects

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 11-14.

Table 11-14 Ornithology inter-relationships

CHAPTER	IMPACT	DESCRIPTION
Fish & shellfish	Impacts of noise on the abundance and distribution of fish and shellfish species.	Impacts on fish and shellfish could impact seabirds through affecting prey availability. Potential for this impact to affect Ornithology receptors was scoped-out of requiring EIA assessment (as detailed in Section 11.3). Chapter 9: Fish and Shellfish concludes no significant impact on fish receptors from noise related impacts.
	Impact of suspended sediments and deposition on fish and shellfish species.	Impacts on fish and shellfish could impact seabirds through affecting prey availability. The potential for this impact to affect Ornithology receptors was scoped-out of requiring EIA assessment.

CHAPTER	IMPACT	DESCRIPTION
		Chapter 9: Fish & Shellfish concludes no significant impact on fish and shellfish species as a result of suspended sediments and deposition.

11.13 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 Project's location in the central North Sea is almost as close to Norway as Scotland. This combined fact, with the very high mobility of seabird species, especially in the non-breeding period, means that the Project Area will be utilised by seabirds that originate from breeding colonies outside the UK.

Given the negligible magnitude of the effects examined for all receptors it is concluded that there is no potential for any phase of the Project to have a likely significant transboundary effect on any EEA ornithological receptor. Therefore, transboundary effects for ornithological receptors are not considered further.

11.14 Summary of Impacts and Mitigation Measures

Information on Ornithology within the Study Area was collected through a desk-based review of publicly available data, the APEM DAS study and the Culzean Platform Surveys.

The key impacts assessed were displacement and disturbance impacts within the construction and operation and maintenance phases and collision risk within the operation and maintenance phase. All potential impacts on Ornithology receptors are assessed as negligible and not significant. No secondary mitigation, over and above the embedded mitigation measures proposed in Section 11.8 is either required as no adverse significant impacts are predicted.

No monitoring is proposed as no significant effects are predicted. Nonetheless the Project is exploring a R&D programme which includes the deployment of cameras and radar technologies to better understand how flying birds respond to floating wind technologies.

REFERENCES

AOWFL (2023). Resolving Key Uncertainties of Seabird Flight and Avoidance Behaviours at Offshore Wind Farms. Final Report for the study period 2020-2021. Aberdeen Offshore Wind Farm Limited. https://group.vattenfall.com/uk/contentassets/1b23f720f2694bd1906c007effe2c85a/aowfl_aberdeen_seabird_study_final_report_20_february_2023.pdf [Accessed on 19/02/2024]

APEM (2023). Ornithological and Marine Mammal Baseline Characterisation Surveys. APEM Final Report: Culzean Platforms P00010265. TotalEnergies E&P UK Limited., 12/01/24, V1.2

Band, B. (2012) Using a collision risk model to assess bird collision risks for offshore windfarms. SOSS report, The Crown Estate.

Bowgen, K. & Cook, A. (2018). Bird Collision Avoidance: Empirical evidence and impact assessments. JNCC Report No. 614, JNCC, Peterborough, ISSN 0963-8091.

Burnell, D., Perkins, A.J., Newton, S.F., Bolton, M., Tierney, T.D. and Dunn, T.E. (2023). Seabirds Count - A census of breeding seabirds in Britain and Ireland (2015–2021). Lynx Editions.

Caneco, B. (2022). Stochastic CRM Shiny app. V0.1.1. DMP Statistical Solutions Ltd, Available at: https://dmpstats.shinyapps.io/sCRM/

Carroll, M., Butler, A., Owen, E., Ewing, S., Cole, T., Green, J., Soanes, L., & Arnould, J., Newton, S., Baer, J., Daunt, F., Wanless, S., Newell, M., Robertson, G., & Mavor, R., & Bolton, M. (2015). Effects of sea temperature and stratification changes on seabird breeding success. Climate Research. 66. 89.

CIEEM (2018). Guidelines for Ecological Impact Assessment in Britain and Ireland: Marine and Coastal. Winchester, Institute of Ecology and Environmental Management. Available at: https://cieem.net/wp-content/uploads/2019/02/Combined-EclA-guidelines-2018-compressed.pdf [Accessed on 19/02/2024]

Cleasby, I.R., Owen, E., Wilson, L.J., and Bolton, M. (2018). Combining habitat modelling and hotspot analysis to reveal the location of high density seabird areas across the UK: Technical Report. RSPB Research Report no. 63. RSPB Centre for Conservation Science, RSPB, The Lodge, Sandy, Bedfordshire, SG19 2DL.

Cook, A. S. C. P., Humphreys, E. M., Masden, E. A., and Burton, N. H. K. (2014) The avoidance rates of collision between birds and offshore turbines. BTO Research Report No. 656. http://www.scotland.gov.uk/Publications/2014/12/1666/0 [Accessed on 19/02/2024]

Furness, R.W., Wade, H.M., Masden, E.A., (2013). Assessing vulnerability of marine bird populations to offshore wind farms. J. Environ. Manage. 119, 56 – 66.

Furness (2015). Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS). Natural England Commissioned Reports, Number 164.

Garthe, S., Hüppop, O., 2004. Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index. J. Appl. Ecol. 41, 724 – 734.

Harris, M.P., Heubeck, M., Bogdanova, M. I., Newell, M.A., Wanless, S. & Daunt, F. (2020). The importance of observer effort on the accuracy of breeding success estimates in the Common Guillemot *Uria aalge*, Bird Study, 67:1, 93-103, DOI:10.1080/00063657.2020.1779654

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

Johnston, A., Cook, A.S.C.P., Wright, L.J., Humphreys, E.M. & Burton, N.H.K. (2014) Modelling flight heights of marine birds to more accurately assess collision risk with offshore wind turbines. Journal of Applied Ecology, 51, 31–41.

Kober, K., Webb, A., Win, I., Lewis, M., O'Brien, S., Wilson, L. and Reid, J.B. (2010). An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs. JNCC Report No. 431.

Lane, J., Jeglinski, J., Avery-Gomm, S and 68 other authors. (2023). High pathogenicity avian influenza (H5N1) in Northern Gannets: Global spread, clinical signs, and demographic consequences. Ibis. 10.1111/ibi.13275.

Maclean, I. M. D., Wright, L. J., Showler, D. A. & Rehfisch, M. M. (2009). A review of assessment methodologies for offshore wind farms. British Trust for Ornithology commissioned by Cowrie Ltd.

Marine Scotland (2011). Scotland's Marine Atlas: Information for The National Marine Plan.

Masden, E (2015) Developing an avian collision risk model to incorporate variability and uncertainty. Scottish Marine and Freshwater Science Report Vol 6 No 14. Marine Scotland Science. ISSN: 2043-7722 DOI: 10.7489/1659-1

Mitchell, P. I., Newton, S. F., Ratcliffe, N. & Dunn, T. E. 2004. Seabird populations in Britain and Ireland: results of the Seabird 2000 census (1998-2002). London: T. & A.D. Poyser.

NatureScot (2018). Environmental Impact Assessment Handbook. V5. Available online at https://www.nature.scot/handbook-environmental-impact-assessment-guidance-competent-authorities-consultees-and-others [Accessed on 19/02/2024]

NatureScot (2020). Guidance Note 9 - Guidance to support Offshore Wind Applications: Seasonal periods for Birds in the Scottish Marine Environment. https://www.nature.scot/doc/guidance-note-9-guidance-support-offshore-wind-applications-seasonal-periods-birds-scottish-marine [Accessed on 19/02/2024]

NatureScot. (2023a). 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. https://www.nature.scot/doc/guidance-note-3-guidance-support-offshore-wind-applications-marine-birds-identifying-theoretical [Accessed on 19/02/2024]

NatureScot. (2023b). 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. https://www.nature.scot/doc/guidance-note-4-guidance-support-offshore-wind-applications-ornithology-determining-connectivity [Accessed on 19/02/2024]

NatureScot. (2023c). Guidance Note 5: Guidance to support Offshore Wind Applications: Recommendations for marine bird population estimates. https://www.nature.scot/doc/guidance-note-5-guidance-support-offshore-wind-applications-recommendations-marine-bird-population [Accessed on 19/02/2024]

NatureScot (2023d). Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology - Advice for assessing the distributional responses, displacement and barrier effects of Marine birds. https://www.nature.scot/doc/guidance-note-8-guidance-support-offshore-wind-applications-marine-ornithology-advice-assessing [Accessed on 19/02/2024]

NatureScot. (2023e). Guidance Note 7: Guidance to support Offshore Wind Applications: Marine Ornithology - Advice for assessing collision risk of marine birds. https://www.nature.scot/doc/guidance-note-7-guidance-support-offshore-wind-applications-marine-ornithology-advice-assessing [Accessed on 19/02/2024]

NatureScot. (2023f). Guidance Note 1: Guidance to support Offshore Wind Applications: Marine Ornithology – Overview. https://www.nature.scot/doc/guidance-note-1-guidance-support-offshore-wind-applications-marine-ornithology-overview [Accessed on 19/02/2024]

NatureScot. (2023g). Guidance Note 2: Guidance to support Offshore Wind Applications: Advice for Marine Ornithology Baseline Characterisation Surveys and Reporting https://www.nature.scot/doc/guidance-note-2-guidance-support-offshore-wind-applications-advice-marine-ornithology-baseline [Accessed on 19/02/2024]

NatureScot. (2023h). Guidance Note 6: Guidance to support Offshore Wind Applications - Marine Ornithology Impact Pathways for Offshore Wind Developments. https://www.nature.scot/doc/guidance-note-6-guidance-support-offshore-wind-applications-marine-ornithology-impact-pathways [Accessed on 19/02/2024]

Pearce-Higgins, J.W., Humphreys, E.M., Burton, N.H.K., Atkinson, P.W., Pollock, C., Clewley, G.D., Johnston, J.T., O'Hanlon, N.J., Balmer, D.E., Frost, T.M., Harris, S.J. & Baker, H. (2022). Highly pathogenic avian influenza in wild birds in the United Kingdom in 2022: impacts, planning for future outbreaks, and conservation and research priorities. Report on virtual workshops held in November 2022. British Trust for Ornithology.

RSPB, (2024). Big news for seabirds as campaign to close the English North Sea and Scottish waters to sandeel fishing succeeds. RSPB website. (accessed 8 Feb 2024) https://www.rspb.org.uk/whats-happening/news/sandeel-campaign-success-in-england [Accessed on 19/02/2024]

Searle, K.R., 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). Report to Marine Science Scotland.

SNH (2016). The Scottish Marine Wildlife Watching Code. Scottish Natural Heritage. https://www.nature.scot/doc/scottish-marine-wildlife-watching-code-smwwc [Accessed on 19/02/2024]

SNCB (2022). Advice on how to present assessment information on the extent and potential consequences of seabird displacement from Offshore Wind Farm (OWF) developments. Joint SNCB Interim Displacement Advice Note. Updated January 2022.

Skov H., Durinck J., Leopold, M.F. and Tasker M.L. (1995): Important Bird Areas for seabirds in the North Sea including the Channel and the Kattegat. Ornis Consult Ltd. for BirdLife International.

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 pp

Stanbury, A.J., Eaton, M.A., Aebischer, N.J., Balmer, D., Brown, A.F., Douse, A., Lindley, P., McCulloch, N., Noble, D.G. & Win, I. (2021). The status of our bird populations: the fifth Birds of Conservation Concern in the United Kingdom, Channel Islands and Isle of Man and second IUCN Red List assessment of extinction risk for Great Britain. British Birds 114 114, 723 –747.

Tasker, M. L., Hope-Jones, P., Blake, B. F., Dixon, T. J. and Wallis, A. W., 1986. Seabirds associated with oil production platforms in the North Sea. Ringing and Migration 7, 7 – 14.

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

Wakefield ED, Bodey TW, Bearhop S, Blackburn J, Colhoun K, Davies R, Dwyer RG, Green JA, Grémillet D, Jackson AL, Jessopp MJ, Kane A, Langston RH, Lescroël A, Murray S, Le Nuz M, Patrick SC, Péron C, Soanes LM, Wanless S, Votier SC, Hamer KC. Space partitioning without territoriality in gannets. Science. 2013 Jul 5;341(6141):68-70. doi:

Wernham, C.V., Toms, M.P., Marchant, J.H., Clark, J.A., Siriwardena, G.M. and Baillie, S.R. eds (2002). The Migration Atlas: movements of the birds of Britain and Ireland. T. & A.D. Poyser, London.

Woodward, I., Thaxter, C.B., Owen, E. and Cook, A.S.C.P. (2019). Desk-based revision of seabird foraging ranges used for HRA screening. Report of work carried out by the British Trust for Ornithology on behalf of NIRAS and The Crown Estate. BTO Research Report No. 724. Thetford, Norfolk.

Wildfowl and Wetlands Trust (2014). Strategic assessment of collision risk of Scottish offshore wind farms to migrating birds. Scottish Marine and Freshwater Science Report Vol 5 No 12.