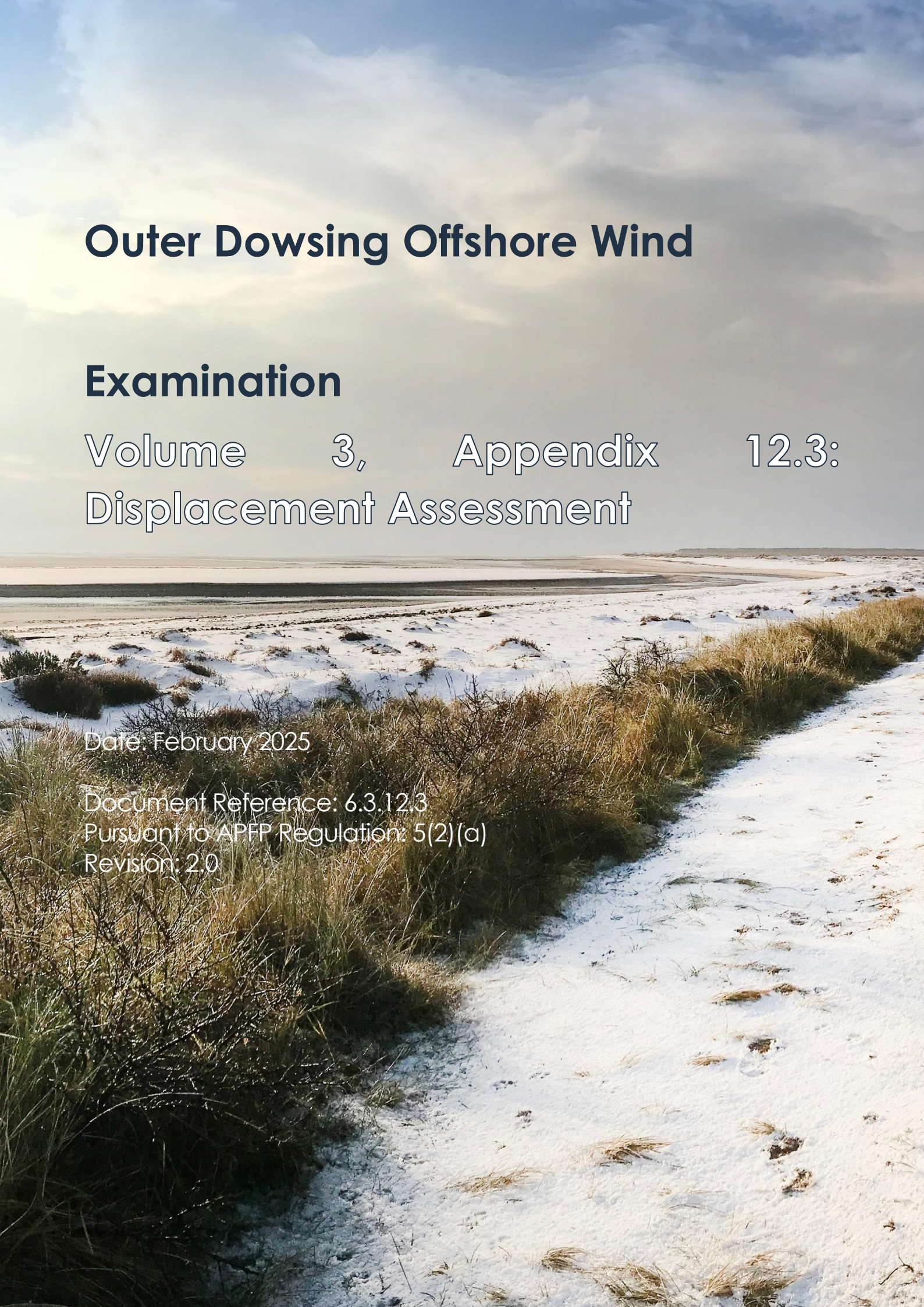
Outer Dowsing Offshore Wind

Examination

Volume 3, Appendix 12.3: Displacement Assessment



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Change Log

- Examination Update: updates to reflect, where relevant: clarifications to date in Examination; correcting errata; additional commitments made through Examination; and changes to status of or addition of cumulative projects.

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Acronyms & Definitions

Abbreviations / Acronyms

Abbreviation / Acronym	Description
ANS	Artificial Nesting Structures
CI	Confidence Interval
DAS	Digital Aerial Surveys
DAS	Digital Aerial Surveys
DCO	Development Consent Order
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Group
MCA	Maritime and Coastguard Agency
MDS	Maximum Design Scenario
MMO	Marine Management Organisation
MRSea	Marine Renewables Strategic environment assessment
OP	Offshore Platforms
ORBA	Offshore Restricted Build Area
ORCP	Offshore Reactive Compensation Platform
OWF	Offshore Windfarm
RSPB	Royal Society for the Protection of Birds
SNCB	Statutory Nature Conservation Body
SPA	Special Protected Area
TCE	The Crown Estate
UKHO	United Kingdom Hydrographic Office
WTG	Wind Turbine Generator

Terminology

Term	Definition
Array area	The area offshore within which the generating station (including wind turbine generators (WTG) and inter array cables), offshore accommodation platforms, offshore transformer substations and associated cabling will be positioned, including the ORBA.
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of the impact with the sensitivity of the receptor, in accordance with defined significance criteria.
Environmental Impact Assessment (EIA)	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Regulations, including the publication of an Environmental Statement (ES).

Term	Definition
EIA Directive	European Union Directive 85/337/EEC, as amended by Directives 97/11/EC, 2003/35/EC and 2009/31/EC and then codified by Directive 2011/92/EU of 13 December 2011 (as amended in 2014 by Directive 2014/52/EU).
EIA Regulations	Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.
Environmental Statement (ES)	The suite of documents that detail the processes and results of the EIA.
Impact	An impact to the receiving environment is defined as any change to its baseline condition, either adverse or beneficial.
Landfall	The location at the land-sea interface where the offshore export cables and fibre optic cables will come ashore.
Maximum Design Scenario	The project design parameters, or a combination of project design parameters that are likely to result in the greatest potential for change in relation to each impact assessed
Outer Dowsing Offshore Wind (ODOW)	The Project.
Offshore Export Cable Corridor (ECC)	The Offshore Export Cable Corridor (Offshore ECC) is the area within the Order Limits within which the export cables running from the array to landfall will be situated.
Offshore Restricted Build Area (ORBA)	The area within the array area, where no wind turbine generator, offshore transformer substation or offshore accommodation platform shall be erected.
Offshore Reactive Compensation Platform (ORCP)	A structure attached to the seabed by means of a foundation, with one or more decks (including bird deterrents) housing electrical reactors and switchgear for the purpose of the efficient transfer of power in the course of HVAC transmission by providing reactive compensation.
Receptor	A distinct part of the environment on which effects could occur and can be the subject of specific assessments. Examples of receptors include species (or groups) of animals or plants, people (often categorised further such as 'residential' or those using areas for amenity or recreation), watercourses etc.
The Applicant	GTR4 Limited (a joint venture between Corio Generation (and its affiliates), TotalEnergies and Gulf Energy Development), trading as Outer Dowsing Offshore Wind.
The Project	Outer Dowsing Offshore Wind, an offshore wind generating station together with associated onshore and offshore infrastructure.
Wind Turbine Generator (WTG)	A structure comprising a tower, rotor with three blades connected at the hub, nacelle and ancillary electrical and other equipment which may include J-tube(s), transition piece, access and rest platforms, access ladders, boat access systems, corrosion protection systems, fenders and maintenance equipment, helicopter landing facilities and other associated equipment, fixed to a foundation
WTG area	Following the introduction of the offshore restricted build area, the

Term	Definition
	WTG area is a reduced area within the array area within which WTG and offshore platforms may be constructed.

1 Introduction

1.1 Project Background

1. GT R4 Limited (trading as Outer Dowsing Offshore Wind) hereafter referred to as the 'Applicant', is proposing to develop the Project. The Applicant submitted an application for a DCO ('the Application') for the Project to the Planning Inspectorate in March 2024, which was accepted for Examination in April 2024.
2. The Project array will be located approximately 54km from the Lincolnshire coastline in the southern North Sea. The Project will include both offshore and onshore infrastructure including an offshore generating station (windfarm), export cables to landfall, Offshore Reactive Compensation Platforms (ORCPs), onshore cables, connection to the electricity transmission network, ancillary and associated development and areas for the delivery of up to two Artificial Nesting Structures (ANS) and the creation of a biogenic reef (if these compensation measures are deemed to be required by the Secretary of State) (see Volume 1, Chapter 3: Project Description [APP-058] for full details).

1.2 Overview

3. This technical annex has been produced to support the assessment of displacement effects on species that are considered sensitive to disturbance and/or displacement from activities associated with and/or the presence of offshore wind farms (OWFs) to inform the consideration of the environmental implications of the ORBA.
4. This document has been updated to introduce two changes which have been made by the Applicant to the proposed Outer Dowsing Offshore Wind (the Project):
   - the introduction of an Offshore Restricted Build Area (ORBA) over the northern section of the array area; and
   - the removal of the northern section of the offshore Export Cable Corridor (ECC).
5. This document was first updated to introduce these changes made by the Applicant during the Examination at the Procedural Deadline 1 (PD1) and was submitted as 15.9F Offshore Restricted Build Area and Revision to the Offshore Export Cable Corridor Appendix F Offshore Ornithology Displacement Assessment (PD1-088). The version submitted at PD1 included updated displacement assessment for the reduced array area, referred to hereafter as 'WTG area'.
6. Following the Examination Authority acceptance of the Change Request, the EIA and HRA assessments have been updated and the version submitted at PD1 has been used as a basis and amended further to incorporate terminology changes and include updated document references.

7. As a result of continuing engagement with stakeholders, and enabled by progress on engineering design, the area within which the Wind Turbine Generators (WTGs) and Offshore Platforms (OPs) will be positioned has been refined. The ORBA has been introduced to reduce the impact from the presence of the WTGs on auk species (specifically common guillemot), informed by a consideration of geophysical and geotechnical data.
8. The ORBA was introduced during examination and covers the northern section of the array area, restricting the installation of WTGs and OPs. This change necessitated an update to the assessments made. For the avoidance of doubt, the ORBA may still be used for cable installation and ancillary operations during construction (and decommissioning) and operations and maintenance. Additionally, Project parameters including number of structures, foundation types, and cable parameters will remain unchanged. As such, no change has been made to the extent of the array area, as defined within the draft Development Consent Order (DCO).
9. Further engineering design and procurement work, informed by additional geophysical, geotechnical and environmental survey work, undertaken post-consent (if granted), will confirm the final layout of infrastructure. Final details will be set out in a design plan to be submitted to and approved by the MMO, following consultation with Trinity House, the Maritime and Coastguard Agency (MCA) and United Kingdom Hydrographic Office (UKHO) prior to commencement of the licensed works, in line deemed Marine Licence condition 13 (see condition 13(1)(a), Part 2, Schedule 10 of the dDCO [document 3.1].
10. The location and size of the ORBA was decided using various factors. MRSea based analysis was used to generate estimates of distribution and abundance, underpinned by observations of guillemot recorded in the DAS imagery (Scott -Hayward et al., 2014). This produced month by month density distribution mapping for the period March 2021 to August 2023 that identified hotspots within the array area plus 2 km buffer.
11. There were some commonality in the hotspots between the 2021 and 2022 surveys with denser concentrations of guillemots recorded in the north and east of the area of interest (Figures 3.1 - 3.4 of Appendix 12.6) particularly within the months of April and August both in 2021 and 2022.
12. The MRSea data (Appendix 12.6) strongly agreed with the design based density estimates, which also show a general pattern of higher densities of guillemot and razorbill to the north of the array area (see Figures 3.31 – 3.33 and 3.37 – 3.39 of Appendix 12.1 Offshore Ornithology Technical Baseline (6.3.12.1)).
13. The introduction and size of the ORBA has been made possible through continued engagement with the relevant oil and gas operators who have interests which overlap with the Project, i.e. due to the presence of oil and gas platforms within or adjacent to the array area. Since the Application, the Applicant has been able to agree the principles for co-existence between the Project and access arrangements to the Malory platform with Perenco, specifically for helicopter transfers to and from this platform. Confidence in the likely final protective provisions for this operator within the DCO for the Project has therefore allowed further engineering work to be undertaken to support additional mitigation of the impact to auk species through a reduction in the area within which WTGs and OPs may be placed.

14. The introduction of the ORBA has resulted in a reduction in the summed mean seasonal peak abundance of guillemot from 27,653.3 birds in the array area plus 2 km buffer (Appendix 12.1 Offshore and Intertidal Ornithology Technical Baseline AS1-064 Version 1) to a summed mean seasonal peak abundance of 23,586 guillemot in the array area minus the ORBA, hereafter referred to as WTG area, plus 2km buffer (Appendix 12.1 Offshore and Intertidal Ornithology Technical Baseline Version 2 (6.3.12.1)).
15. The offshore ECC presented within the Environmental Statement (ES) that supported the DCO Application included two routeing options within the inshore area of the cable route, a northern and a southern route. The northern route was included as it is situated north of the Inner Dowsing sandbank and thus avoided impacts to this designated feature[1]. The southern route was also included as the northern route passes through aggregates Area 1805 which has an option and exploration area agreement with The Crown Estate, although this was due to expire on 31st August 2024. In the event that the option agreement was not taken up by the holder, this seabed area would have become available, thus allowing the Project to avoid crossing the Inner Dowsing sandbank.
16. It has now been confirmed that the option on this area has been extended by TCE until 2025 (pers. comms. Hansons via email 1st May 2024), with a Marine Licence Application (MLA/2024/00227) having been made by the agreement holder on 25th April 2024 to permit aggregates extraction within the site. As such, it is clear that the agreement holder intends to take up the option over this area of the seabed for aggregate extraction, and therefore it is no longer a viable option for the Project to pursue. Consequently, the Project has excluded the northern route from the offshore ECC.

1.3 Document Purpose

17. This technical annex has been produced to support the assessment of displacement effects on species that are considered sensitive to disturbance and/or displacement from activities associated with and/or the presence of offshore wind farms (OWFs) to inform the consideration of the environmental implications of the ORBA. A separate report (Appendix 12.1 Intertidal and Offshore Ornithology Technical Baseline (document reference 6.3.12.1)) provides the findings from offshore and intertidal ornithology surveys to determine the receptors that characterise the baseline and are of relevance to the assessment of likely significant effects from the Project.

[1] The Inner Dowsing sandbank is a designated feature of the Inner Dowsing, Race Bank and North Ridge Special Area of Conservation (SAC), with the feature "sandbanks covered with water at all times" a marine habitat of particular conservation importance and listed under Annex I of the Conservation of Offshore Marine Habitats Regulations (2017)

18. The consideration of offshore and intertidal ornithology for the Project has been discussed with consultees (Natural England and the Royal Society for the Protection of Birds [RSPB]) through The Project Evidence Plan Process (EPP). The latest Natural England and Statutory Nature Conservation Bodies (SNCB) advice has been followed (Parker et al., 2022c; MIG-Birds, 2022). Where there is deviation from this guidance, details are discussed within Volume 1, Chapter 12: Offshore and Intertidal Ecology of the ES (document reference 6.1.12)

1.4 Updates since the ES application

19. All relevant updates based on Natural England comments within their Relevant Representation submission (RR-045) have been incorporated into this displacement assessment appendix. Key updates include:

- Exclusion of the Offshore Restricted Build Area (ORBA) within the displacement assessment;
- Inclusion of matrices presenting the upper 95% Confidence Interval (CI) for all bio-seasons (RR-045- Annex G);
- Inclusion of displacement impacts from Natural England's additional post-breeding bio-season (RR-045- Appendix 2); and
- Inclusion of displacement impacts using abundances derived from model-based estimates (MRSea) (RR-045- F14).

2 Displacement Assessment

20. WTGs may directly disturb and displace vulnerable seabirds that would normally reside within and around The Project array area. The WTG area covers an area of 364.4km^2. This potential habitat loss may reduce the area available for those seabirds sensitive to disturbance to forage, rest and/or moult, particularly during the operational phase. There is also the potential for the construction and decommissioning of WTGs, substations, and cable laying, to directly disturb and displace seabirds within the array area and along the Offshore ECC. However, these potential impacts are more restricted spatially and temporally by virtue of the nature of those phases of the development. The ORBA does not change the construction/ decommissioning phase disturbance effects.
21. Including birds in flight in the assessment accounts forpotential barrier effects (i.e., birds that avoid flying through the space occupied by turbines and incur increased energy costs). Including sitting birds within the assessment accounts for potential habitat loss effects (i.e. birds are potentially displaced from an area of sea where they reside).
22. Six key seabird species, agreed through the EPP [AS1-040], were identified as requiring a displacement assessment in relation to the Project. These include:
    - Common scoter (*Melanitta nigra*);
    - Guillemot (*Uria aalge*);
    - Razorbill (*Alca torda*);
    - Puffin (*Fratacula arctica*).
    - Red-throated diver (*Gavia stellata*); and
    - Gannet (*Morus bassanus*).
23. The same species are considered herein for the WTG area.
24. The data contributing to this analysis are from digital aerial surveys (DAS) (March 2021 to August 2023) of The Project array area plus 4 km buffer. Abundance data from these surveys are used for the assessment of potential displacement impacts from the WTG area and appropriate buffers for the five species of interest (guillemot, razorbill, puffin, red-throated diver, gannet). In addition, using the data from Lawson *et al.* (2015), red-throated diver and common scoter have been assessed for potential displacement resulting from the offshore export cable laying activities within the Offshore ECC, as is outlined in Section 2.1.4.

2.1 Methodology

2.1.1 Guidance

25. The methodology for assessing displacement and barrier effects is based on UK joint SNCB guidance on displacement (MIG-Birds, 2022) and the latest guidance for offshore wind marine environmental assessments published by Natural England (Parker *et al.*, 2022c). These guidance documents outline how to present assessment information on the extent and potential consequences of seabird displacement from OWF developments. This approach has been agreed through EPP consultation and also through the Scoping Opinion as the most appropriate method to assess displacement and barrier effects on seabirds. The guidance states that the following inputs are required for the displacement assessments (MIG-Birds, 2022):
    - Monthly population estimates presented for a minimum two years pre-consent monitoring or another agreed period of time;
    - Site-based abundance estimates to include birds on water and in flight;
    - Counts to be assessed as mean seasonal peaks; and
    - Full details of the worst case and typical scenarios for the development footprint and development footprint plus relevant buffer.
26. In addition, the following inputs can be found within document 6.1.12.1:
    - Full details of the survey techniques;
    - Proportions of different age classes of birds;
    - Raw count data; and
    - Population estimates for development footprint and development footprint plus relevant buffers.
27. The results presented in this Appendix represent the Maximum Design Scenario (MDS) (i.e., The project design scenario giving rise to the greatest level of estimated displacement impact) and are used to subsequently inform the Environmental Statement (document 6.1.12). For displacement impacts the MDS considers that infrastructure would be laid out within the full limits of the WTG area.
28. Displacement has been defined as *"a reduced number of birds occurring within or immediately adjacent to an OWF"* (Furness *et al.*, 2013). Both flying birds and birds on the water are considered in this displacement assessment as recommended by the SNCBs in their latest guidance (MIG-Birds, 2022). Including birds in flight in the assessment accounts for potential barrier effects (i.e., birds that avoid flying through the space occupied by turbines and incur increased energy costs). Including sitting birds within the assessment accounts for potential habitat loss effects (i.e. birds are potentially displaced from an area of sea where they reside).

2.1.2 Bio-seasons

29. Bio-seasons defined by Furness (2015) for each species are presented in Table 2-1. Depending on the species involved, a different number of bio-seasons have been applied during the assessment; these are outlined further below. Natural England have also requested an additional post-breeding bio-season be added for guillemot as defined below.
30. The guidance recommends assessing the effects of displacement based on the overall mean seasonal peak numbers of birds (averaged over the years of survey) in the development footprint and appropriate buffer. For this assessment, DAS data were available for 30 months (March 2021 to August 2023), including two surveys per month for the 2022 breeding season (March – August 2022). The most appropriate method to deal with the two monthly surveys was to calculate the monthly mean abundance of birds for 2022. The mean seasonal peak abundance was then calculated across the same bio-season between survey years.

Table 2-1. Bio-seasons used in the assessment for various seabird species (Furness (2015) for all species apart from Common Scoter. The bio-seasons for Common Scoter were taken from Cramp *et al.*, 1977).

Species	Breeding	Post-breeding migration	Pre-breeding migration	Migration-free winter	Non-breeding
Common scoter	May-Aug	-	-	-	Sept-Apr
Guillemot	Mar-Jul	-	-	-	Aug-Feb
Guillemot (Natural England)	Mar-Jul	Aug-Sep	-	-	Oct-Feb
Razorbill	Apr-Jul	Aug-Oct	Jan-Mar	Nov-Dec	-
Puffin	Apr-Aug	-	-	-	Sept-Mar
Red-throated diver	May-Aug	-	-	-	Sept-Apr
Gannet	Mar-Sept	Oct-Nov	Dec-Feb	-	-

2.1.3 The Matrix Approach

31. This report presents displacement matrices for the WTG area and appropriate buffers for five key species (gannet, puffin, guillemot, razorbill and red-throated diver), and for the Offshore ECC for two key species (red-throated diver and common scoter) that are considered sensitive to disturbance and displacement from the presence of OWFs and/or associated activity including vessel traffic. Common scoter are not assessed within the array and buffer as no birds were recorded in the survey area over the 30 month survey period. Following SNCB guidance (MIG-Birds, 2022), displacement matrices include birds within the WTG area and a 2km buffer for gannet, puffin, guillemot and razorbill, and within the WTG area 4km buffer (the maximum extent of the surveys) for red-throated diver. Matrices for the Offshore ECC considered both red-throated diver and common scoter, using bird density data for the Greater Wash SPA extracted from the Lawson *et al.* (2016) data. Based on the evidence presented in Section 35, a displacement radius of 2km from cable laying vessels was assumed.
32. Displacement matrices are presented for a minimum of two seasons (breeding and non-breeding), as per SNCB guidance (MIG-Birds, 2022). Additional non-breeding bio-seasons are presented for some species (gannet and razorbill) as determined by Furness (2015) and recommended for other OWF projects within the southern North Sea (Natural England, 2022) (Table 2-1).

2.1.4 Displacement of Red-Throated Diver and Common Scoter in the Offshore ECC

33. Seabird species may be at risk of disturbance and displacement effects from construction activities associated with the offshore export cable installation within the offshore ECC, largely as a result of the activity of the cable laying vessel (s) present during the construction period.
34. The Greater Wash SPA, through which the inshore part of the Offshore ECC passes, is designated for two species which are considered sensitive to disturbance and displacement from vessel activity: red-throated diver and common scoter. Both of these species have been shown to be sensitive to vessels at a distance of up to 1km (Schwemmer *et al.*, 2011; Bradbury *et al.*, 2014).
35. Data used to assess the abundance and distributions of red-throated diver and common scoter in the Greater Wash SPA (Lawson *et al.* 2016) have been used to inform the assessment, providing the mean and maximum density of both species within the Offshore ECC as per the analysis to support the DCO Application [APP-164]. The displacement of red-throated diver and common scoter was estimated within the Offshore ECC during the migration-free winter bio-season (January and February). Using the available evidence (Fliessbach *et al.* 2019), and applying a precautionary approach, both species were assumed to be disturbed from an area of 2km surrounding a maximum of three cable laying vessels spread across the full width of the Offshore ECC that lies within the Greater Wash SPA. This is a highly precautionary approach considering it is unlikely that three cable-laying vessels would be operational simultaneously for the installation of cables within the part of the offshore ECC overlapping with the Greater Wash SPA.

2.1.5 Mean and Peak Abundances

36. The mean peak abundances for each bio-season for the WTG area plus an appropriate buffer are presented for each species in Table 2-2. See the Offshore Restricted Build Area and Revision to the Offshore Export Cable Corridor Ornithology Baseline Summary (document 15.9D) for monthly abundances throughout the 30 months of DAS. For conciseness, matrices are only provided for the relevant buffer for each species within this report.
37. Design-based estimates were used to inform the results for all species (Table 2-2). For the species listed below, including guillemot, the bioseasons shown reflect the Applicant's approach. Natural England have suggested an alternative approach for guillemot within their relevant representations (RR-045); however, this approach is outlined in full in Section 3.

Table 2-2. Bio-season mean peak abundances calculated from design-based estimates of species in the WTG area + 2km buffer assessed for disturbance and displacement. Model-based estimates are also included for guillemot. The WTG area + 4km buffer was used for red-throated diver.

Species	Pre-breeding migration	Breeding	Post-breeding migration	Non-breeding	Migration free winter	Total
Guillemot	-	14,371	-	9,215	-	23,586
Guillemot (Natural England)	-	14,371	9,215	4,349	-	27,934
Razorbill	5,134	3,159	2,185	-	1,779	12,257
Puffin	-	666	-	414	-	1,080
Red-throated diver	-	13	-	180	-	192
Gannet	69	554	496	-	-	1,119

2.2 Results

38. The following sections display the displacement matrices for the Offshore ECC and WTG area and relevant buffer zone for each species. The number highlighted in the bottom right of each matrix is the estimated seasonal mean peak abundance of individuals within the WTG area and appropriate buffer. For each matrix the Applicant's approach is highlighted in dark blue and the full range of displacement and mortality suggested by SNCBs highlighted in light blue.

2.2.1 Displacement of Red-Throated Diver and Common Scoter in the Offshore ECC

39. The mean and maximum density of red-throated divers estimated to be within The Project Offshore ECC during the migration free winter bio-season was 0.232 birds km^{-2} and 0.692 birds km^{-2}, respectively. Similarly, the estimated mean and maximum density for common scoter within the ECC was 0.004 birds km^{-2} and 0.029 birds km^{-2}, respectively. Based on a maximum of three cable laying vessels and a 2km disturbance radius, the total area of disturbance at any time was estimated at a maximum of 37.7km. This resulted in a mean (maximum) abundance of 8.75 (26.0) red-throated diver and 0.14 (1.1) common scoter at risk of displacement, highlighted in the bottom right cell of the displacement matrix (Table 2-3 and Table 2-5). As this data was derived from Lawson *et al.* (2016) it was not possible to estimate confidence limits. Therefore, the results have been presented for both the mean and maximum density estimates within the ECC.

Table 2-3. Displacement matrix presenting the maximum number of red-throated diver in the Offshore ECC within a 2km buffer surrounding the cable laying vessels only, during the migration-free winter bio-season. Pale blue shading represents the range of impacts requested by Natural England, with the Applicant's approach shaded dark blue.

Displaced (%)	Mortality Rate (%)												
	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0	0	0	0	1	1	1	1	2	2	2	2	3
20	0	0	0	1	1	2	2	3	3	4	4	5	5
30	0	0	0	1	2	2	3	4	5	5	6	7	8
40	0	0	1	1	2	3	4	5	6	7	8	9	10
50	0	0	1	1	3	4	5	7	8	9	10	12	13
60	0	0	1	2	3	5	6	8	9	11	13	14	16
70	0	0	1	2	4	5	7	9	11	13	15	16	18
80	0	0	1	2	4	6	8	10	13	15	17	19	21
90	0	0	1	2	5	7	9	12	14	16	19	21	23
100	0	1	1	3	5	8	10	13	16	18	21	23	26

Table 2-4. Displacement matrix presenting the mean number of red-throated diver in the Offshore ECC within a 2km buffer surrounding the cable laying vessels only, during the migration-free winter bio-season. Pale blue shading represents the range of impacts requested by Natural England, with the Applicant's approach shaded dark blue.

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

Table 2-5. Displacement matrix presenting the maximum number of common scoter in the Offshore ECC within a 2km buffer surrounding the cable laying vessels only, during the migration-free winter bio-season. Pale blue shading represents the range of impacts requested by Natural England, with the Applicant's approach shaded dark blue.

Displaced (%)	Mortality Rate (%)												
	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	1
60	0	0	0	0	0	0	0	0	0	0	1	1	1
70	0	0	0	0	0	0	0	0	0	1	1	1	1
80	0	0	0	0	0	0	0	0	1	1	1	1	1
90	0	0	0	0	0	0	0	0	1	1	1	1	1
100	0	0	0	0	0	0	0	1	1	1	1	1	1

Table 2-6. Displacement matrix presenting the mean number of common scoter in the Offshore ECC within a 2km buffer surrounding the cable laying vessels only, during the migration-free winter bio-season. Pale blue shading represents the range of impacts requested by Natural England, with the Applicant's approach shaded dark blue.

Displaced (%)	Mortality Rate (%)												
	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0

2.2.2 Gannet

40. Confidence intervals for mean peak bio-season counts for gannet are presented in Table 2-7, and the impact at a range of displacement and mortality rates, over the relevant bio-seasons, in Table 2-8 to Table 2-15.

Table 2-7. Mean peak bio-season counts for gannet within the WTG area plus 2km buffer including upper and lower confidence intervals.

Bioseason	Period	Mean peak Count	Lower 95% CI	Upper 95% CI
Pre-breeding Migration	Dec - Feb	69	41	103
Breeding	Mar - Sept	554	316	829
Post-breeding Migration	Oct - Nov	496	280	767
Total		1,119	637	1,699

Table 2-8. Mean gannet pre-breeding migration displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Pre-breeding migration (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0	0	0	1	1	2	3	3	4	5	6	6	7
20	0	0	1	1	3	4	6	7	8	10	11	12	14
30	0	0	1	2	4	6	8	10	12	14	17	19	21
40	0	1	1	3	6	8	11	14	17	19	22	25	28
50	0	1	2	3	7	10	14	17	21	24	28	31	35
60	0	1	2	4	8	12	17	21	25	29	33	37	41
70	0	1	2	5	10	14	19	24	29	34	39	43	48
80	1	1	3	6	11	17	22	28	33	39	44	50	55
90	1	1	3	6	12	19	25	31	37	43	50	56	62
100	1	1	3	7	14	21	28	35	41	48	55	62	69

Table 2-9 Upper 95% CI gannet pre-breeding migration displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Pre-breeding migration (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0	0	1	1	2	3	4	5	6	7	8	9	10
20	0	0	1	2	4	6	8	10	12	14	16	18	21
30	0	1	2	3	6	9	12	15	18	22	25	28	31
40	0	1	2	4	8	12	16	21	25	29	33	37	41
50	1	1	3	5	10	15	21	26	31	36	41	46	51
60	1	1	3	6	12	18	25	31	37	43	49	55	62
70	1	1	4	7	14	22	29	36	43	50	57	65	72
80	1	2	4	8	16	25	33	41	49	57	66	74	82
90	1	2	5	9	18	28	37	46	55	65	74	83	92
100	1	2	5	10	21	31	41	51	62	72	82	92	103

Table 2-10. Mean gannet breeding season displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Migration-free breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	1	1	3	6	11	17	22	28	33	39	44	50	55
20	1	2	6	11	22	33	44	55	67	78	89	100	111
30	2	3	8	17	33	50	67	83	100	116	133	150	166
40	2	4	11	22	44	67	89	111	133	155	177	200	222
50	3	6	14	28	55	83	111	139	166	194	222	249	277
60	3	7	17	33	67	100	133	166	200	233	266	299	333
70	4	8	19	39	78	116	155	194	233	272	310	349	388
80	4	9	22	44	89	133	177	222	266	310	355	399	443
90	5	10	25	50	100	150	200	249	299	349	399	449	499
100	6	11	28	55	111	166	222	277	333	388	443	499	554

Table 2-11 Upper 95% CI gannet breeding season displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Migration-free breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	1	2	4	8	17	25	33	41	50	58	66	75	83
20	2	3	8	17	33	50	66	83	100	116	133	149	166
30	2	5	12	25	50	75	100	124	149	174	199	224	249
40	3	7	17	33	66	100	133	166	199	232	265	299	332
50	4	8	21	41	83	124	166	207	249	290	332	373	415
60	5	10	25	50	100	149	199	249	299	348	398	448	498
70	6	12	29	58	116	174	232	290	348	406	464	522	581
80	7	13	33	66	133	199	265	332	398	464	531	597	663
90	7	15	37	75	149	224	299	373	448	522	597	672	746
100	8	17	41	83	166	249	332	415	498	581	663	746	829

Table 2-12. Mean gannet post-breeding migration displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Post migration (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0	1	2	5	10	15	20	25	30	35	40	45	50
20	1	2	5	10	20	30	40	50	59	69	79	89	99
30	1	3	7	15	30	45	59	74	89	104	119	134	149
40	2	4	10	20	40	59	79	99	119	139	159	178	198
50	2	5	12	25	50	74	99	124	149	173	198	223	248
60	3	6	15	30	59	89	119	149	178	208	238	268	297
70	3	7	17	35	69	104	139	173	208	243	277	312	347
80	4	8	20	40	79	119	159	198	238	277	317	357	396
90	4	9	22	45	89	134	178	223	268	312	357	401	446
100	5	10	25	50	99	149	198	248	297	347	396	446	496

Table 2-13 Upper 95% CI gannet post-breeding migration displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Post migration (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	1	2	4	8	15	23	31	38	46	54	61	69	77
20	2	3	8	15	31	46	61	77	92	107	123	138	153
30	2	5	12	23	46	69	92	115	138	161	184	207	230
40	3	6	15	31	61	92	123	153	184	215	245	276	307
50	4	8	19	38	77	115	153	192	230	268	307	345	384
60	5	9	23	46	92	138	184	230	276	322	368	414	460
70	5	11	27	54	107	161	215	268	322	376	430	483	537
80	6	12	31	61	123	184	245	307	368	430	491	552	614
90	7	14	35	69	138	207	276	345	414	483	552	621	690
100	8	15	38	77	153	230	307	384	460	537	614	690	767

Table 2-14 Mean gannet annual total displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Total (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	1	2	6	11	22	34	45	56	67	78	90	101	112
20	2	4	11	22	45	67	90	112	134	157	179	201	224
30	3	7	17	34	67	101	134	168	201	235	269	302	336
40	4	9	22	45	90	134	179	224	269	313	358	403	448
50	6	11	28	56	112	168	224	280	336	392	448	504	560
60	7	13	34	67	134	201	269	336	403	470	537	604	671
70	8	16	39	78	157	235	313	392	470	548	627	705	783
80	9	18	45	90	179	269	358	448	537	627	716	806	895
90	10	20	50	101	201	302	403	504	604	705	806	906	1,007
100	11	22	56	112	224	336	448	560	671	783	895	1,007	1,119

Table 2-15 Upper 95% CI gannet annual total displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Total (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	2	3	8	17	34	51	68	85	102	119	136	153	170
20	3	7	17	34	68	102	136	170	204	238	272	306	340
30	5	10	25	51	102	153	204	255	306	357	408	459	510
40	7	14	34	68	136	204	272	340	408	476	544	612	680
50	8	17	42	85	170	255	340	425	510	595	680	765	850
60	10	20	51	102	204	306	408	510	612	714	816	917	1,019
70	12	24	59	119	238	357	476	595	714	833	951	1,070	1,189
80	14	27	68	136	272	408	544	680	816	951	1,087	1,223	1,359
90	15	31	76	153	306	459	612	765	917	1,070	1,223	1,376	1,529
100	17	34	85	170	340	510	680	850	1,019	1,189	1,359	1,529	1,699

2.2.3 Guillemot

Confidence intervals for peak bio-season counts for guillemot are presented in Table 2-16, and the impact at a range of displacement and mortality rates based on the design-based estimates, over the relevant bio-seasons, in Table 2-17 to Table 2-22.

Table 2-16. Mean peak bio-season counts for guillemot within the WTG area plus 2km buffer including upper and lower confidence intervals based on the design-based estimates.

Bioseason	Period	Peak Count	Lower 95% CI	Upper 95% CI
Breeding	Mar - July	14,371	10,765	18,669
Non-Breeding	Aug - Feb	9,215	6,979	12,043
Total		23,586	17,743	30,712

Table 2-17. Mean guillemot breeding season displacement matrix (WTG area plus 2km buffer) based on the design-based estimates, with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	14	29	72	144	287	431	575	719	862	1,006	1,150	1,293	1,437
20	29	57	144	287	575	862	1,150	1,437	1,725	2,012	2,299	2,587	2,874
30	43	86	216	431	862	1,293	1,725	2,156	2,587	3,018	3,449	3,880	4,311
40	57	115	287	575	1,150	1,725	2,299	2,874	3,449	4,024	4,599	5,174	5,748
50	72	144	359	719	1,437	2,156	2,874	3,593	4,311	5,030	5,748	6,467	7,186
60	86	172	431	862	1,725	2,587	3,449	4,311	5,174	6,036	6,898	7,760	8,623
70	101	201	503	1,006	2,012	3,018	4,024	5,030	6,036	7,042	8,048	9,054	10,060
80	115	230	575	1,150	2,299	3,449	4,599	5,748	6,898	8,048	9,197	10,347	11,497
90	129	259	647	1,293	2,587	3,880	5,174	6,467	7,760	9,054	10,347	11,641	12,934
100	144	287	719	1,437	2,874	4,311	5,748	7,186	8,623	10,060	11,497	12,934	14,371

Table 2-18 Upper 95% CI guillemot breeding season displacement matrix (WTG area plus 2km buffer) based on the design-based estimates, with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	19	37	93	187	373	560	747	933	1,120	1,307	1,494	1,680	1,867
20	37	75	187	373	747	1,120	1,494	1,867	2,240	2,614	2,987	3,360	3,734
30	56	112	280	560	1,120	1,680	2,240	2,800	3,360	3,920	4,481	5,041	5,601
40	75	149	373	747	1,494	2,240	2,987	3,734	4,481	5,227	5,974	6,721	7,468
50	93	187	467	933	1,867	2,800	3,734	4,667	5,601	6,534	7,468	8,401	9,335
60	112	224	560	1,120	2,240	3,360	4,481	5,601	6,721	7,841	8,961	1,081	11,201
70	131	261	653	1,307	2,614	3,920	5,227	6,534	7,841	9,148	10,455	11,761	13,068
80	149	299	747	1,494	2,987	4,481	5,974	7,468	8,961	10,455	11,948	13,442	14,935
90	168	336	840	1,680	3,360	5,041	6,721	8,401	10,081	11,761	13,442	15,122	16,802
100	187	373	933	1,867	3,734	5,601	7,468	9,335	11,201	13,068	14,935	6,802	18,669

Table 2-19. Mean guillemot non-breeding season displacement matrix (WTG area plus 2km buffer) based on the design-based estimates, with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Non-breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	9	18	46	92	184	276	369	461	553	645	737	829	922
20	18	37	92	184	369	553	737	922	1,106	1,290	1,474	1,659	1,843
30	28	55	138	276	553	829	1,106	1,382	1,659	1,935	2,212	2,488	2,765
40	37	74	184	369	737	1,106	1,474	1,843	2,212	2,580	2,949	3,317	3,686
50	46	92	230	461	922	1,382	1,843	2,304	2,765	3,225	3,686	4,147	4,608
60	55	111	276	553	1,106	1,659	2,212	2,765	3,317	3,870	4,423	4,976	5,529
70	65	129	323	645	1,290	1,935	2,580	3,225	3,870	4,515	5,160	5,805	6,451
80	74	147	369	737	1,474	2,212	2,949	3,686	4,423	5,160	5,898	6,635	7,372
90	83	166	415	829	1,659	2,488	3,317	4,147	4,976	5,805	6,635	7,464	8,294
100	92	184	461	922	1,843	2,765	3,686	4,608	5,529	6,451	7,372	8,294	9,215

Table 2-20 Upper 95% CI guillemot non-breeding season displacement matrix (WTG area plus 2km buffer) based on the design-based estimates, with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Non-breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	12	24	60	120	241	361	482	602	723	843	963	1,084	1,204
20	24	48	120	241	482	723	963	1,204	1,445	1,686	1,927	2,168	2,409
30	36	72	181	361	723	1,084	1,445	1,806	2,168	2,529	2,890	3,252	3,613
40	48	96	241	482	963	1,445	1,927	2,409	2,890	3,372	3,854	4,335	4,817
50	60	120	301	602	1,204	1,806	2,409	3,011	3,613	4,215	4,817	5,419	6,022
60	72	145	361	723	1,445	2,168	2,890	3,613	4,335	5,058	5,781	6,503	7,226
70	84	169	422	843	1,686	2,529	3,372	4,215	5,058	5,901	6,744	7,587	8,430
80	96	193	482	963	1,927	2,890	3,854	4,817	5,781	6,744	7,708	8,671	9,634
90	108	217	542	1,084	2,168	3,252	4,335	5,419	6,503	7,587	8,671	9,755	10,839
100	120	241	602	1,204	2,409	3,613	4,817	6,022	7,226	8,430	9,634	10,839	12,043

Table 2-21 Mean guillemot total displacement matrix (WTG area plus 2km buffer) based on the design-based estimates, with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Total (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	24	47	118	236	472	708	943	1,179	1,415	1,651	1,887	2,123	2,359
20	47	94	236	472	943	1,415	1,887	2,359	2,830	3,302	3,774	4,245	4,717
30	71	142	354	708	1,415	2,123	2,830	3,538	4,245	4,953	5,661	6,368	7,076
40	94	189	472	943	1,887	2,830	3,774	4,717	5,661	6,604	7,548	8,491	9,434
50	118	236	590	1,179	2,359	3,538	4,717	5,897	7,076	8,255	9,434	10,614	11,793
60	142	283	708	1,415	2,830	4,245	5,661	7,076	8,491	9,906	11,321	12,736	14,152
70	165	330	826	1,651	3,302	4,953	6,604	8,255	9,906	11,557	13,208	14,859	16,510
80	189	377	943	1,887	3,774	5,661	7,548	9,434	11,321	13,208	15,095	16,982	18,869
90	212	425	1,061	2,123	4,245	6,368	8,491	10,614	12,736	14,859	16,982	19,105	21,227
100	236	472	1,179	2,359	4,717	7,076	9,434	11,793	14,152	16,510	18,869	21,227	23,586

Table 2-22 Upper 95% CI guillemot total displacement matrix (WTG area plus 2km buffer) based on the design-based estimates, with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Total (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	31	61	154	307	614	921	1,228	1,536	1,843	2,150	2,457	2,764	3,071
20	61	123	307	614	1,228	1,843	2,457	3,071	3,685	4,300	4,914	5,528	6,142
30	92	184	461	921	1,843	2,764	3,685	4,607	5,528	6,450	7,371	8,292	9,214
40	123	246	614	1,228	2,457	3,685	4,914	6,142	7,371	8,599	9,828	11,056	12,285
50	154	307	768	1,536	3,071	4,607	6,142	7,678	9,214	10,749	12,285	13,820	15,356
60	184	369	921	1,843	3,685	5,528	7,371	9,214	11,056	12,899	14,742	16,584	18,427
70	215	430	1,075	2,150	4,300	6,450	8,599	10,749	12,899	15,049	17,199	19,349	21,498
80	246	491	1,228	2,457	4,914	7,371	9,828	12,285	14,742	17,199	19,656	22,113	24,570
90	276	553	1,382	2,764	5,528	8,292	11,056	13,820	16,584	19,349	22,113	24,877	27,641
100	307	614	1,536	3,071	6,142	9,214	12,285	15,356	18,427	21,498	24,570	27,641	30,712

2.2.4 Razorbill

42. Confidence intervals for peak bio-season counts for razorbill are presented in Table 2-23, and the impact at a range of displacement and mortality rates, over the relevant bio-seasons, in Table 2-24 to Table 2-33.

Table 2-23. Mean peak bio-season counts for razorbill within the WTG area plus 2km buffer including upper and lower confidence intervals.

Bioseason	Period	Peak Count	Lower 95% CI	Upper 95% CI
Pre-breeding migration	Jan - Mar	5,134	3,575	6,800
Breeding	Apr - July	3,159	1,935	4,712
Post-breeding migration	Aug - Oct	2,185	932	3,847
Migration free winter	Nov - Dec	1,779	1,338	2,253
Total		12,257	7,779	17,611

Table 2-24. Mean razorbill pre-breeding migration displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Pre-breeding migration (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	5	10	26	51	103	154	205	257	308	359	411	462	513
20	10	21	51	103	205	308	411	513	616	719	821	924	1,027
30	15	31	77	154	308	462	616	770	924	1,078	1,232	1,386	1,540
40	21	41	103	205	411	616	821	1,027	1,232	1,438	1,643	1,848	2,054
50	26	51	128	257	513	770	1,027	1,284	1,540	1,797	2,054	2,310	2,567
60	31	62	154	308	616	924	1,232	1,540	1,848	2,156	2,464	2,772	3,080
70	36	72	180	359	719	1,078	1,438	1,797	2,156	2,516	2,875	3,234	3,594
80	41	82	205	411	821	1,232	1,643	2,054	2,464	2,875	3,286	3,696	4,107
90	46	92	231	462	924	1,386	1,848	2,310	2,772	3,234	3,696	4,159	4,621
100	51	103	257	513	1,027	1,540	2,054	2,567	3,080	3,594	4,107	4,621	5,134

Table 2-25 Upper 95% CI razorbill pre-breeding migration displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Pre-breeding migration (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	7	14	34	68	136	204	272	340	408	476	544	612	680
20	14	27	68	136	272	408	544	680	816	952	1,088	1,224	1,360
30	20	41	102	204	408	612	816	1,020	1,224	1,428	1,632	1,836	2,040
40	27	54	136	272	544	816	1,088	1,360	1,632	1,904	2,176	2,448	2,720
50	34	68	170	340	680	1,020	1,360	1,700	2,040	2,380	2,720	3,060	3,400
60	41	82	204	408	816	1,224	1,632	2,040	2,448	2,856	3,264	3,672	4,080
70	48	95	238	476	952	1,428	1,904	2,380	2,856	3,332	3,808	4,284	4,760
80	54	109	272	544	1,088	1,632	2,176	2,720	3,264	3,808	4,352	4,896	5,440
90	61	122	306	612	1,224	1,836	2,448	3,060	3,672	4,284	4,896	5,508	6,120
100	68	136	340	680	1,360	2,040	2,720	3,400	4,080	4,760	5,440	6,120	6,800

Table 2-26. Mean razorbill breeding season displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	3	6	16	32	63	95	126	158	190	221	253	284	316
20	6	13	32	63	126	190	253	316	379	442	505	569	632
30	9	19	47	95	190	284	379	474	569	663	758	853	948
40	13	25	63	126	253	379	505	632	758	885	1,011	1,137	1,264
50	16	32	79	158	316	474	632	790	948	1,106	1,264	1,422	1,580
60	19	38	95	190	379	569	758	948	1,137	1,327	1,516	1,706	1,895
70	22	44	111	221	442	663	885	1,106	1,327	1,548	1,769	1,990	2,211
80	25	51	126	253	505	758	1,011	1,264	1,516	1,769	2,022	2,274	2,527
90	28	57	142	284	569	853	1,137	1,422	1,706	1,990	2,274	2,559	2,843
100	32	63	158	316	632	948	1,264	1,580	1,895	2,211	2,527	2,843	3,159

Table 2-27 Upper 95% CI razorbill breeding season displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	5	9	24	47	94	141	188	236	283	330	377	424	471
20	9	19	47	94	188	283	377	471	565	660	754	848	942
30	14	28	71	141	283	424	565	707	848	990	1,131	1,272	1,414
40	19	38	94	188	377	565	754	942	1,131	1,319	1,508	1,696	1,885
50	24	47	118	236	471	707	942	1,178	1,414	1,649	1,885	2,120	2,356
60	28	57	141	283	565	848	1,131	1,414	1,696	1,979	2,262	2,544	2,827
70	33	66	165	330	660	990	1,319	1,649	1,979	2,309	2,639	2,969	3,298
80	38	75	188	377	754	1,131	1,508	1,885	2,262	2,639	3,016	3,393	3,770
90	42	85	212	424	848	1,272	1,696	2,120	2,544	2,969	3,393	3,817	4,241
100	47	94	236	471	942	1,414	1,885	2,356	2,827	3,298	3,770	4,241	4,712

Table 2-28. Mean razorbill post-breeding season displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Post-breeding dispersal (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	2	4	11	22	44	66	87	109	131	153	175	197	219
20	4	9	22	44	87	131	175	219	262	306	350	393	437
30	7	13	33	66	131	197	262	328	393	459	524	590	656
40	9	17	44	87	175	262	350	437	524	612	699	787	874
50	11	22	55	109	219	328	437	546	656	765	874	983	1,093
60	13	26	66	131	262	393	524	656	787	918	1,049	1,180	1,311
70	15	31	76	153	306	459	612	765	918	1,071	1,224	1,377	1,530
80	17	35	87	175	350	524	699	874	1,049	1,224	1,398	1,573	1,748
90	20	39	98	197	393	590	787	983	1,180	1,377	1,573	1,770	1,967
100	22	44	109	219	437	656	874	1,093	1,311	1,530	1,748	1,967	2,185

Table 2-29 Upper 95% CI razorbill post-breeding season displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Post-breeding dispersal (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	4	8	19	38	77	115	154	192	231	269	308	346	385
20	8	15	38	77	154	231	308	385	462	539	616	692	769
30	12	23	58	115	231	346	462	577	692	808	923	1,039	1,154
40	15	31	77	154	308	462	616	769	923	1,077	1,231	1,385	1,539
50	19	38	96	192	385	577	769	962	1,154	1,346	1,539	1,731	1,924
60	23	46	115	231	462	692	923	1,154	1,385	1,616	1,847	2,077	2,308
70	27	54	135	269	539	808	1,077	1,346	1,616	1,885	2,154	2,424	2,693
80	31	62	154	308	616	923	1,231	1,539	1,847	2,154	2,462	2,770	3,078
90	35	69	173	346	692	1,039	1,385	1,731	2,077	2,424	2,770	3,116	3,462
100	38	77	192	385	769	1,154	1,539	1,924	2,308	2,693	3,078	3,462	3,847

Table 2-30. Mean razorbill migration free winter displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Migration-free winter (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	2	4	9	18	36	53	71	89	107	125	142	160	178
20	4	7	18	36	71	107	142	178	213	249	285	320	356
30	5	11	27	53	107	160	213	267	320	374	427	480	534
40	7	14	36	71	142	213	285	356	427	498	569	640	712
50	9	18	44	89	178	267	356	445	534	623	712	801	890
60	11	21	53	107	213	320	427	534	640	747	854	961	1,067
70	12	25	62	125	249	374	498	623	747	872	996	1,121	1,245
80	14	28	71	142	285	427	569	712	854	996	1,139	1,281	1,423
90	16	32	80	160	320	480	640	801	961	1,121	1,281	1,441	1,601
100	18	36	89	178	356	534	712	890	1,067	1,245	1,423	1,601	1,779

Table 2-31 Upper 95% CI razorbill migration free winter displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Migration-free winter (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	2	5	11	23	45	68	90	113	135	158	180	203	225
20	5	9	23	45	90	135	180	225	270	315	360	406	451
30	7	14	34	68	135	203	270	338	406	473	541	608	676
40	9	18	45	90	180	270	360	451	541	631	721	811	901
50	11	23	56	113	225	338	451	563	676	789	901	1,014	1,127
60	14	27	68	135	270	406	541	676	811	946	1,081	1,217	1,352
70	16	32	79	158	315	473	631	789	946	1,104	1,262	1,419	1,577
80	18	36	90	180	360	541	721	901	1,081	1,262	1,442	1,622	1,802
90	20	41	101	203	406	608	811	1,014	1,217	1,419	1,622	1,825	2,028
100	23	45	113	225	451	676	901	1,127	1,352	1,577	1,802	2,028	2,253

Table 2-32 Mean razorbill total displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Total (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	12	25	61	123	245	368	490	613	735	858	981	1,103	1,226
20	25	49	123	245	490	735	981	1,226	1,471	1,716	1,961	2,206	2,451
30	37	74	184	368	735	1,103	1,471	1,839	2,206	2,574	2,942	3,309	3,677
40	49	98	245	490	981	1,471	1,961	2,451	2,942	3,432	3,922	4,413	4,903
50	61	123	306	613	1,226	1,839	2,451	3,064	3,677	4,290	4,903	5,516	6,129
60	74	147	368	735	1,471	2,206	2,942	3,677	4,413	5,148	5,883	6,619	7,354
70	86	172	429	858	1,716	2,574	3,432	4,290	5,148	6,006	6,864	7,722	8,580
80	98	196	490	981	1,961	2,942	3,922	4,903	5,883	6,864	7,844	8,825	9,806
90	110	221	552	1,103	2,206	3,309	4,413	5,516	6,619	7,722	8,825	9,928	1,031
100	123	245	613	1,226	2,451	3,677	4,903	6,129	7,354	8,580	9,806	11,031	12,257

Table 2-33 Upper 95% CI razorbill total displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Total (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	18	35	88	176	352	528	704	881	1,057	1,233	1,409	1,585	1,761
20	35	70	176	352	704	1,057	1,409	1,761	2,113	2,466	2,818	3,170	3,522
30	53	106	264	528	1,057	1,585	2,113	2,642	3,170	3,698	4,227	4,755	5,283
40	70	141	352	704	1,409	2,113	2,818	3,522	4,227	4,931	5,636	6,340	7,044
50	88	176	440	881	1,761	2,642	3,522	4,403	5,283	6,164	7,044	7,925	8,806
60	106	211	528	1,057	2,113	3,170	4,227	5,283	6,340	7,397	8,453	9,510	10,567
70	123	247	616	1,233	2,466	3,698	4,931	6,164	7,397	8,629	9,862	11,095	12,328
80	141	282	704	1,409	2,818	4,227	5,636	7,044	8,453	9,862	11,271	12,680	14,089
90	158	317	792	1,585	3,170	4,755	6,340	7,925	9,510	11,095	12,680	14,265	15,850
100	176	352	881	1,761	3,522	5,283	7,044	8,806	10,567	12,328	14,089	15,850	17,611

2.2.5 Puffin

43. Confidence intervals for peak bio-season counts for puffin are presented in Table 2-34, and the impact at a range of displacement and mortality rates, over the relevant bio-seasons, in Table 2-35 to Table 2-40.

Table 2-34. Mean peak bio-season counts for puffin within the WTG area plus 2km buffer including upper and lower confidence intervals.

Bioseason	Period	Peak Count	Lower 95% CI	Upper 95% CI
Breeding	Apr – Aug	666	419	960
Non-Breeding	Sept – Mar	414	293	570
Total		1,080	712	1,529

44.

Table 2-35. Mean puffin breeding season displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	1	1	3	7	13	20	27	33	40	47	53	60	67
20	1	3	7	13	27	40	53	67	80	93	107	120	133
30	2	4	10	20	40	60	80	100	120	140	160	180	200
40	3	5	13	27	53	80	107	133	160	186	213	240	266
50	3	7	17	33	67	100	133	167	200	233	266	300	333
60	4	8	20	40	80	120	160	200	240	280	320	360	400
70	5	9	23	47	93	140	186	233	280	326	373	420	466
80	5	11	27	53	107	160	213	266	320	373	426	480	533
90	6	12	30	60	120	180	240	300	360	420	480	539	599
100	7	13	33	67	133	200	266	333	400	466	533	599	666

Table 2-36 Upper 95% CI puffin breeding season displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	1	2	5	10	19	29	38	48	58	67	77	86	96
20	2	4	10	19	38	58	77	96	115	134	154	173	192
30	3	6	14	29	58	86	115	144	173	202	230	259	288
40	4	8	19	38	77	115	154	192	230	269	307	346	384
50	5	10	24	48	96	144	192	240	288	336	384	432	480
60	6	12	29	58	115	173	230	288	346	403	461	518	576
70	7	13	34	67	134	202	269	336	403	470	538	605	672
80	8	15	38	77	154	230	307	384	461	538	614	691	768
90	9	17	43	86	173	259	346	432	518	605	691	778	864
100	10	19	48	96	192	288	384	480	576	672	768	864	960

Table 2-37. Mean puffin non-breeding season displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Non-breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0	1	2	4	8	12	17	21	25	29	33	37	41
20	1	2	4	8	17	25	33	41	50	58	66	75	83
30	1	2	6	12	25	37	50	62	75	87	99	112	124
40	2	3	8	17	33	50	66	83	99	116	132	149	166
50	2	4	10	21	41	62	83	104	124	145	166	186	207
60	2	5	12	25	50	75	99	124	149	174	199	224	248
70	3	6	14	29	58	87	116	145	174	203	232	261	290
80	3	7	17	33	66	99	132	166	199	232	265	298	331
90	4	7	19	37	75	112	149	186	224	261	298	335	373
100	4	8	21	41	83	124	166	207	248	290	331	373	414

Table 2-38 Upper 95% CI puffin non-breeding season displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Non-breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	1	1	3	6	11	17	23	29	34	40	46	51	57
20	1	2	6	11	23	34	46	57	68	80	91	103	114
30	2	3	9	17	34	51	68	86	103	120	137	154	171
40	2	5	11	23	46	68	91	114	137	160	182	205	228
50	3	6	14	29	57	86	114	143	171	200	228	257	285
60	3	7	17	34	68	103	137	171	205	239	274	308	342
70	4	8	20	40	80	120	160	200	239	279	319	359	399
80	5	9	23	46	91	137	182	228	274	319	365	410	456
90	5	10	26	51	103	154	205	257	308	359	410	462	513
100	6	11	29	57	114	171	228	285	342	399	456	513	570

Table 2-39 Mean puffin total displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Total (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	1	2	5	11	22	32	43	54	65	76	86	97	108
20	2	4	11	22	43	65	86	108	130	151	173	194	216
30	3	6	16	32	65	97	130	162	194	227	259	292	324
40	4	9	22	43	86	130	173	216	259	302	346	389	432
50	5	11	27	54	108	162	216	270	324	378	432	486	540
60	6	13	32	65	130	194	259	324	389	454	518	583	648
70	8	15	38	76	151	227	302	378	454	529	605	680	756
80	9	17	43	86	173	259	346	432	518	605	691	778	864
90	10	19	49	97	194	292	389	486	583	680	778	875	972
100	11	22	54	108	216	324	432	540	648	756	864	972	1,080

Table 2-40 Upper 95% CI puffin total displacement matrix (WTG area plus 2km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Total (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	2	3	8	15	31	46	61	76	92	107	122	138	153
20	3	6	15	31	61	92	122	153	183	214	245	275	306
30	5	9	23	46	92	138	183	229	275	321	367	413	459
40	6	12	31	61	122	183	245	306	367	428	489	550	612
50	8	15	38	76	153	229	306	382	459	535	612	688	765
60	9	18	46	92	183	275	367	459	550	642	734	826	917
70	11	21	54	107	214	321	428	535	642	749	856	963	1,070
80	12	24	61	122	245	367	489	612	734	856	979	1,101	1,223
90	14	28	69	138	275	413	550	688	826	963	1,101	1,238	1,376
100	15	31	76	153	306	459	612	765	917	1,070	1,223	1,376	1,529

2.2.6 Red-Throated Diver

46. Confidence intervals for peak bio-season counts for red-throated diver are presented in Table 2-41, and the impact at a range of displacement and mortality rates, over the relevant bio-seasons, in Table 2-42 to Table 2-47.

Table 2-41. Mean peak bio-season counts for red-throated diver within the WTG area plus 2km buffer including upper and lower confidence intervals.

Bioseason	Period	Peak Count	Lower 95% CI	Upper 95% CI
Breeding	May - Aug	13	0	29
Non-Breeding	Sept - Apr	180	104	266
Total		192	104	295

Table 2-42. Mean red-throated diver breeding season displacement matrix (WTG area plus 4km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Breeding (Array + 4km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0	0	0	0	0	0	1	1	1	1	1	1	1
20	0	0	0	0	1	1	1	1	2	2	2	2	3
30	0	0	0	0	1	1	2	2	2	3	3	3	4
40	0	0	0	1	1	2	2	3	3	4	4	5	5
50	0	0	0	1	1	2	3	3	4	4	5	6	6
60	0	0	0	1	2	2	3	4	5	5	6	7	8
70	0	0	0	1	2	3	4	4	5	6	7	8	9
80	0	0	1	1	2	3	4	5	6	7	8	9	10
90	0	0	1	1	2	3	5	6	7	8	9	10	11
100	0	0	1	1	3	4	5	6	8	9	10	11	13

Table 2-43 Upper 95% CI red-throated diver breeding season displacement matrix (WTG area plus 4km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Breeding (Array + 4km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0	0	0	0	1	1	1	1	2	2	2	3	3
20	0	0	0	1	1	2	2	3	4	4	5	5	6
30	0	0	0	1	2	3	4	4	5	6	7	8	9
40	0	0	1	1	2	4	5	6	7	8	9	11	12
50	0	0	1	1	3	4	6	7	9	10	12	13	15
60	0	0	1	2	4	5	7	9	11	12	14	16	18
70	0	0	1	2	4	6	8	10	12	14	16	18	20
80	0	0	1	2	5	7	9	12	14	16	19	21	23
90	0	1	1	3	5	8	11	13	16	18	21	24	26
100	0	1	1	3	6	9	12	15	18	20	23	26	29

Table 2-44 Mean red-throated diver non-breeding displacement matrix (WTG area plus 4km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Non-breeding (Array + 4km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0	0	1	2	4	5	7	9	11	13	14	16	18
20	0	1	2	4	7	11	14	18	22	25	29	32	36
30	1	1	3	5	11	16	22	27	32	38	43	48	54
40	1	1	4	7	14	22	29	36	43	50	57	65	72
50	1	2	4	9	18	27	36	45	54	63	72	81	90
60	1	2	5	11	22	32	43	54	65	75	86	97	108
70	1	3	6	13	25	38	50	63	75	88	101	113	126
80	1	3	7	14	29	43	57	72	86	101	115	129	144
90	2	3	8	16	32	48	65	81	97	113	129	145	162
100	2	4	9	18	36	54	72	90	108	126	144	162	180

Table 2-45 Upper 95% CI red-throated diver non-breeding displacement matrix (WTG area plus 4km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Non-breeding (Array + 4km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0	1	1	3	5	8	11	13	16	19	21	24	27
20	1	1	3	5	11	16	21	27	32	37	43	48	53
30	1	2	4	8	16	24	32	40	48	56	64	72	80
40	1	2	5	11	21	32	43	53	64	74	85	96	106
50	1	3	7	13	27	40	53	66	80	93	106	120	133
60	2	3	8	16	32	48	64	80	96	112	128	143	159
70	2	4	9	19	37	56	74	93	112	130	149	167	186
80	2	4	11	21	43	64	85	106	128	149	170	191	213
90	2	5	12	24	48	72	96	120	143	167	191	215	239
100	3	5	13	27	53	80	106	133	159	186	213	239	266

Table 2-46 Mean CI red-throated diver total displacement matrix (WTG area plus 4km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Total (Array + 4km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0	0	1	2	4	6	8	10	12	13	15	17	19
20	0	1	2	4	8	12	15	19	23	27	31	35	38
30	1	1	3	6	12	17	23	29	35	40	46	52	58
40	1	2	4	8	15	23	31	38	46	54	61	69	77
50	1	2	5	10	19	29	38	48	58	67	77	86	96
60	1	2	6	12	23	35	46	58	69	81	92	104	115
70	1	3	7	13	27	40	54	67	81	94	108	121	134
80	2	3	8	15	31	46	61	77	92	108	123	138	154
90	2	3	9	17	35	52	69	86	104	121	138	156	173
100	2	4	10	19	38	58	77	96	115	134	154	173	192

Table 2-47 Upper 95% CI red-throated diver total displacement matrix (WTG area plus 4km buffer), with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Total (Array + 4km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	0	1	1	3	6	9	12	15	18	21	24	27	30
20	1	1	3	6	12	18	24	30	35	41	47	53	59
30	1	2	4	9	18	27	35	44	53	62	71	80	89
40	1	2	6	12	24	35	47	59	71	83	94	106	118
50	1	3	7	15	30	44	59	74	89	103	118	133	148
60	2	4	9	18	35	53	71	89	106	124	142	159	177
70	2	4	10	21	41	62	83	103	124	145	165	186	207
80	2	5	12	24	47	71	94	118	142	165	189	212	236
90	3	5	13	27	53	80	106	133	159	186	212	239	266
100	3	6	15	30	59	89	118	148	177	207	236	266	295

3 Natural England's Approach

48. Consultation with key stakeholders has been undertaken as part of this DCO application process. The species assessed for displacement and barrier effects used the UK joint SNCB parameters for displacement (MIG-Birds, 2022) and the latest guidance for offshore wind marine environmental assessments published by Natural England (Parker *et al.*, 2022c). These guidance documents outline how to present assessment information on the extent and potential consequences of seabird displacement from OWF developments. This approach has been agreed through EPP consultation and also through the Scoping Opinion as the most appropriate method to assess displacement and barrier effects on seabirds (for details see AS1-040].
49. Within their Relevant Representation, however, Natural England has stated a preference that alternative bioseaons for guillemot be used in displacement analysis (RR-045, reference F36). In the full displacement analysis above, bioseasons for all species, including guillemot, have been taken from Furness (2015), as per UK joint SNCB guidance. However, the alternative bioseasons based on Natural England Relevant Representations (RR-045) are presented here in Table 3-1.

Table 3-1 Bio-seasons used in the assessment for guillemot, including the UK joint SNCB bioseasons taken from Furness (2015) and the Natural England suggested bioseasons.

Species	Pre-breeding migration	Breeding	Post-breeding migration	Non-breeding	Migration-free winter
Guillemot (Furness, 2015)	-	Mar-Jul	-	Aug-Feb	-
Guillemot (Natural England)	-	Mar-Jul	Aug-Sep	Oct-Feb	-

50. The mean peak abundances for each bio-season for the WTG area plus an appropriate buffer are presented for both guillemot scenarios in Table 3-2. The displacement assessment was carried out according to the same methodology in Section 2.1, although with the new Natural England parameters.

Table 3-2 Bio-season mean peak abundances calculated from design-based estimates of guillemot in the WTG area + 2km buffer assessed for disturbance and displacement. The results of both the project-specific and Natural England scenarios are shown below.

Species	Pre-breeding migration	Breeding	Post-breeding migration	Non-breeding	Migration free winter	Total
Guillemot (Furness, 2015)	-	14,371	-	9,215	-	23,586
Guillemot (Natural England)	-	14,371	9,215	4,349	-	27,934

51. The full results of the displacement assessment using Natural England parameters are shown below. Confidence intervals for peak bio-season counts for guillemot are presented in Table 3-3, and the impact at a range of displacement and mortality rates based on the design-based estimates, over the relevant bio-seasons, in Table 3-4 to Table 3-11.

Table 3-3 Mean peak bio-season counts for guillemot (using the Natural England parameters) within the WTG area plus 2km buffer including upper and lower confidence intervals.

Bioseason	Period	Peak Count	Lower 95% CI	Upper 95% CI
Breeding	Mar-Jul	14,371	10,765	18,669
Post-breeding migration	Aug-Sep	9,215	6,979	12,043
Non-Breeding	Oct-Feb	4,349	3,511	5,311
Total		27,934	21,254	36,022

Table 3-4 Mean guillemot breeding season displacement matrix (WTG area plus 2km buffer) using the Natural England parameters. The applicant's approach is highlighted in dark blue and the full range suggested by SNCBs in light blue.

Breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	14	29	72	144	287	431	575	719	862	1,006	1,150	1,293	1,437
20	29	57	144	287	575	862	1,150	1,437	1,725	2,012	2,299	2,587	2,874
30	43	86	216	431	862	1,293	1,725	2,156	2,587	3,018	3,449	3,880	4,311
40	57	115	287	575	1,150	1,725	2,299	2,874	3,449	4,024	4,599	5,174	5,748
50	72	144	359	719	1,437	2,156	2,874	3,593	4,311	5,030	5,748	6,467	7,186
60	86	172	431	862	1,725	2,587	3,449	4,311	5,174	6,036	6,898	7,760	8,623
70	101	201	503	1,006	2,012	3,018	4,024	5,030	6,036	7,042	8,048	9,054	10,060
80	115	230	575	1,150	2,299	3,449	4,599	5,748	6,898	8,048	9,197	10,347	11,497
90	129	259	647	1,293	2,587	3,880	5,174	6,467	7,760	9,054	10,347	11,641	12,934
100	144	287	719	1,437	2,874	4,311	5,748	7,186	8,623	10,060	11,497	12,934	14,371

Table 3-5 Upper 95% CI guillemot breeding season displacement matrix (WTG area plus 2km buffer) using the Natural England parameters. The applicant's approach is highlighted in dark blue and the full range suggested by SNCBs in light blue.

Breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	19	37	93	187	373	560	747	933	1,120	1,307	1,494	1,680	1,867
20	37	75	187	373	747	1,120	1,494	1,867	2,240	2,614	2,987	3,360	3,734
30	56	112	280	560	1,120	1,680	2,240	2,800	3,360	3,920	4,481	5,041	5,601
40	75	149	373	747	1,494	2,240	2,987	3,734	4,481	5,227	5,974	6,721	7,468
50	93	187	467	933	1,867	2,800	3,734	4,667	5,601	6,534	7,468	8,401	9,335
60	112	224	560	1,120	2,240	3,360	4,481	5,601	6,721	7,841	8,961	10,081	11,201
70	131	261	653	1,307	2,614	3,920	5,227	6,534	7,841	9,148	10,455	11,761	13,068
80	149	299	747	1,494	2,987	4,481	5,974	7,468	8,961	10,455	11,948	13,442	14,935
90	168	336	840	1,680	3,360	5,041	6,721	8,401	10,081	11,761	13,442	15,122	16,802
100	187	373	933	1,867	3,734	5,601	7,468	9,335	11,201	13,068	14,935	16,802	18,669

Table 3-6 Mean guillemot post-breeding migration season displacement matrix (WTG area plus 2km buffer) using the Natural England parameters. The applicant's approach is highlighted in dark blue and the full range suggested by SNCBs in light blue.

Post-breeding migration (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	9	18	46	92	184	276	369	461	553	645	737	829	922
20	18	37	92	184	369	553	737	922	1,106	1,290	1,474	1,659	1,843
30	28	55	138	276	553	829	1,106	1,382	1,659	1,935	2,212	2,488	2,765
40	37	74	184	369	737	1,106	1,474	1,843	2,212	2,580	2,949	3,317	3,686
50	46	92	230	461	922	1,382	1,843	2,304	2,765	3,225	3,686	4,147	4,608
60	55	111	276	553	1,106	1,659	2,212	2,765	3,317	3,870	4,423	4,976	5,529
70	65	129	323	645	1,290	1,935	2,580	3,225	3,870	4,515	5,160	5,805	6,451
80	74	147	369	737	1,474	2,212	2,949	3,686	4,423	5,160	5,898	6,635	7,372
90	83	166	415	829	1,659	2,488	3,317	4,147	4,976	5,805	6,635	7,464	8,294
100	92	184	461	922	1,843	2,765	3,686	4,608	5,529	6,451	7,372	8,294	9,215

Table 3-7 Upper 95% CI guillemot post-breeding migration season displacement matrix (WTG area plus 2km buffer) using the Natural England parameters. The applicant's approach is highlighted in dark blue and the full range suggested by SNCBs in light blue.

Post-breeding migration (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	12	24	60	120	241	361	482	602	723	843	963	1,084	1,204
20	24	48	120	241	482	723	963	1,204	1,445	1,686	1,927	2,168	2,409
30	36	72	181	361	723	1,084	1,445	1,806	2,168	2,529	2,890	3,252	3,613
40	48	96	241	482	963	1,445	1,927	2,409	2,890	3,372	3,854	4,335	4,817
50	60	120	301	602	1,204	1,806	2,409	3,011	3,613	4,215	4,817	5,419	6,022
60	72	145	361	723	1,445	2,168	2,890	3,613	4,335	5,058	5,781	6,503	7,226
70	84	169	422	843	1,686	2,529	3,372	4,215	5,058	5,901	6,744	7,587	8,430
80	96	193	482	963	1,927	2,890	3,854	4,817	5,781	6,744	7,708	8,671	9,634
90	108	217	542	1,084	2,168	3,252	4,335	5,419	6,503	7,587	8,671	9,755	10,839
100	120	241	602	1,204	2,409	3,613	4,817	6,022	7,226	8,430	9,634	10,839	12,043

Table 3-8 Mean guillemot non-breeding season displacement matrix (WTG area plus 2km buffer) using the Natural England parameters. The applicant's approach is highlighted in dark blue and the full range suggested by SNCBs in light blue.

Non-breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	4	9	22	43	87	130	174	217	261	304	348	391	435
20	9	17	43	87	174	261	348	435	522	609	696	783	870
30	13	26	65	130	261	391	522	652	783	913	1,044	1,174	1,305
40	17	35	87	174	348	522	696	870	1,044	1,218	1,392	1,566	1,740
50	22	43	109	217	435	652	870	1,087	1,305	1,522	1,740	1,957	2,175
60	26	52	130	261	522	783	1,044	1,305	1,566	1,827	2,088	2,348	2,609
70	30	61	152	304	609	913	1,218	1,522	1,827	2,131	2,435	2,740	3,044
80	35	70	174	348	696	1,044	1,392	1,740	2,088	2,435	2,783	3,131	3,479
90	39	78	196	391	783	1,174	1,566	1,957	2,348	2,740	3,131	3,523	3,914
100	43	87	217	435	870	1,305	1,740	2,175	2,609	3,044	3,479	3,914	4,349

Table 3-9 Upper 95% CI guillemot non-breeding season displacement matrix (WTG area plus 2km buffer) using the Natural England parameters. The applicant's approach is highlighted in dark blue and the full range suggested by SNCBs in light blue.

Non-breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	5	11	27	53	106	159	212	266	319	372	425	478	531
20	11	21	53	106	212	319	425	531	637	744	850	956	1,062
30	16	32	80	159	319	478	637	797	956	1,115	1,275	1,434	1,593
40	21	42	106	212	425	637	850	1,062	1,275	1,487	1,700	1,912	2,124
50	27	53	133	266	531	797	1,062	1,328	1,593	1,859	2,124	2,390	2,656
60	32	64	159	319	637	956	1,275	1,593	1,912	2,231	2,549	2,868	3,187
70	37	74	186	372	744	1,115	1,487	1,859	2,231	2,602	2,974	3,346	3,718
80	42	85	212	425	850	1,275	1,700	2,124	2,549	2,974	3,399	3,824	4,249
90	48	96	239	478	956	1,434	1,912	2,390	2,868	3,346	3,824	4,302	4,780
100	53	106	266	531	1,062	1,593	2,124	2,656	3,187	3,718	4,249	4,780	5,311

Table 3-10 Mean guillemot total displacement matrix (WTG area plus 2km buffer) using the Natural England parameters. The applicant's approach is highlighted in dark blue and the full range suggested by SNCBs in light blue.

Total (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	28	56	140	279	559	838	1,117	1,397	1,676	1,955	2,235	2,514	2,793
20	56	112	279	559	1,117	1,676	2,235	2,793	3,352	3,911	4,469	5,028	5,587
30	84	168	419	838	1,676	2,514	3,352	4,190	5,028	5,866	6,704	7,542	8,380
40	112	223	559	1,117	2,235	3,352	4,469	5,587	6,704	7,822	8,939	10,056	11,174
50	140	279	698	1,397	2,793	4,190	5,587	6,984	8,380	9,777	11,174	12,570	13,967
60	168	335	838	1,676	3,352	5,028	6,704	8,380	10,056	11,732	13,408	15,084	16,760
70	196	391	978	1,955	3,911	5,866	7,822	9,777	11,732	13,688	15,643	17,598	19,554
80	223	447	1,117	2,235	4,469	6,704	8,939	11,174	13,408	15,643	17,878	20,112	22,347
90	251	503	1,257	2,514	5,028	7,542	10,056	12,570	15,084	17,598	20,112	22,627	25,141
100	279	559	1,397	2,793	5,587	8,380	11,174	13,967	16,760	19,554	22,347	25,141	27,934

Table 3-11 Upper 95% CI guillemot total displacement matrix (WTG area plus 2km buffer) using the Natural England parameters. The applicant's approach is highlighted in dark blue and the full range suggested by SNCBs in light blue.

Total (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	36	72	180	360	720	1,081	1,441	1,801	2,161	2,522	2,882	3,242	3,602
20	72	144	360	720	1,441	2,161	2,882	3,602	4,323	5,043	5,764	6,484	7,204
30	108	216	540	1,081	2,161	3,242	4,323	5,403	6,484	7,565	8,645	9,726	10,807
40	144	288	720	1,441	2,882	4,323	5,764	7,204	8,645	10,086	11,527	12,968	14,409
50	180	360	901	1,801	3,602	5,403	7,204	9,006	10,807	12,608	14,409	16,210	18,011
60	216	432	1,081	2,161	4,323	6,484	8,645	10,807	12,968	15,129	17,291	19,452	21,613
70	252	504	1,261	2,522	5,043	7,565	10,086	12,608	15,129	17,651	20,172	22,694	25,215
80	288	576	1,441	2,882	5,764	8,645	11,527	14,409	17,291	20,172	23,054	25,936	28,818
90	324	648	1,621	3,242	6,484	9,726	12,968	16,210	19,452	22,694	25,936	29,178	32,420
100	360	720	1,801	3,602	7,204	10,807	14,409	18,011	21,613	25,215	28,818	32,420	36,022

4 Displacement using MRSea Abundance and Density Estimates

52. Model-based abundance and density estimates using the MRSea (Marine Renewables Strategic Environmental Assessment) modelling framework were used in the ES that were developed specifically for offshore wind development (Scott-Hayward *et al.*, 2014).
53. To provide more detail for common guillemot within the Project site, model-based approaches were used to determine statistically robust, spatially distributed population estimates. Using model-based techniques means that environmental variables can be included within the displacement analysis to help predict abundance and density distributions within the AoI. MRSea based analysis was used to generate estimates of distribution and abundance, underpinned by observations of guillemot recorded in the DAS imagery (Scott-Hayward *et al.*, 2014). Full details of the methods used to calculate the estimates from MRSea can be found in: Offshore Restricted Build Area and Revision to the Offshore Export Cable Corridor Appendix G MRSea Modelling for Offshore Ornithology (Document reference 15.9G).
54. Model-based peak abundance (apportioned & availability bias) throughout the whole survey area was estimated in April 2022, with 29,720 guillemots - equating to a density of 54.17 birds/km^2. Results from the model-based abundance estimates show that in August 2021, the highest density of guillemots were estimated in the east of the survey area, while in August 2022 high densities were to the north of the survey area. Full modelled abundance and density estimates are provided in: Offshore Restricted Build Area and Revision to the Offshore Export Cable Corridor Appendix G MRSea Modelling for Offshore Ornithology (Document reference 15.9G).
55. These modelled abundance estimates were used to provide mean peak abundance estimates for each guillemot bioseason. These seasonal mean peak abundance estimates are provided below in Table 4-1 using both the Furness (2015) and Natural England bioseasons. The MRSea model produced a lower estimated abundance of guillemot across all months

Table 4-1 Bio-seasons used in the assessment for guillemot, including the UK joint SNCB bioseasons taken from Furness (2015) and the Natural England suggested bioseasons.

Species	Pre-breeding migration	Breeding	Post-breeding migration	Non-breeding	Migration-free winter
Guillemot (Furness, 2015)	-	Mar-Jul	-	Aug-Feb	-
Guillemot (Natural England)	-	Mar-Jul	Aug-Sep	Oct-Feb	-

56. The modelled mean peak abundances for each bio-season for the WTG area plus an appropriate buffer are presented for both guillemot scenarios in Table 4-2. The displacement assessment was carried out according to the same methodology as above.

Table 4-2 Modelled bio-season mean peak abundances calculated from design-based estimates of guillemot in the WTG area + 2km buffer assessed for disturbance and displacement. The results of both the project-specific and Natural England scenarios are shown below.

Species	Pre-breeding migration	Breeding	Post-breeding migration	Non-breeding	Migration free winter	Total
Guillemot (Furness, 2015)	-	11,364	-	9,066	-	20,430
Guillemot (Natural England)	-	11,364	9,066	4,279	-	24,709

57. The full results of the modelled displacement assessment using project (Furness, 2015) parameters are shown below. Confidence intervals for peak bio-season counts for guillemot are presented in Table 4-3, and the impact at a range of displacement and mortality rates derived from the design-based estimates, over the relevant bio-seasons, in Table 4-4 to Table 4-9.

Table 4-3 Modelled mean peak bio-season counts for guillemot (using the Natural England parameters) within the WTG area plus 2km buffer including upper and lower confidence intervals.

Bioseason	Period	Peak Count	Lower 95% CI	Upper 95% CI
Breeding	Mar - July	11,364	8,352	15,606
Non-Breeding	Aug - Feb	9,066	5,604	16,011
Total		20,430	13,956	31,616

Table 4-4. Modelled mean guillemot breeding season displacement matrix (WTG area plus 2km buffer) based on the design-based estimates, with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	11	23	57	114	227	341	455	568	682	795	909	1,023	1,136
20	23	45	114	227	455	682	909	1,136	1,364	1,591	1,818	2,046	2,273
30	34	68	170	341	682	1,023	1,364	1,705	2,046	2,386	2,727	3,068	3,409
40	45	91	227	455	909	1,364	1,818	2,273	2,727	3,182	3,636	4,091	4,546
50	57	114	284	568	1,136	1,705	2,273	2,841	3,409	3,977	4,546	5,114	5,682
60	68	136	341	682	1,364	2,046	2,727	3,409	4,091	4,773	5,455	6,137	6,818
70	80	159	398	795	1,591	2,386	3,182	3,977	4,773	5,568	6,364	7,159	7,955
80	91	182	455	909	1,818	2,727	3,636	4,546	5,455	6,364	7,273	8,182	9,091
90	102	205	511	1,023	2,046	3,068	4,091	5,114	6,137	7,159	8,182	9,205	10,228
100	114	227	568	1,136	2,273	3,409	4,546	5,682	6,818	7,955	9,091	10,228	11,364

Table 4-5 Modelled upper 95% CI guillemot breeding season displacement matrix (WTG area plus 2km buffer) based on the design-based estimates, with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	16	31	78	156	312	468	624	780	936	1,092	1,248	1,405	1,561
20	31	62	156	312	624	936	1,248	1,561	1,873	2,185	2,497	2,809	3,121
30	47	94	234	468	936	1,405	1,873	2,341	2,809	3,277	3,745	4,214	4,682
40	62	125	312	624	1,248	1,873	2,497	3,121	3,745	4,370	4,994	5,618	6,242
50	78	156	390	780	1,561	2,341	3,121	3,902	4,682	5,462	6,242	7,023	7,803
60	94	187	468	936	1,873	2,809	3,745	4,682	5,618	6,555	7,491	8,427	9,364
70	109	218	546	1,092	2,185	3,277	4,370	5,462	6,555	7,647	8,739	9,832	10,924
80	125	250	624	1,248	2,497	3,745	4,994	6,242	7,491	8,739	9,988	11,236	12,485
90	140	281	702	1,405	2,809	4,214	5,618	7,023	8,427	9,832	11,236	12,641	14,045
100	156	312	780	1,561	3,121	4,682	6,242	7,803	9,364	10,924	12,485	14,045	15,606

Table 4-6. Modelled mean guillemot non-breeding season displacement matrix (WTG area plus 2km buffer) based on the design-based estimates, with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Non-breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	9	18	45	91	181	272	363	453	544	635	725	816	907
20	18	36	91	181	363	544	725	907	1,088	1,269	1,451	1,632	1,813
30	27	54	136	272	544	816	1,088	1,360	1,632	1,904	2,176	2,448	2,720
40	36	73	181	363	725	1,088	1,451	1,813	2,176	2,538	2,901	3,264	3,626
50	45	91	227	453	907	1,360	1,813	2,267	2,720	3,173	3,626	4,080	4,533
60	54	109	272	544	1,088	1,632	2,176	2,720	3,264	3,808	4,352	4,896	5,440
70	63	127	317	635	1,269	1,904	2,538	3,173	3,808	4,442	5,077	5,712	6,346
80	73	145	363	725	1,451	2,176	2,901	3,626	4,352	5,077	5,802	6,528	7,253
90	82	163	408	816	1,632	2,448	3,264	4,080	4,896	5,712	6,528	7,343	8,159
100	91	181	453	907	1,813	2,720	3,626	4,533	5,440	6,346	7,253	8,159	9,066

Table 4-7 Modelled upper 95% CI guillemot non-breeding season displacement matrix (WTG area plus 2km buffer) based on the design-based estimates, with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Non-breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	16	32	80	160	320	480	640	801	961	1,121	1,281	1,441	1,601
20	32	64	160	320	640	961	1,281	1,601	1,921	2,242	2,562	2,882	3,202
30	48	96	240	480	961	1,441	1,921	2,402	2,882	3,362	3,843	4,323	4,803
40	64	128	320	640	1,281	1,921	2,562	3,202	3,843	4,483	5,124	5,764	6,404
50	80	160	400	801	1,601	2,402	3,202	4,003	4,803	5,604	6,404	7,205	8,006
60	96	192	480	961	1,921	2,882	3,843	4,803	5,764	6,725	7,685	8,646	9,607
70	112	224	560	1,121	2,242	3,362	4,483	5,604	6,725	7,845	8,966	10,087	11,208
80	128	256	640	1,281	2,562	3,843	5,124	6,404	7,685	8,966	10,247	11,528	12,809
90	144	288	720	1,441	2,882	4,323	5,764	7,205	8,646	10,087	11,528	12,969	14,410
100	160	320	801	1,601	3,202	4,803	6,404	8,006	9,607	11,208	12,809	14,410	16,011

Table 4-8 Modelled mean guillemot total displacement matrix (WTG area plus 2km buffer) based on the design-based estimates, with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Total (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	20	41	102	204	409	613	817	1,022	1,226	1,430	1,634	1,839	2,043
20	41	82	204	409	817	1,226	1,634	2,043	2,452	2,860	3,269	3,677	4,086
30	61	123	306	613	1,226	1,839	2,452	3,065	3,677	4,290	4,903	5,516	6,129
40	82	163	409	817	1,634	2,452	3,269	4,086	4,903	5,720	6,538	7,355	8,172
50	102	204	511	1,022	2,043	3,065	4,086	5,108	6,129	7,151	8,172	9,194	10,215
60	123	245	613	1,226	2,452	3,677	4,903	6,129	7,355	8,581	9,806	11,032	12,258
70	143	286	715	1,430	2,860	4,290	5,720	7,151	8,581	10,011	11,441	12,871	14,301
80	163	327	817	1,634	3,269	4,903	6,538	8,172	9,806	11,441	13,075	14,710	16,344
90	184	368	919	1,839	3,677	5,516	7,355	9,194	11,032	12,871	14,710	16,548	18,387
100	204	409	1,022	2,043	4,086	6,129	8,172	10,215	12,258	14,301	16,344	18,387	20,430

Table 4-9 Modelled upper 95% CI guillemot total displacement matrix (WTG area plus 2km buffer) based on the design-based estimates, with the applicant's approach highlighted in dark blue and the full range suggested by SNCBs in light blue.

Total (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	32	63	158	316	632	948	1,265	1,581	1,897	2,213	2,529	2,845	3,162
20	63	126	316	632	1,265	1,897	2,529	3,162	3,794	4,426	5,059	5,691	6,323
30	95	190	474	948	1,897	2,845	3,794	4,742	5,691	6,639	7,588	8,536	9,485
40	126	253	632	1,265	2,529	3,794	5,059	6,323	7,588	8,852	10,117	11382	12,646
50	158	316	790	1,581	3,162	4,742	6,323	7,904	9,485	11,066	12,646	14,227	15,808
60	190	379	948	1,897	3,794	5,691	7,588	9,485	11,382	13,279	15,176	17,073	18,970
70	221	443	1,107	2,213	4,426	6,639	8,852	11,066	13,279	15,492	7,705	19,918	22,131
80	253	506	1,265	2,529	5,059	7,588	10,117	12,646	15,176	17,705	20,234	22,764	25,293
90	285	569	1,423	2,845	5,691	8,536	11,382	14,227	17,073	19,918	22,764	25,609	28,454
100	316	632	1,581	3,162	6,323	9,485	12,646	15,808	18,970	22,131	25,293	28,454	31,616

58. The full results of the modelled displacement assessment using Natural England parameters are shown below. Confidence intervals for peak bio-season counts for guillemot are presented in Table 4-10, and the impact at a range of displacement and mortality rates based on the design-based estimates, over the relevant bio-seasons, in Table 4-11 to Table 4-18.

Table 4-10 Modelled mean peak bio-season counts for guillemot (using the Natural England parameters) within the WTG area plus 2km buffer including upper and lower confidence intervals.

Bioseason	Period	Peak Count	Lower 95% CI	Upper 95% CI
Breeding	Mar-Jul	11,364	8,352	15,606
Post-breeding migration	Aug-Sep	9,066	5,604	16,011
Non-Breeding	Oct-Feb	4,279	3,523	5,226
Total		24,709	17,479	36,842

Table 4-11 Modelled mean guillemot breeding season displacement matrix (WTG area plus 2km buffer) using the Natural England parameters. The applicant's approach is highlighted in dark blue and the full range suggested by SNCBs in light blue.

Breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	11	23	57	114	227	341	455	568	682	795	909	1,023	1,136
20	23	45	114	227	455	682	909	1,136	1,364	1,591	1,818	2,046	2,273
30	34	68	170	341	682	1,023	1,364	1,705	2,046	2,386	2,727	3,068	3,409
40	45	91	227	455	909	1,364	1,818	2,273	2,727	3,182	3,636	4,091	4,546
50	57	114	284	568	1,136	1,705	2,273	2,841	3,409	3,977	4,546	5,114	5,682
60	68	136	341	682	1,364	2,046	2,727	3,409	4,091	4,773	5,455	6,137	6,818
70	80	159	398	795	1,591	2,386	3,182	3,977	4,773	5,568	6,364	7,159	7,955
80	91	182	455	909	1,818	2,727	3,636	4,546	5,455	6,364	7,273	8,182	9,091
90	102	205	511	1,023	2,046	3,068	4,091	5,114	6,137	7,159	8,182	9,205	10,228
100	114	227	568	1,136	2,273	3,409	4,546	5,682	6,818	7,955	9,091	10,228	11,364

Table 4-12 Modelled upper 95% CI guillemot breeding season displacement matrix (WTG area plus 2km buffer) using the Natural England parameters. The applicant's approach is highlighted in dark blue and the full range suggested by SNCBs in light blue.

Breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	16	31	78	156	312	468	624	780	936	1,092	1,248	1,405	1,561
20	31	62	156	312	624	936	1,248	1,561	1,873	2,185	2,497	2,809	3,121
30	47	94	234	468	936	1,405	1,873	2,341	2,809	3,277	3,745	4,214	4,682
40	62	125	312	624	1,248	1,873	2,497	3,121	3,745	4,370	4,994	5,618	6,242
50	78	156	390	780	1,561	2,341	3,121	3,902	4,682	5,462	6,242	7,023	7,803
60	94	187	468	936	1,873	2,809	3,745	4,682	5,618	6,555	7,491	8,427	9,364
70	109	218	546	1,092	2,185	3,277	4,370	5,462	6,555	7,647	8,739	9,832	10,924
80	125	250	624	1,248	2,497	3,745	4,994	6,242	7,491	8,739	9,988	11,236	12,485
90	140	281	702	1,405	2,809	4,214	5,618	7,023	8,427	9,832	11,236	12,641	14,045
100	156	312	780	1,561	3,121	4,682	6,242	7,803	9,364	10,924	12,485	14,045	15,606

Table 4-13 Modelled mean guillemot post-breeding migration season displacement matrix (WTG area plus 2km buffer) using the Natural England parameters. The applicant's approach is highlighted in dark blue and the full range suggested by SNCBs in light blue.

Post-breeding migration (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	9	18	45	91	181	272	363	453	544	635	725	816	907
20	18	36	91	181	363	544	725	907	1,088	1,269	1,451	1,632	1,813
30	27	54	136	272	544	816	1,088	1,360	1,632	1,904	2,176	2,448	2,720
40	36	73	181	363	725	1,088	1,451	1,813	2,176	2,538	2,901	3,264	3,626
50	45	91	227	453	907	1,360	1,813	2,267	2,720	3,173	3,626	4,080	4,533
60	54	109	272	544	1,088	1,632	2,176	2,720	3,264	3,808	4,352	4,896	5,440
70	63	127	317	635	1,269	1,904	2,538	3,173	3,808	4,442	5,077	5,712	6,346
80	73	145	363	725	1,451	2,176	2,901	3,626	4,352	5,077	5,802	6,528	7,253
90	82	163	408	816	1,632	2,448	3,264	4,080	4,896	5,712	6,528	7,343	8,159
100	91	181	453	907	1,813	2,720	3,626	4,533	5,440	6,346	7,253	8,159	9,066

Table 4-14 Modelled upper 95% CI guillemot post-breeding migration season displacement matrix (WTG area plus 2km buffer) using the Natural England parameters. The applicant's approach is highlighted in dark blue and the full range suggested by SNCBs in light blue.

Post-breeding migration (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	16	32	80	160	320	480	640	801	961	1,121	1,281	1,441	1,601
20	32	64	160	320	640	961	1,281	1,601	1,921	2,242	2,562	2,882	3,202
30	48	96	240	480	961	1,441	1,921	2,402	2,882	3,362	3,843	4,323	4,803
40	64	128	320	640	1,281	1,921	2,562	3,202	3,843	4,483	5,124	5,764	6,404
50	80	160	400	801	1,601	2,402	3,202	4,003	4,803	5,604	6,404	7,205	8,006
60	96	192	480	961	1,921	2,882	3,843	4,803	5,764	6,725	7,685	8,646	9,607
70	112	224	560	1,121	2,242	3,362	4,483	5,604	6,725	7,845	8,966	10,087	11,208
80	128	256	640	1,281	2,562	3,843	5,124	6,404	7,685	8,966	10,247	11,528	12,809
90	144	288	720	1,441	2,882	4,323	5,764	7,205	8,646	10,087	11,528	12,969	14,410
100	160	320	801	1,601	3,202	4,803	6,404	8,006	9,607	11,208	12,809	14,410	16,011

Table 4-15 Modelled mean guillemot non-breeding season displacement matrix (WTG area plus 2km buffer) using the Natural England parameters. The applicant's approach is highlighted in dark blue and the full range suggested by SNCBs in light blue.

Non-breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	4	9	21	43	86	128	171	214	257	300	342	385	428
20	9	17	43	86	171	257	342	428	513	599	685	770	856
30	13	26	64	128	257	385	513	642	770	899	1,027	1,155	1,284
40	17	34	86	171	342	513	685	856	1,027	1,198	1,369	1,540	1,712
50	21	43	107	214	428	642	856	1,070	1,284	1,498	1,712	1,926	2,140
60	26	51	128	257	513	770	1,027	1,284	1,540	1,797	2,054	2,311	2,567
70	30	60	150	300	599	899	1,198	1,498	1,797	2,097	2,396	2,696	2,995
80	34	68	171	342	685	1,027	1,369	1,712	2,054	2,396	2,739	3,081	3,423
90	39	77	193	385	770	1,155	1,540	1,926	2,311	2,696	3,081	3,466	3,851
100	43	86	214	428	856	1,284	1,712	2,140	2,567	2,995	3,423	3,851	4,279

Table 4-16 Modelled upper 95% CI guillemot non-breeding season displacement matrix (WTG area plus 2km buffer) using the Natural England parameters. The applicant's approach is highlighted in dark blue and the full range suggested by SNCBs in light blue.

Non-breeding (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	5	10	26	52	105	157	209	261	314	366	418	470	523
20	10	21	52	105	209	314	418	523	627	732	836	941	1,045
30	16	31	78	157	314	470	627	784	941	1,097	1,254	1,411	1,568
40	21	42	105	209	418	627	836	1,045	1,254	1,463	1,672	1,881	2,090
50	26	52	131	261	523	784	1,045	1,307	1,568	1,829	2,090	2,352	2,613
60	31	63	157	314	627	941	1,254	1,568	1,881	2,195	2,508	2,822	3,136
70	37	73	183	366	732	1,097	1,463	1,829	2,195	2,561	2,927	3,292	3,658
80	42	84	209	418	836	1,254	1,672	2,090	2,508	2,927	3,345	3,763	4,181
90	47	94	235	470	941	1,411	1,881	2,352	2,822	3,292	3,763	4,233	4,703
100	52	105	261	523	1,045	1,568	2,090	2,613	3,136	3,658	4,181	4,703	5,226

Table 4-17 Modelled mean guillemot total displacement matrix (WTG area plus 2km buffer) using the Natural England parameters. The applicant's approach is highlighted in dark blue and the full range suggested by SNCBs in light blue.

Total (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	25	49	124	247	494	741	988	1,235	1,483	1,730	1,977	2,224	2,471
20	49	99	247	494	988	1,483	1,977	2,471	2,965	3,459	3,953	4,448	4,942
30	74	148	371	741	1,483	2,224	2,965	3,706	4,448	5,189	5,930	6,671	7,413
40	99	198	494	988	1,977	2,965	3,953	4,942	5,930	6,919	7,907	8,895	9,884
50	124	247	618	1,235	2,471	3,706	4,942	6,177	7,413	8,648	9,884	11,119	12,355
60	148	297	741	1,483	2,965	4,448	5,930	7,413	8,895	10,378	11,860	13,343	14,825
70	173	346	865	1,730	3,459	5,189	6,919	8,648	10,378	12,107	13,837	15,567	17,296
80	198	395	988	1,977	3,953	5,930	7,907	9,884	11,860	13,837	15,814	17,790	19,767
90	222	445	1,112	2,224	4,448	6,671	8,895	11,119	13,343	15,567	17,790	20,014	22,238
100	247	494	1,235	2,471	4,942	7,413	9,884	12,355	14,825	17,296	19,767	22,238	24,709

Table 4-18 Modelled upper 95% CI guillemot total displacement matrix (WTG area plus 2km buffer) using the Natural England parameters. The applicant's approach is highlighted in dark blue and the full range suggested by SNCBs in light blue.

Total (2km Buffer)	Mortality Rate (%)												
Displaced (%)	1	2	5	10	20	30	40	50	60	70	80	90	100
10	37	74	184	368	737	1,105	1,474	1,842	2,211	2,579	2,947	3,316	3,684
20	74	147	368	737	1,474	2,211	2,947	3,684	4,421	5,158	5,895	6,632	7,368
30	111	221	553	1,105	2,211	3,316	4,421	5,526	6,632	7,737	8,842	9,947	11,053
40	147	295	737	1,474	2,947	4,421	5,895	7,368	8,842	10,316	11,789	13,263	14,737
50	184	368	921	1,842	3,684	5,526	7,368	9,211	11,053	12,895	14,737	16,579	18,421
60	221	442	1,105	2,211	4,421	6,632	8,842	11,053	13,263	15,474	17,684	19,895	22,105
70	258	516	1,289	2,579	5,158	7,737	10,316	12,895	15,474	18,053	20,632	23,210	25,789
80	295	589	1,474	2,947	5,895	8,842	11,789	14,737	17,684	20,632	23,579	26,526	29,474
90	332	663	1,658	3,316	6,632	9,947	13,263	16,579	19,895	23,210	26,526	29,842	33,158
100	368	737	1,842	3,684	7,368	11,053	14,737	18,421	22,105	25,789	29,474	33,158	36,842

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