MUIR MHÒR
OFFSHORE WIND FARM

A joint venture between Fred. Olsen Seawind & Vattenfall

Additional Information Report

Muir Mhòr Offshore Wind Farm

Additional Environmental Information Report

Chapter 2: Offshore Ornithology EIA

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Contents

2. Offshore Ornithology EIA 8

2.1. Introduction 8

Project Background 8
Purpose of this Document 8
Document Structure 9

2.2. Consultation Summary 9
2.3. Updated Regional Population Size 24

Gannet 24
Puffin 27
Kittiwake 27

2.4. Updated Distributional responses 29

SeabORD 31
Matrix Displacement Assessment 32

2.5. Updated Collision Risk Modelling Information 45

Updated Method for Summing Seasonal and Annual Predicted Collisions 45
Example Species Using Updated Avoidance Rate 45

2.6. Updated Magnitude and Sensitivity Classification 46

Magnitude 46
Sensitivity 47
Summary 50

2.7. Updated Cumulative Effects Assessment for Additional Species 50

Arctic Tern 51
Great Black-Backed Gull 52
Fulmar and Manx Shearwater 59
Red-Throated Diver 59
Summary 59

2.8. Updated Information on Apportioning Impacts 60
2.9. Overall Summary 60

Conclusions 62

2.10. References 63

Tables

Table 2.1 Post Application Consultation Relevant to Offshore Ornithology 10

Table 2.2 Copy of the Response from NatureScot on the Colony Sizes and Regional Breeding Population Sizes for Gannet 24

Table 2.3 Most Recent Gannet Colony Counts from Pre-HPAI years (before 2022) and Post/During HPAI (after 2022) and the Year in Which the Counts Were Undertaken 26

Table 2.4 Predicted Impacts from Year 1 and Year 2 Surveys of Muir Mhòr Compared with Pre-HPAI and During/Post-HPAI Epidemic in Gannets. The Mean of the Pre-HPAI and Post-HPAI Regional Breeding Population and the EIA Predicted Impacts are Also Shown. 26

Table 2.5 Copy of the Response from NatureScot on the Colony Sizes and Regional Breeding Population Sizes for Puffin 27

Table 2.6 Copy of the Response from NatureScot on the Colony Sizes and Regional Breeding Population Sizes for Kittiwake 28

Table 2.7 Change in Adult Survival for Both Calf of Eday Population Sizes 29

Table 2.8 Updated Mean Seasonal Peak Abundance for Each Species for the AA Only and AA Plus a 2 or 4 km Buffer. Values in Grey Shaded Cells Have Changed from the EIAR. The Non-breeding Overall Column was Calculated as the sum of the Non-breeding Sub-period. 30

Table 2.9 Project-only Predicted Impacts from Changes to Matrix Displacement Predictions Only Compared with the Approach Taken in the EIAR (SeabORD plus matrix displacement predictions). Cells Shaded Grey Show Values from the EIAR. 34

Table 2.10 Cumulative Predicted Impacts from Changes to Matrix Displacement Predictions Only Compared with the Approach Taken in the EIAR (SeabORD plus matrix displacement predictions). Cells Shaded Grey Show Values from the EIAR. 35

Table 2.11 Project Only Impact Summary of % Point Reduction to Regional Breeding Adult Survival Rates Resultant from Changes to Distributional Response Impact Quantification Approaches 36

Table 2.12 Cumulative Impact Summary of % Point Reduction to Regional Breeding Adult Survival Rates Resultant from Changes to Distributional Response Impact Quantification Approaches 37

Table 2.13 Kittiwake PVA Inputs and Outputs 38

Table 2.14 Guillemot PVA Inputs and Outputs 39

Table 2.15 Razorbill PVA Inputs and Outputs 40

Table 2.16 Puffin PVA Inputs and Outputs 41

Table 2.17 Project Only Impact Summary of PVA Results from the EIAR and Updated PVAs to Provide Additional Information. A Summary of the Changes to EIA Magnified and Significance is Also Provided. CPS = Counterfactual of Population Size. CGR = Counterfactual of Growth Rate. 43

Table 2.18 Cumulative Impact Summary of PVA Output Changes Resulting from Changes to Distributional Response Impact Quantification Approaches and Consequences to Assessment Conclusions 44

Table 2.19 Change in Predicted Annual Collisions to Kittiwake Using Update Avoidance Rate Guidance from NatureScot 46

Table 2.20 Classification of Vulnerability of Seabird to Collisions and Displacement. 47

Table 2.21 Vulnerability Scores for Collisions Risk from Wade et al. (2016) and Classifications of Vulnerability based on NatureScot Advice and those used in the EIAR (shaded cells indicate where a difference occurred between the advice from NatureScot and the classification used in the EIAR) _ 48

Table 2.22 Vulnerability Scores for Displacement/Disturbance from Wade et al. (2016) and Classifications of Vulnerability based on NatureScot Advice and those used in the EIAR (shaded cells indicate where a difference occurred between the advice from NatureScot and the classification used in the EIAR). _____ 49

Table 2.23 Predicted Breeding Season and Non-breeding Season Impacts on Great Black-backed Gulls from the Project Alone and Cumulatively _____ 52

Table 2.24 Calculation of Impact on Adult Survival Rate on the Great Black-backed Gull Regional Non-breeding Population from the Project Alone_____ 54

Table 2.25 Adult and Immature Mean Survival Rates, age at First Breeding and Maximum Brood Size used in the PVA Modelling. Numbers in Brackets Represent the Standard Deviations used. All Values are Taken from Horswill and Robinson, 2015, in line with NatureScot Guidance (NatureScot, 2023a) _____ 55

Table 2.26 Median Simulated Population Sizes (breeding pairs) and Counterfactual Population Sizes for Great Black-backed gull. Values are Median Values with 95% Confidence Intervals in Brackets 57

Table 2.27 Simulated Growth Rates and Counterfactual Growth Rates for Great Black-backed gull. Values are Median Values with 95% Confidence Intervals in Brackets_____ 58

Figures

Figure 2.1 Change in Population Size of Gannet Colonies at Bass Rock and Hermaness Over Time. Red Lines Show 2021 (first year of site surveys) and 2022 (second year of site surveys). Counts from 2021 are Estimated Values from Wanless et al. (2023)_____ 25

Glossary

Term	Definition
Applicant	Muir Mhòr Offshore Wind Farm Limited.
Array Area	The area in which the generation infrastructure (including Wind Turbine Generators and associated foundations and Inter-array Cables), Offshore Electrical Platform(s), and an Interconnector cable will be located.
E2	The ScotWind Plan Option Area where the Proposed Development is located.
EIA Regulations	Collectively the term used to refer to The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, The Marine Works (Environmental Impact Assessment) Regulations 2007, and The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017.
Floating Foundations	The floating structures on which the Wind Turbine Generators are installed.
Foundation anchors	The mooring structures which anchor the Floating Foundations to the seabed connected to the foundation mooring.
Inter-array Cables	Cables which link the Wind Turbines Generators to each other and the Offshore Electrical Platform(s).
Interconnector cable	Cable which links the Offshore Electrical Platforms to one another, allowing for power to be transferred between the platforms.
Landfall	The area between Mean High Water Springs and Mean Low Water Springs where the Offshore export cables are brought onshore.
Offshore Electrical Platform (OEP)	Offshore platform consisting of High Voltage Alternating Current equipment, details depending on the final electrical set up of the Project.
Offshore Export Cable Corridor (ECC)	The area within which the Offshore export cable(s) will be installed.
Offshore export cable(s)	The subsea electricity cable circuits running from the Offshore Electrical Platform(s) to the landfall which will transmit the electricity generated by the offshore wind farm to the onshore export cables for transmission onwards to the onshore substation and the national electrical transmission system along with auxiliary cables such as fibre optic cables.
Offshore transmission infrastructure	The proposed transmission infrastructure comprising: Offshore Electrical Platform(s) and associated foundations and substructures; the interconnector cable, the Offshore export cables; and the landfall area up to Mean High Water Springs.
Project	Muir Mhòr Offshore Wind Farm – comprises the wind farm and all associated offshore and onshore components.
Proposed Development	The offshore Muir Mhòr Offshore Wind Farm project elements to which the Offshore Environmental Impact Assessment Report relates.
Wind Turbine Generator (WTG)	The wind turbines that generate electricity consisting of tubular towers and blades attached to a nacelle housing mechanical and electrical generating equipment.

Acronyms and Abbreviations

Term	Definition
AIR	Additional Information Report
BDMPS	Biologically Defined Minimum Population Size
CEA	Cumulative Effects Assessment
CGR	Counterfactual of Growth Rate
CIEEM	Chartered Institute of Ecology and Environmental Management
CPS	Counterfactual of Population Size
CRM	Collision Risk Modelling
DAS	Digital Aerial Survey
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
FMP	Fish Mitigation Plan
HPAI	Highly Pathogenic Avian Influenza
JNCC	Joint Nature Conservation Committee
km	Kilometre
km^2	Kilometres square
MHWS	Mean High Water Springs
MLA	Marine Licence Application
OEP	Offshore Electrical Platform
OWF	Offshore Wind Farm
PVA	Population Viability Analysis
RSPB	The Royal Society for the Protection of Birds
sCRM	Stochastic Collision Risk Model
SMP	Seabird Monitoring Programme
SNCB	Statutory Nature Conservation Body
SPA	Special Protection Area
UKCEH	UK Centre for Ecology and Hydrology
WTG	Wind Turbine Generator

2. OFFSHORE ORNITHOLOGY EIA

2.1. INTRODUCTION

PROJECT BACKGROUND

2.1.1. Muir Mhòr Offshore Wind Farm Limited (hereafter referred to as 'the Applicant') is proposing to develop the Muir Mhòr Offshore Wind Farm (hereafter 'the Project'). The Project is made up of both offshore and onshore components. The subject of this report is the offshore infrastructure of the Project seaward of Mean High Water Springs (MHWS) which is hereafter referred to as 'the Proposed Development'.

2.1.2. The Muir Mhòr Array Area covers an area of approximately 200 kilometres square (km^2) and is located approximately 63 kilometres (km) east of Peterhead on the east coast of Scotland. The offshore infrastructure of the Proposed Development includes Wind Turbine Generators (WTGs) and associated floating foundations and foundation anchors, the Offshore Electrical Platforms (OEP(s)) and their associated fixed foundations, the Inter-array Cables, Interconnector cable, Offshore export cables and Landfall. A full description of the Proposed Development is provided in Volume 1, Chapter 3: Project Description of the Environmental Impact Assessment Report (EIAR).

PURPOSE OF THIS DOCUMENT

2.1.3. This document has been drafted in response to request for additional information from NatureScot and comments from Natural England and The Royal Society for the Protection of Birds (RSPB) with regards to the to the Section 36 and Marine Licence Applications (MLA) submitted by the Applicant for the Proposed Development.

2.1.4. The additional information requested by NatureScot in relation to the MLAs relates to the predicted impacts of the Proposed Development to ornithological interests within the marine and intertidal environment (i.e. below MHWS). Requests were received from NatureScot in relation to the assessment of impacts to ornithology across the three project areas; the Array Area, the Offshore Export Cable Corridor (ECC) and the intertidal landfall area, as well as the three project phases; construction, operation and maintenance and decommissioning.

2.1.5. A summary of this consultation precedes sections which directly relate to each of the topics covered within the NatureScot response. These topics are:

- Updates to regional population sizes;
- Updates to the assessment of distributional responses;
- Updates to the assessment of Collision Risk Modelling (CRM);
- Updates to the assessment of impact magnitude and species sensitivity;
- Updates to the Cumulative Effects Assessment (CEA) for additional species; and
- Updates to information regarding the apportioning of impacts.

2.1.6. Advice from consultation with NatureScot on each of the above topics has been taken into account to ensure the information provided meets the expectations of NatureScot. This AIR presents updates to the impact assessment in response to this consultation advice, taking into account any changes and/or updates required.

2.1.7. A summary of conclusions is provided below; however, the results of updates and changes to the assessment which are included in this Chapter of the AIR do not change the conclusions of the EIAR. Further information relating to apportioning tables are provided in Appendix I: Updated Apportioning Tables of the AIR.

DOCUMENT STRUCTURE

2.1.8. This Chapter of the AIR is structured as follows:

- Section 2.2: Consultation Summary
- Section 2.3: Updated Regional Population Size
- Section 2.4: Updated Distributional Responses
- Section 2.5: Updated Collision Risk Modelling Information
- Section 2.6: Updated Magnitude and Sensitivity Classification
- Section 2.7: Updated Cumulative Effects Assessment for Additional Species
- Section 2.8: Updated Information on Apportioning Impacts
- Section 2.9: Overall Summary

2.2. CONSULTATION SUMMARY

2.2.1. Table 2.1 provides a summary of the NatureScot consultation activities response to offshore ornithology. The issues raised and actions to address and incorporate this feedback into the AIR are outlined.

2.2.2. The consultation response was conveyed in a letter received via email on 4 of March 2025, followed by online meetings which took place on 30 of May, 18 June 2025, 17 July 2025 and 13 August 2025.

Table 2.1 Post Application Consultation Relevant to Offshore Ornithology

Date	Consultee and Type of Consultation	Description / Issues Raised	How This Has Been Considered In The AIR
Apportioning			
04/03/2025	NatureScot; Post Application Consultation Email Correspondence	Designated sites – St Abb's Head to Fast Castle Special Protection Area (SPA) – distances from the development to this site appear incorrect.	The distances used in apportioning have been calculated using a centroid-to-centroid method following shortest distance by sea. This is addressed in Section 2.8 (Updated Information on Apportioning Impacts) of this Chapter.
		For the apportioning of impacts to kittiwake during the breeding season, errors in the mortality figures used and subsequently in survival rates were identified. NatureScot stated their requirement for displacement, CRM, apportioning and Population Viability Analysis (PVA) to be repeated with the resulting percentage point change in survival rate presented, unless the Applicant can justify that the errors do not result in significant changes to the PVA outcomes.	Apparent errors were investigated and it was found that these were due to the rounding of numbers in the data provided. The correct values were used through the assessment. Updated values with correct rounding is provided in Section 2.8 (Updated Information on Apportioning Impacts) of this Chapter.
		Regarding the proportion of foraging area at sea, NatureScot notes that the Applicant refers to the 'proportion of the foraging range of a colony that is sea area' as an element of the equation to calculate the apportioning factors. However, the value of this at-sea foraging area for each colony and species is not stated, therefore making it impossible to recreate the apportioning factor calculations.	Area of foraging area at sea is provided in the updated tables in Section 2.8 (Updated Information on Apportioning Impacts) of this Chapter.

Date	Consultee and Type of Consultation	Description / Issues Raised	How This Has Been Considered In The AIR
Approach to the Assessment			
04/03/2025	NatureScot; Post Application Consultation Email Correspondence	In their appraisal of the approach to determining breeding season populations using available colony counts, NatureScot noted several instances where more recent colony counts than those presented have not been used.	Updates have been made within Section 2.4 (Updated Distributional Responses) of this Chapter.
		Magnitude criteria: We note an error with how magnitude has been assessed using this approach. The Applicant has presented the percentage point decrease in survival rate, which is a substantially lower number than the corresponding increase in baseline mortality. The implication of using this metric of impact incorrectly is that the Applicant has based conclusions of impact magnitude on a substantially lower number than intended. Change in survival may be used as criteria to inform impact magnitude (with appropriate thresholds), but this was not stated by the Applicant in Table 11-17, which further underplays the magnitude of some of the impacts.	There does not appear to be an error in the approach as applied in the Environmental Impact Assessment (EIA). This is addressed in Section 2.6 (Updated Magnitude and Sensitivity Classification) of this Chapter.
		Within the EIAR, the Applicant does not state the magnitude assigned to the impacts of the high displacement scenario or the combined displacement and collision impacts for relevant species	A summary table with the conclusions based on the high displacement mortality rate is included in Section 2.6 (Updated Magnitude and Sensitivity Classification) of this Chapter, along with the updated matrix displacement assessment for kittiwake, gannet, razorbill and puffin.

Date	Consultee and Type of Consultation	Description / Issues Raised	How This Has Been Considered In The AIR
		Sensitivity criteria: we advise the exclusive use of Wade *et al*. (2016) to derive scores of vulnerability to marine renewable energy developments, which incorporates conservation value scoring specific to Scottish seabird populations. For our assessment of the EIA conclusions, we have used Wade *et al*. (2016) to inform our advice.	Classification of scores from Wade *et al*. (2016) were requested from, and provided by, NatureScot. These were compared with the sensitivity values used in the EIA and are addressed in Section 2.6 (Updated Magnitude and Sensitivity Classification) of this Chapter.
		We note several instances where more recent colony counts were not used for gannet, puffin and kittiwake. We do not require apportioning to be redone at this time and overall conclusions will be based on the population counts andapportioning approach provided in the application. However, we request clarification from the Applicant regarding why the more recent population counts were not used in the assessment and commentary around the likely implications of this decision.	Updated colony counts for kittiwake have been addressed in Section 2.2 (Updated Regional Population Size) of this Chapter.
		Changes in prey availability: As per our response dated 31 January 2025, we highlighted issues regarding the implications for herring and sandeel, as well as the mitigation proposed. Should these issues be addressed and appropriate mitigation secured, then we are content with what is presented in the ornithology assessment.	This comment is acknowledged; a Fish Mitigation Plan (FMP) will be agreed post-consent. The Plan will focus on the secondary mitigations for herring spawning, however, Chapter 5: Fish Ecology of the AIR provides further context on sandeel conclusions.

Date	Consultee and Type of Consultation	Description / Issues Raised	How This Has Been Considered In The AIR
Cumulative Effects Assessment			
04/03/2025	NatureScot; Post Application Consultation Email Correspondence	For Arctic tern, great black-backed gull, fulmar, Manx shearwater, and red-throated diver, we are content with the proposal alone conclusions, whereby impacts are not significant in EIA terms. However, we are unable to provide advice regarding cumulative impacts for these species based on the current information in the application, as above.	This is addressed in Section 2.7 (Updated Cumulative Effects Assessment for Additional Species) of this Chapter.
Collision Risk Modelling			
04/03/2025	NatureScot; Post Application Consultation Email Correspondence	For kittiwake CRM, NatureScot identified discrepancies between monthly, seasonal and annual collision mortality totals.	The seasonal and annual impacts were not summed from the means but calculated from the monthly iterations being complied and an overall mean calculated (the approach taken in the updated Stochastic Collision Risk Model (sCRM) by Caneco *et al;* 2022). This is addressed in Section 2.5 (Updated Collision Risk Modelling Information) of this Chapter.
		We require apportioning and PVA to be repeated with the correct seasonal and annual collision mortality totals, unless the Applicant can justify the discrepancy through the presentation of the raw model outputs.	The seasonal and annual impacts were not summed from the means but calculated from the monthly iterations being complied and an overall mean calculated (the approach taken in the updated sCRM by Caneco *et al;* 2022). This is addressed in Section 2.5 (Updated Collision Risk Modelling Information) of this Chapter.

Date	Consultee and Type of Consultation	Description / Issues Raised	How This Has Been Considered In The AIR
		CRM parameters: NatureScot notes that the Applicant used input parameters set out in NatureScot Guidance Note 7 (NatureScot, 2023) to parameterise the CRM. Paragraph 11.19.42 notes that since running the CRM, the joint advice note from the Statutory Nature Conservation Bodies (SNCBs) regarding bird collision risk modelling for offshore wind developments (Joint Nature Conservation Committee (JNCC), Natural England, Natural Resources Wales, NatureScot, 2024) has been published and includes updated input parameters recommended by NatureScot for use in the model. The Applicant notes that this was not published in time to adopt these updated parameters, but that a qualitative assessment was undertaken to assess the implications of not using these. We acknowledge efforts made to qualitatively assess these differences but note a lack of evidence and conclusions of this assessment in the application. The Applicant states that the qualitative assessment resulted in a conclusion of no difference in impact magnitude for any species assessed in the collision risk model, with all impacts remaining at negligible magnitude. However, it is difficult to support this conclusion without a comparison of model outputs from both parameter sets, and we would have appreciated at least one species example of this.	An example has been produced using kittiwake, as discussed and agreed with NatureScot (consultation meeting 17/07/2025). This is presented in Section 2.5 (Updated Collision Risk Modelling Information) of this Chapter.

Date	Consultee and Type of Consultation	Description / Issues Raised	How This Has Been Considered In The AIR
		Annual collision totals: There are discrepancies between the seasonal and annual collision mortality estimates, and the sum of monthly collision estimates making up the relevant seasonal and annual periods. The sum of the relevant monthly collision estimates which fall within each species' bio season does not equal the seasonal totals presented in Table 3.1 of the report	The seasonal and annual impacts were not summed from the means but calculated from the monthly iterations being complied and an overall mean calculated (the approach taken in the updated sCRM by Caneco *et al;* 2022). This is addressed in Section 2.5 (Updated Collision Risk Modelling Information) of this Chapter.
		Annual collision totals: For kittiwake, the correct seasonal and annual totals are greater than the numbers taken through for further assessment. Therefore, for kittiwake we require apportioning and PVA to be repeated with the correct seasonal and annual collision mortality totals, unless the Applicant can justify the discrepancy through the presentation of the raw model output	The seasonal and annual impacts were not summed from the means but calculated from the monthly iterations being complied and an overall mean calculated (the approach taken in the updated sCRM by Caneco *et al;* 2022). This is addressed in Section 2.5 (Updated Collision Risk Modelling Information) of this Chapter.
Distributional Responses			
04/03/2025	NatureScot; Post Application Consultation Email Correspondence	NatureScot's position is that SeabORD is the more biologically accurate model.	Comment is acknowledged and agreed.
		The Applicant can repeat the apportioning and PVA elements of the assessment, using displacement matrix outputs to inform the predicted mortality from distributional responses for kittiwake, guillemot, razorbill and puffin.	This is addressed in Section 2.4 (Updated Distributional Responses) of this Chapter. ().

Date	Consultee and Type of Consultation	Description / Issues Raised	How This Has Been Considered In The AIR
		The Applicant can repeat the SeabORD model in MATLAB using an adjusted distance decay value to determine bird distribution, ensuring that a suitable number of birds are predicted to enter the development footprint, in consultation with NatureScot.	It has been agreed with NatureScot not to provide additional information using SeabORD. Further details are provided in Section 2.4 (Updated Distributional Responses) of this Chapter.
		Once values are calculated, the Applicant can repeat the apportioning and PVA elements of the assessment with the new SeabORD MATLAB outputs.	It has been agreed with NatureScot not to provide additional information using SeabORD. Further details are provided in Section 2.4 (Updated Distributional Responses) of this Chapter.
		The Applicant is provided access to the SeabORD-R tool by UK Centre for Ecology & Hydrology (UKCEH)/Marine Directorate to re-run SeabORD, in consultation with NatureScot.	SeabORD-R is not available at this time so will not be used. No further action is required at this time.
		Distributional responses - Mean seasonal peak abundances: Table 2.3 contains errors in the mean seasonal peak abundance numbers. However, we note that it appears that these errors were not carried through to the displacement matrix assessment, therefore there should be no implications to the conclusion of impacts to the regional populations in the EIAR. For completeness, we present the NatureScot corrected totals alongside the Muir Mhòr reported totals in Table A4.	Total numbers of razorbill in the non-breeding season were found to be incorrect, but this did not affect the overall conclusions of the assessment. An updated table is provided in Section 2.4 (Updated Distributional Responses) of this Chapter.
Population Viability Analysis			
04/03/2025	NatureScot; Post Application Consultation Email Correspondence	Some species have been excluded from cumulative assessment on the basis that proposal-alone effects are below the relevant threshold. This is incorrect. We request that	Reasoning was discussed with NatureScot (consultation meeting 17/07/2025) for why no cumulative assessment was needed for Arctic tern, fulmar, Manx shearwater and red-throated divers. An

Date	Consultee and Type of Consultation	Description / Issues Raised	How This Has Been Considered In The AIR
		cumulative impact values are presented to determine whether a cumulative PVA is required for Arctic tern, great black-backed gull, fulmar, Manx shearwater, and red-throated diver.	updated cumulative impact assessment has been completed for great black-backed gull. This comment is addressed in Section 2.7 (Updated Cumulative Effects Assessment for Additional Species) of this Chapter.
		We request that cumulative impact values are presented to determine whether a cumulative PVA is required for Arctic tern, great black-backed gull, fulmar, Manx shearwater, and red-throated diver. It may be the case that the in-combination impacts on each of these species does not equal or exceed the 0.02 percentage point threshold, however this is not presented in the PVA report or in the impact values presented in Volume 3, Chapter 11, Appendix 11.5 Annex B: Cumulative Impact Calculations.	Reasoning was provided for why no cumulative assessment was needed for Arctic tern, fulmar, Manx shearwater and red-throated divers. An updated cumulative impact assessment has been completed for great black-backed gull. This comment is addressed in Section 2.7 (Updated Cumulative Effects Assessment for Additional Species) of this Chapter.
Distributional Responses			
24/03/2025	Natural England; Post Application Consultation Written correspondence	NatureScot have noted that the SeabORD model outputs presented do not appropriately account for connectivity between the development and designated sites. …we defer to NatureScot on this matter and support their advice to review the ornithology assessment as per their provided instruction.	SeabORD updates discussed with NatureScot, updated displacement matrix predicted impacts and updated PVAs are addressed in Section 2.4 (Updated Distributional Responses) of this Chapter.
Apportioning			
27/03/2025	RSPB; Post Application Consultation Written correspondence	We are concerned that there appear to be some problems with the PVA apportionment.	Additional Information is provided in Section 2.8 (Updated Information on Apportioning Impacts) of this Chapter.

Date	Consultee and Type of Consultation	Description / Issues Raised	How This Has Been Considered In The AIR
Distributional Responses			
30/05/2025	NatureScot. Meeting to discuss SeabORD updates	Discussion of NatureScot's request for further information and modelling of distributions responses. Agreed that suggested SeabORD updates would not be undertaken. Agreed that displacement matrix approach would be completes for kittiwake, guillemot, razorbill and puffin for breeding season. Agreed that updated PVAs would be run (where necessary) based on breeding season impacts estimated using displacement matrices.	SeabORD updates discussed with NatureScot, updated displacement matrix predicted impacts and updated PVAs are addressed in Section 2.4 (Updated Distributional Responses) of this Chapter.
Distributional Responses			
02/06/2025	NatureScot – email	Email that, "acknowledge agreement regarding the use of the matrix approach for Muir Mhòr Offshore Wind Farm going forward"	Updated distributional response impact predictions are provided in Section 2.4 (Updated Distributional Responses) of this Chapter (Matrix Displacement Assessment).
Assessment Approach			
04/06/2025	NatureScot – email	NatureScot noted "an error with how magnitude has been assessed using this approach" and that "The Applicant has presented the percentage point decrease in survival rate, which is a substantially lower number than the corresponding increase in baseline mortality". NatureScot clarified the error they thought had occurred.	Additional Information in the assessment approach to assessing the magnitude of predicted impacts is provided in Section 2.6 (Updated Magnitude and Sensitivity Classification) of this Chapter.
04/06/2025	NatureScot – email	NatureScot provided the vulnerability scores applied to each species from Wade et al. (2016) and the sensitivity classification then used in determining significance	Additional Information in the assessment approach to assessing the magnitude of predicted impacts is provided in Section 2.6 (Updated Magnitude and Sensitivity Classification) of this Chapter.

Date	Consultee and Type of Consultation	Description / Issues Raised	How This Has Been Considered In The AIR
Distributional Responses			
18/06/2025	NatureScot. Consultation meeting one.	NatureScot requested that the applicant ”repeat the SeabORD model in MATLAB using an adjusted distance decay value to determine bird distribution, ensuring that a suitable number of birds are predicted to enter the development footprint.”	Following discussion in a meeting with NatureScot on 30 May 2025 it was agreed that further SeabORD modelling was not requested and the Additional Information on distributional responses using the matrix displacement approach was requested. Updated distributional response impact predictions are provided in Section 2.4 (Updated Distributional Responses) of this Chapter (Matrix Displacement Assessment).
18/06/2025	NatureScot. Consultation meeting one.	NatureScot noted that ”Table 2.3 contains errors in the mean seasonal peak abundance numbers.”	An updated table with corrected error is provided in Section 2.4 (Updated Distributional Responses) of this Chapter (Matrix Displacement Assessment).
Cumulative Effects Assessment			
18/06/2025	NatureScot. Consultation meeting one.	NatureScot requested that, ”cumulative impact values are presented to determine whether a cumulative PVA is required for Arctic tern, great black-backed gull, fulmar, Manx shearwater, and red-throated diver”.	Additional Information on cumulative impact assessment is provided in Section 2.7 (Updated Cumulative Effects Assessment for Additional Species) of this Chapter.
Assessment Approach			
18/06/2025	NatureScot. Consultation meeting one.	NatureScot noted, ”several instances where more recent colony counts were not used for gannet, puffin and kittiwake. …we request clarification from the Applicant regarding why the more recent population counts were not used in the assessment and commentary around the likely implications of this decision”.	Additional Information on seabird colony counts is provided in Section 2.2 (Updated Regional Population Size) of this Chapter.

Date	Consultee and Type of Consultation	Description / Issues Raised	How This Has Been Considered In The AIR
18/06/2025	NatureScot. Consultation meeting one.	NatureScot noted ”an error with how magnitude has been assessed using this approach” and that “The Applicant has presented the percentage point decrease in survival rate, which is a substantially lower number than the corresponding increase in baseline mortality”	Additional Information in the assessment approach to assessing the magnitude of predicted impacts is provided in Section 2.6 (Updated Magnitude and Sensitivity Classification) of this Chapter.
18/06/2025	NatureScot. Consultation meeting one.	NatureScot commented that, ”derived from multiple sources for disturbance, including Bradbury *et al.* (2014) and NatureScot (2023) for displacement, and Bradbury *et al.* (2014) and Furness *et al.* (2013) for collision” and that “we advise the exclusive use of Wade *et al.* (2016) to derive scores of vulnerability to marine renewable energy developments”.	Additional Information in the assessment approach to assessing the magnitude of predicted impacts is provided in Section 2.6 (Updated Magnitude and Sensitivity Classification) of this Chapter.
Cumulative Effects Assessment			
01/07/2025	NatureScot. Technical Note from applicant.	NatureScot requested that cumulative impact values were presented to determine whether a cumulative PVA is required for Arctic tern, great black-backed gull, fulmar, Manx shearwater, and red-throated diver.	A short technical note was provided to NatureScot.
Assessment Approach			
08/07/2025	NatureScot – Letter to applicant	NatureScot provided updated advice on population size for puffin in the North Caithness Cliffs SPA.	Additional Information on seabird colony counts is provided in Section 2.2 (Updated Regional Population Size) of this Chapter.
Distributional Responses			

Date	Consultee and Type of Consultation	Description / Issues Raised	How This Has Been Considered In The AIR
17/07/2025	NatureScot. Consultation meeting two.	Provision of updated breeding season predicted distribution response impacts for kittiwake, guillemot, razorbill and puffin. Predicted impact based on displacement matrices. Showed increased impacts to guillemot and razorbill populations, similar impacts to puffin populations and decreased impacts to kittiwake populations when compared with predicted impacts in the EIAR.	Updated distributional response impact predictions are provided in Section 2.4 (Updated Distributional Responses) of this Chapter (Matrix Displacement Assessment).
Cumulative Effects Assessment			
17/07/2025	NatureScot. Consultation meeting two.	NatureScot requested that cumulative impact values were presented to determine whether a cumulative PVA is required for Arctic tern, great black-backed gull, fulmar, Manx shearwater, and red-throated diver.	Additional information on the need for cumulative effects on Arctic tern, great black-backed gull, fulmar, Manx shearwater and red-throated diver populations is provided in Section 2.7 (Updated Cumulative Effects Assessment for Additional Species) of this Chapter.
Collision Risk Modelling			
17/07/2025	NatureScot. Consultation meeting two.	NatureScot noted that it was difficult to support the conclusion that updated avoidance rates would not change predicted impacts without a comparison of model outputs from both parameter sets. NatureScot requested ”one species example of this”.	An example of the difference in predicted collision predictions based on updated avoidance rate is provided for kittiwake populations in Section 2.5 (Updated Collision Risk Modelling Information) of this Chapter () (Example Species Using Updated Avoidance Rate).
Apportioning			
17/07/2025	NatureScot. Consultation meeting two.	NatureScot noted that the value of the proportion of the foraging range of a colony that is sea area for each colony and species was not stated, therefore making it impossible to recreate the apportioning factor calculations.	The proportions of the foraging range of a colony that is sea area are provided in Section 2.8 (Updated Information on Apportioning Impacts) of this Chapter.

Date	Consultee and Type of Consultation	Description / Issues Raised	How This Has Been Considered In The AIR
17/07/2025	NatureScot. Consultation meeting two.	NatureScot noted that the distances from the development to St Abb's Head to Fast Castle Special Protection Area SPA appear incorrect.	Information on this distance is provided in Section 2.8 (Updated Information on Apportioning Impacts) of this Chapter.
17/07/2025	NatureScot. Consultation meeting two.	Impacts to breeding adults were provided in Excel format in the EIAR. NatureScot noted that they found, "some errors in the column 'Breeding season displacement mortality of breeding adults - lower displacement...The implication of these errors are minor, with a decrease in the percentage point change in survival rate ranging from 0.00000 to 0.00008 as a result of correcting the lower displacement mortality of breeding adults in the breeding season"	Additional information is provided in Section 2.8 (Updated Information on Apportioning Impacts) of this Chapter.and an updated Excel file is provided with the AIR.
Cumulative Effects Assessment			
08/08/2025	NatureScot – email	NatureScot provided updated advice on PVA modelling for the great black-backed gull regional population.	Additional information on the need for cumulative effects on Arctic tern, great black-backed gull, fulmar, Manx shearwater and red-throated diver populations is provided in Section 2.7 (Updated Cumulative Effects Assessment for Additional Species) of this Chapter.
Assessment Approach			
08/08/2025	NatureScot – email	NatureScot provided updated advice on kittiwake populations in the Calf of Eday SPA.	Additional Information on seabird colony counts is provided in Section 2.2 (Updated Regional Population Size) of this Chapter.

Date	Consultee and Type of Consultation	Description / Issues Raised	How This Has Been Considered In The AIR
Cumulative Effects Assessment			
08/08/2025	NatureScot – email	NatureScot provided updated advice on PVA modelling for the great black-backed gull regional population.	Additional information on the need for cumulative effects on Arctic tern, great black-backed gull, fulmar, Manx shearwater and red-throated diver populations is provided in Section 2.7 (Updated Cumulative Effects Assessment for Additional Species) of this Chapter.

2.3. UPDATED REGIONAL POPULATION SIZE

2.3.1. Written consultation from NatureScot prior to submission of the EIAR advised that the EIA application should set out the approach to using colony counts from Burnell *et al*. (2023), supplemented by more recent counts from the Seabird Monitoring Programme (SMP) database. This approach was adopted in the EIA and NatureScot acknowledged this in their post-submission consultation response (04/03/2025).

2.3.2. However, NatureScot noted several instances where more recent colony counts were not used for gannet, puffin and kittiwake. Updated colony counts incorporating NatureScot comments and resultant regional breeding population estimates of gannet, puffin and kittiwake are provided in Table 2.2, Table 2.5 and Table 2.6 respectively.

GANNET

2.3.3. In their post-application consultation email correspondence, NatureScot advised more recent counts for two gannet colonies should be used (Table 2.2). These changes affected the regional population size. The two colonies for which NatureScot recommended more recent population information were Bass Rock (Forth Islands SPA) and Hermaness (Hermaness, Saxa Vord and Valla Field SPA) (Table 2.3). For both of these colonies, NatureScot recommended counts from 2023, which were not available for the application.

Table 2.2 Copy of the Response from NatureScot on the Colony Sizes and Regional Breeding Population Sizes for Gannet

SPA	Muir Mhòr Count (breeding adults)	Year	NatureScot Advised Count (breeding adults)	Year
Fair Isle	9,654	2023		
Forth Islands	150,518	2014	1,03,688	2023
Hermaness, Saxa Vord and Valla Field	59,124	2021	37,478	2023
North Rona and Sula Sgeir	18,990	2023		
Noss	24,670	2023		
Sule skerry + Sule stack	18,130	2013 – 2018		
St Kilda	120,580	2013		
SPA total	401,666		333,190	
Regional total	458,378		369,902	

2.3.4. It is noted that the colony counts from 2023 were smaller likely due the effects Highly Pathogenic Avian Influenza (HPAI) on populations (Tremlett *et al*. 2024). It is logical that other colonies, not counted since HPAI affected gannet populations, would also be smaller. However, the impact assessment process is relative to population size and as populations change, the level of impact should change. Surveys of the Muir Mhòr site (and buffer) were undertaken in 2021 and 2022. HPAI had not started impacting breeding gannet population sizes in 2021 and first occurred in the two colonies suggested by NatureScot as needing amending in 2022 (Tremlett *et al*. 2024). As such, the surveys of the Muir Mhòr site (and buffer) occurred in the year prior to HPAI affecting colony sizes and the year in which HPAI started impacting colonies. Both of the Bass Rock and Hermaness gannet colonies have

changed over time (Figure 2.1). Both colonies have grown over the last 20 years, with large declines occurring when HPAI occurred.

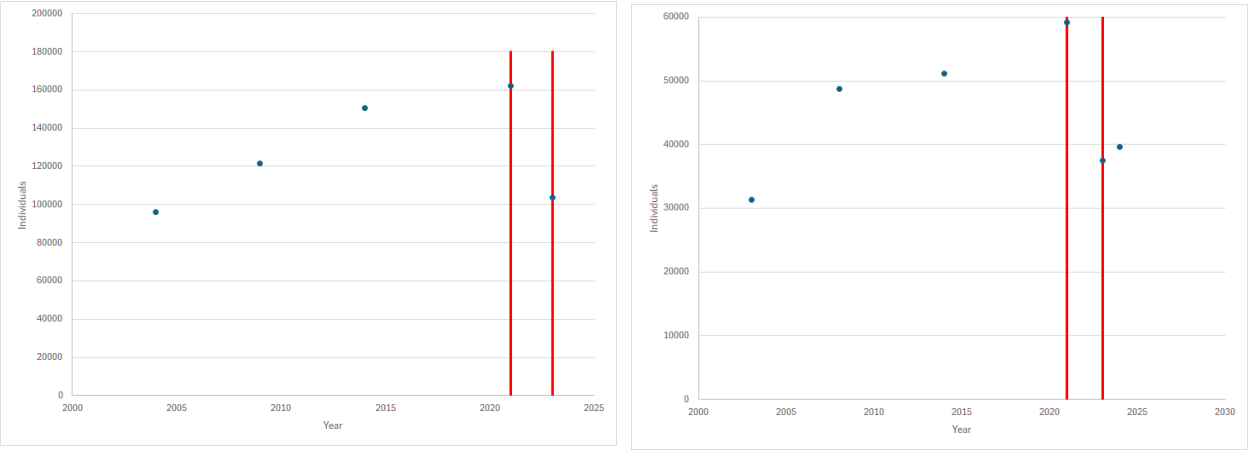

Figure 2.1 Change in Population Size of Gannet Colonies at Bass Rock and Hermaness Over Time. Red Lines Show 2021 (first year of site surveys) and 2022 (second year of site surveys). Counts from 2021 are Estimated Values from Wanless et al. (2023)

2.3.5. There was also a large difference in the abundance of gannets in the Muir Mhòr site (and buffer) between 2021 and 2022. It is therefore important to carefully consider the effects of HPAI on gannet colonies alongside the predicted impacts from the Muir Mhòr project. In the submitted EIAR the predicted impacts are essentially based on averages of the data from the two years of survey data. Since the surveys occurred before and during the HPAI epidemic the approach to providing suitable additional information for NatureScot to reach conclusions was discussed during consultation meeting 1 on 18 June 2025.

2.3.6. It was agreed that providing predicted impacts from the 2021 and 2022 survey data and comparing these results with available colony counts before 2021 and 2022 onwards would provide suitable context to understand the impact on gannet before and after HPAI. Colony counts were selected for each colony from counts before the HPAI epidemic in gannets (i.e. 2021 or earlier) and during or after the HPAI epidemic in gannets (i.e. 2022 or later) (Table 2.3).

Table 2.3 Most Recent Gannet Colony Counts from Pre-HPAI years (before 2022) and Post/During HPAI (after 2022) and the Year in Which the Counts Were Undertaken

SPA	Pre-HPAI	Year	Post/During HPAI	Year
Fair Isle	9,942	2021	9,654	2023
Forth Islands	150,518	2014	103,688	2023
Hermaness, Saxa Vord and Valla Field	51,160	2014	37,478	2023
North Rona and Sula Sgeir	22,460	2013	18,990	2023
Noss	27,530	2019	24,670	2023
Sule skerry + Sule stack	12,840	2013	6,548	2024
St Kilda	120,580	2013	118,410	2023
SPA total	395,030	2013 - 2021	319,438	2023-2024
Regional total	451,742		376,150	

2.3.7. These results showed that the regional population in the years during or after the HPAI epidemic in gannets was 75,592 individuals smaller.

2.3.8. Predicted impacts from the Muir Mhòr project alone differed between the two years of survey data. The predicted total impact to all adult birds was 16.7 in 2021 but 4.0 in 2022 (Table 2.4). This difference resulted in a much smaller predicted change in annual adult survival rate for the 2022 predicted impact compared with the during/post-HPAI epidemic in gannet colony counts (0.0010% points) than the 2021 predicted impacts with the pre-HPAI colony counts (0.0037% point). However, comparison of the Year 1 (2021) with the mean of Year 1 and Year 2 and the predicted impacts, were relatively similar. It is important to note that while relative difference across these scenarios were large, the absolute difference in adult survival were very small.

Table 2.4 Predicted Impacts from Year 1 and Year 2 Surveys of Muir Mhòr Compared with Pre-HPAI and During/Post-HPAI Epidemic in Gannets. The Mean of the Pre-HPAI and Post-HPAI Regional Breeding Population and the EIA Predicted Impacts are Also Shown.

Metric	Year 1	Year 2	Mean	EIA
Impact (ALL) - CRM plus maximum displacement mortality	34.96	8.32	21.64	31.72
Regional breeding population size (individuals)	451,742	389,902	420,822	458,378
Proportion adults	0.531	0.531	0.531	0.531
Adult survival rate	0.919	0.919	0.919	0.919
Baseline mortality rate	0.08	0.08	0.081	0.08
Sabbatical rate	0.90	0.90	0.900	0.90
Predicted impact from Muir Mhòr only to adults	16.71	3.97	10.34	15.16
Impacted adult mortality rate (Muir Mhòr only)	0.08104	0.08101	0.08102	0.08103
Change in adult survival/mortality rate (Muir Mhòr only)	0.0037%	0.0010%	0.0025%	0.0033%

2.3.9. It is important to note that the difference in the abundance of gannets in the Muir Mhòr site (and buffer) between 2021 and 2022 were relatively larger than the difference in the population size between these two years. It is unlikely that all of the difference in the use of the Muir Mhòr site between 2021 and 2022 was due to the effects of HPAI on population sizes. It is likely, given the relative difference in the size of the Muir Mhòr site and the space

use by gannets from the colonies in the North Sea, that this relative difference in abundance is due to normal variation in space use by gannets.

PUFFIN

2.3.10. NatureScot advised, as part of their post-submission consultation letter (04/03/2025), that more recent count data for one puffin colony should be used. This change affected the regional population size (Table 2.5). The colony for which NatureScot recommended more recent count data were available was North Caithness Cliffs SPA. For this colony, NatureScot recommended counts which included data from 2023, which were not available for the application at the time of writing.

Table 2.5 Copy of the Response from NatureScot on the Colony Sizes and Regional Breeding Population Sizes for Puffin

Colony	Colony Counts as Referenced in the EIAR (breeding adults)	Colony Counts as Advised by NatureScot (breeding adults)
Coquet Island SPA	50,058	50,058
Fair Isle SPA	13,332	13,332
Farne Islands SPA	87,504	87,504
Forth Islands SPA	90,291	90,291
Hoy SPA	860	860
North Caithness Cliffs SPA	5,438	6,102
Non-SPA colonies (Total)	15,146	15,146
Regional breeding Population	262,629	263,293

2.3.11. The NatureScot recommended revision to the colony count value used in relation to North Caithness Cliffs SPA results in a 0.25% increase in the estimated regional breeding population of puffin.

KITTIWAKE

2.3.12. NatureScot advised, as part of their post-submission consultation letter (04/03/2025), more recent count data for six kittiwake colonies should be used. These changes affected the regional population size (Table 2.6). The colonies for which NatureScot recommended more recent count data were available were Calf of Eday SPA, Cape Wrath SPA, Forth Islands SPA, Fowlsheugh SPA, Hoy SPA and North Caithness Cliffs SPA. For some of these colonies, NatureScot recommended counts which included data from 2023, which were not available for the application at the time of writing.

Table 2.6 Copy of the Response from NatureScot on the Colony Sizes and Regional Breeding Population Sizes for Kittiwake

Colony	Colony Counts as Referenced in the EIAR (breeding adults)	Colony Counts as Advised by NatureScot* (breeding adults)
Buchan Ness to Collieston Coast SPA	27,094	27,094
Calf of Eday SPA	672	292
Cape Wrath SPA	7,244	6,616
Copinsay SPA	592	592
East Caithness Cliffs SPA	48,958	48,958
Fair Isle SPA	896	896
Farne Islands SPA	7166	7,166
Forth Islands SPA	13,244	13,708
Foula SPA	850	850
Fowlsheugh SPA	30,966	40,156
Hoy SPA	532	608
Marwick Head SPA	2,878	2,878
North Caithness Cliffs SPA	11,142	16,424
Noss SPA	172	172
Rousay SPA	660	660
St Abb's Head to Fast Castle SPA	9,158	9,158
Sumburgh Head SPA	1932	1,932
Troup, Pennan and Lion's Heads SPA	27,344	27,344
West Westray SPA	4,838	4,838
Non-SPA colonies (Total)	36,801	36,801
Regional breeding Population	233,139	247,143

* Values from NatureScot consultation response (03/03/2025)

2.3.13. The NatureScot recommended revision to the colony count values used in relation to Calf of Eday, Cape Wrath, Forth Islands, Fowlsheugh, Hoy and North Caithness Cliffs SPAs results in a 6.01% increase in the estimated regional breeding population of kittiwake.

2.3.14. It was noted that the count value used for Calf of Eday (286 individuals) was not inclusive of four pairs nesting on Eday. Whether these birds should be included in the SPA was questioned and remained unresolved at the time of writing. Including these pairs would have increased the total population to 292 individuals. NatureScot agreed in the consultation meeting on the 13 of August 2025 that the change in adult survival makes no material difference and that difference in the predicted impact apportioned to this SPA based on each population size was negligible (Table 2.7).

Table 2.7 Change in Adult Survival for Both Calf of Eday Population Sizes

Calf of Eday Population Size	286	292
Apportionment ratio	0.000278	0.000284
Breeding collisions	0.017173	0.017533
Breeding displacement (lower)	0.002715	0.002772
Breeding displacement (upper)	0.008142	0.008313
Total	0.028031	0.028619
Change in adult survival (percentage point)	0.00980098%	0.00980092%

2.4. UPDATED DISTRIBUTIONAL RESPONSES

2.4.1. NatureScot stated in their consultation response (04/03/2025) that their, "position is that SeabORD is the more biologically accurate model" for informing displacement mortality estimates. However, due to the predicted positive effects from some model runs on some seabird populations NatureScot recommended that SeabORD be re-run with updated distance decay functions. This was discussed in detail with NatureScot (meeting on 30/05/2025). The applicant demonstrated that the recommended updates to the distance decay function would not result in the expected changes to SeabORD outputs (see Appendix II: Additional Information on SeabORD of this AIR). It was also discussed at the meeting that updated SeabORD-R model would not be available in time for inclusion in this AIR. It was agreed that additional information on predicted breeding season distributional response impact would be assessed using the matrix displacement approach. Due to these issues, NatureScot requested that the apportioning and PVA elements of the distributional responses assessment be repeated, this time utilising the matrix approach, to inform predicted mortality for kittiwake, guillemot, razorbill and puffin.

2.4.2. NatureScot identified errors relating to mean seasonal peak abundances within Volume 3, Appendix 11.3: Offshore Ornithology Distributional Responses Report of the EIAR. It was noted by NatureScot that these errors do not carry through to the displacement matrix assessment and as such have no implications for the EIA conclusions. It was nevertheless requested that, for completeness, these calculations are corrected. It was identified that only non-breeding season mean peak abundance estimates for razorbill were incorrect and corrected values are shown in Table 2.8.

Table 2.8 Updated Mean Seasonal Peak Abundance for Each Species for the AA Only and AA Plus a 2 or 4 km Buffer. Values in Grey Shaded Cells Have Changed from the EIAR. The Non-breeding Overall Column was Calculated as the sum of the Non-breeding Sub-period.

Species	Displacement Area	Breeding Season	Non-breeding Total	Non-breeding Sub-periods		
				Autumn Migration	Spring Migration	Over Winter
Red-throated diver	AA	6.49	0.00	0.00	0.00	0.00
	AA + 4 km buffer	6.65	0.00	0.00	0.00	0.00
Velvet scoter	AA	0.00	0.00	0.00	0.00	0.00
	AA + 4 km buffer	0.00	0.00	0.00	0.00	0.00
Guillemot	AA	6,940.84	6,723.08	0.00	0.00	6,723.08
	AA + 2 km buffer	13,122.48	11,862.68	0.00	0.00	11,862.68
Razorbill	AA	1,042.32	1,037.19	943.39	67.76	26.05
	AA + 2 km buffer	1,548.65	1,546.61	1,388.27	116.57	41.77
Arctic tern	AA	227.06	0.00	0.00	0.00	0.00
	AA + 2 km buffer	293.74	0.00	0.00	0.00	0.00
Common tern	AA	11.09	0.00	0.00	0.00	0.00
	AA + 2 km buffer	11.12	0.00	0.00	0.00	0.00
Puffin	AA	1,108.67	1,108.67	0.00	0.00	1,108.67
	AA + 2 km buffer	1,812.10	1,812.10	0.00	0.00	1,812.10
Kittiwake	AA	1,849.72	450.11	32.36	417.75	0.00
	AA + 2 km buffer	3,252.35	809.29	58.23	751.06	0.00
Gannet	AA	259.35	388.32	348.17	40.15	0.00
	AA + 2 km buffer	597.43	666.76	592.63	74.13	0.00
Black-headed gull	AA	4.99	0.00	0.00	0.00	0.00
	AA + 2 km buffer	5.01	0.00	0.00	0.00	0.00
Manx shearwater	AA	4.99	0.00	0.00	0.00	0.00
	AA + 2 km buffer	10.01	0.00	0.00	0.00	0.00

SEABORD

2.4.3. Following submission of the EIAR, Muir Mhòr have received feedback from NatureScot indicating that they consider the information currently presented in the assessment of distributional responses of seabirds in response to the development to be insufficient to allow them to advise on the Project. The approach taken in the AIR was agreed with NatureScot in a consultation meeting on 30 May 2025.

SUMMARY OF NATURESCOT COMMENTS

2.4.4. The SeabORD MATLAB tool was used by the Applicant to assess impacts associated with distributional responses of guillemot, razorbill, puffin and kittiwake deriving from certain key SPA populations during the breeding season. NatureScot note that the impacts predicted using the SeabORD tool are not as they would have expected and suggest that the distance decay function used within the tool may not appropriately account for connectivity between the development and designated sites. NatureScot's feedback draws particular attention to instances of predictions of negative additional adult mortality (i.e. increased adult survival) for kittiwake and guillemot in some instances.

APPROACH FOLLOWED BY THE APPLICANT

2.4.5. The Applicant applied the distance decay function inbuilt within the SeabORD tool, parameterised according to the parameter descriptions within the tool and associated documentation i.e. the foraging distance in km (parameter *r*, taken as the mean maximum plus one standard deviation from Woodward *et al.,* 2019) and a proportion of individuals foraging within the distance provided (parameter *p*). This was taken to be 0.95 (i.e. 5% of birds forage beyond this distance) which was considered by the Applicant to be precautionary since, in reality, fewer than 5% of foraging trips would be expected to extend beyond the mean maximum foraging range.

2.4.6. In a consultation meeting on 30 May 2025, NatureScot advised that the developers of SeabORD have since suggested that no value smaller than 0.985 should be used as the input value representing the proportion of individuals foraging within the provided foraging range since numbers below this value produce distance decay curves that are unrealistically steep close to the colony. Whilst this could result in underestimation of birds present at a wind farm sites close to colonies, subsequent examination of the curves by the Applicant demonstrated that there is a crossing point of the curves, beyond which foraging density at further distances from the colony will in fact be predicted to be higher at lower values of *p* as expected, meaning that use of 0.95 is still precautionary in terms of predicted bird densities within the Array Area, though it is acknowledged that the unrealistic distributions elsewhere may still be a concern.

2.4.7. During consultation with NatureScot (consultation meeting 18/06/2025) the alternative approaches to seaboard were discussed, a summary of these discussions are provided in the AIR Appendix II: Additional Information on SeabORD.

FURTHER COMMENTS ON THE COMPARISON BETWEEN SEABORD AND DAS-DERIVED DENSITIES

2.4.8. When considering these results, it should be noted that both the density estimates derived from the Digital Aerial Survey (DAS) data and those derived from the distance decay function were based on a series of different assumptions which may be violated.

2.4.9. For density estimates from DAS data these are:

- The surveys conducted are representative of the bird activity across the whole chick-rearing period;
- The apportioning to colonies is correct;
- The sabbatical rate is correct; and
- The ratio of adults to juveniles is correct.

2.4.10. For the distance decay function these are:

- The shape of the distance decay curve is correct i.e. the majority of birds forage close to the colony;
- 50% of the breeding adults at the colony are at sea at any time; and
- All foraging birds are at their foraging site rather than travelling between them.

2.4.11. The numbers derived therefore provide a rough indication of the potential magnitude of difference in densities of birds using the site derived from each method, but it should be noted that comparing and evaluating two such different methodologies against one another is not straightforward.

MATRIX DISPLACEMENT ASSESSMENT

2.4.12. NatureScot requested that the Applicant present displacement impacts to the regional populations of guillemot, razorbill, puffin and kittiwake using entirely matrix-based approaches, rather than the combined matrix and SeabORD based approaches presented within the assessment in Volume 2, Chapter 11: Offshore and Intertidal Ornithology of the EIAR.

2.4.13. To do this, components of breeding season distributional response mortality estimates derived using SeabORD within the Application, were substituted with the equivalent components taken from breeding season displacement matrices presented within Annex B:Displacement Matrices of Volume 3, Appendix 11.3: Offshore Ornithology Distributional Responses Report of the EIAR. Seasonal and annual total displacement mortality predictions were duly redetermined.

2.4.14. Revised distributional response mortality estimates were then considered in relation to regional breeding populations (also revised, where necessary, to incorporate NatureScot comments relating to particular colony count) to determine the percentage point reduction to regional breeding adult survival rates resultant from distributional responses (or combined distributional responses and collision impacts in the case of kittiwake) and the requirement for PVA to contextualise the population level consequences of predicted impacts.

2.4.15. This information is presented for each species for project only impacts in Table 2.9, and for cumulative impacts in Table 2.10.

2.4.16. Summaries of differences in % point reduction to regional breeding adult survival rates resultant from changes to distributional response impact quantification approaches between the EIAR and this Chapter of the AIR are provided in Tables 1-6 (project only) and 1-7 (cumulative), with inclusion of additional information relating to changes in the requirement for PVA. Where relevant, equivalent information relating to the distributional response impact assessment methodology used within the EIAR (i.e. a combined SeabORD and Matrix approach) is presented alongside revised information in order to facilitate comparison. This supplementary information is shown in grey in the tables.

UPDATED PVA

2.4.17. Following updated breeding season impacts requested by NatureScot to be based on displacement matrix predictions, rather than SeabORD, updated PVAs were completed for kittiwake, guillemot, razorbill and puffin. These updated PVAs were not as a result of comments from NatureScot on the PVA in the EIAR. Where the requirement for PVA is identified in relation to revised distributional response modelling and/or regional population estimates the relevant input and output values of revised PVAs are included in Table 2.9 to Table 2.10**.** Summaries of differences between PVA outputs resulting from changes to distributional response impact predictions between the EIAR and the Additional Information provided here are provided in Table 2.11 (project only) and Table 2.12 (cumulative). Changes to predicted impact magnitude and determination of impact significance are also provided. Where relevant, equivalent information relating to the distributional response impact assessment methodology used within the EIAR (i.e. a combined SeabORD and matrix displacement estimate) is presented alongside revised information in order to aid comparisons.

Table 2.9 Project-only Predicted Impacts from Changes to Matrix Displacement Predictions Only Compared with the Approach Taken in the EIAR (SeabORD plus matrix displacement predictions). Cells Shaded Grey Show Values from the EIAR.

	Species	Guillemot		Razorbill		Puffin		Kittiwake	
	Distributional Response Scenario	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
Breeding Season Impacts	Displacement rate	60%	60%	60%	60%	60%	60%	30%	30%
	Mortality rate	3%	5%	3%	5%	3%	5%	1%	3%
	Breeding season mortality (all individuals)	236.20	393.67	27.88	46.46	32.62	54.36	9.76	29.27
	Breeding season mortality (breeding adults) from matrix displacement only	113.35	188.91	14.49	24.15	16.95	28.25	4.11	12.33
	Previous breeding season mortality (breeding adults) from combined SeabORD and matrix displacement	2.93	4.81	7.26	11.17	17.73	18.75	15.58	17.14
Non-breeding Season Impacts	Displacement rate	60%	60%	60%	60%	NA[1]		30%	30%
	Mortality rate	1%	3%	1%	3%			1%	3%
	Non-breeding season mortality (breeding adults) from matrix displacement only (unchanged from EIAR)	34.16	102.49	0.44	1.34			0.76	2.28
Annual Impacts	Annual mortality (breeding adults) from matrix displacement only	147.51	291.40	14.93	25.49	16.95	28.25	4.87	14.61
	Previous annual mortality (breeding adults) from combined SeabORD and matrix displacement	37.09	107.30	7.70	12.51	23.05	34.70	16.34	19.42
	Annual collision mortality to breeding adults	NA	NA	NA	NA	NA	NA	28.54	28.54
	Total annual mortality to breeding adults from matrix displacement only and CRM	147.51	291.40	14.93	25.49	16.95	28.25	33.41	43.15
	Total annual mortality (unchanged from EIAR)	37.09	107.3	7.7	12.51	17.73	18.75	44.88	47.96
Revised regional population (breeding adults)		90,866	90,866	43,663	43,663	263,293	263,293	247,143	247,143
EIAR regional population (breeding adults)		90,866	90,866	43,663	43,663	262,629	262,629	233,139	233,139
% point reduction in annual adult survival rate from matrix displacement only		0.162%	0.321%	0.034%	0.058%	0.006%	0.011%	0.014%	0.017%
% point reduction in annual adult survival rate (unchanged from EIAR)		0.041%	0.118%	0.018%	0.029%	0.007%	0.007%	0.019%	0.021%
Exceeds 0.02% point threshold for PVA? (matrix displacement only)		Yes	Yes	Yes	Yes	No	No	No	No
Exceeds 0.02% point threshold for PVA? (EIAR)		Yes	Yes	No	Yes	No	No	No	Yes

[1] Following the advice from NatureScot for the EIAR, non-breeding season impacts to puffin populations were not assessed

Table 2.10 Cumulative Predicted Impacts from Changes to Matrix Displacement Predictions Only Compared with the Approach Taken in the EIAR (SeabORD plus matrix displacement predictions). Cells Shaded Grey Show Values from the EIAR.

Species		Guillemot		Razorbill		Puffin		Kittiwake	
Distributional Response Scenario		**Lower**	**Upper**	**Lower**	**Upper**	**Lower**	**Upper**	**Lower**	**Upper**
Breeding Season Impacts	Displacement rate	60%	60%	60%	60%	60%	60%	30%	30%
	Mortality rate	3%	5%	3%	5%	3%	5%	1%	3%
	Cumulative breeding season mortality (breeding adults) from matrix displacement only	164.42	274.03	112.04	191.07	266.20	442.88	132.83	397.83
	Cumulative breeding season mortality (breeding adults) from EIAR (SeabORD and matrix)	54	89.93	104.81	178.09	266.98	433.38	144.3	402.64
Non-breeding Season Impacts	Cumulative non-breeding season mortality (breeding adults) from matrix displacement only (EIAR)	74.08	222.24	22.92	68.77	NA[1]		118	353.67
Annual Impacts	Cumulative annual mortality (breeding adults) from matrix displacement only	238.50	496.27	134.96	259.84	266.20	442.88	250.83	751.50
	Cumulative annual mortality (breeding adults) from collisions (EIAR)	NA	NA	NA	NA	NA	NA	1017.74	1017.74
	Total cumulative annual mortality (breeding adults)	238.50	496.27	134.96	259.84	266.20	442.88	1268.57	1769.24
	Total cumulative annual mortality (breeding adults) EIAR	128.08	312.17	127.73	246.86	266.98	433.38	1280.04	1774.05
Revised regional population (breeding adults)		90866	90866	43663	43663	263293	263293	247143	247143
EIAR regional population (breeding adults)		90866	90866	43663	43663	262629	262629	233139	233139
% point reduction in annual adult survival rate from matrix displacement only		0.262%	0.546%	0.309%	0.594%	0.101%	0.168%	0.514%	0.716%
% point reduction in annual adult survival rate (unchanged from EIAR)		0.141%	0.344%	0.293%	0.565%	0.102%	0.165%	0.549%	0.761%
Exceeds 0.02% point threshold for PVA? (matrix displacement only)		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exceeds 0.02% point threshold for PVA? (EIAR)		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

[1] Following the advice from NatureScot for the EIAR, non-breeding season impacts to puffin populations were not assessed

Table 2.11 Project Only Impact Summary of % Point Reduction to Regional Breeding Adult Survival Rates Resultant from Changes to Distributional Response Impact Quantification Approaches

Species	EIAR Results (Combined SeabORD and Matrix approach)		AIR Results (Matrix approach only)		Summary of Changes to Predicted Impact
	% Point Reduction To Regional Breeding Adult Survival Rate				
Distributional Response Scenario	**Lower**	**Upper**	**Lower**	**Upper**	
Kittiwake	0.019%	0.021%	0.014%	0.017%	**Decrease to combined distributional response and collision impact estimates.** PVAs were required for upper distributional response scenario impacts within the EIAR (and also undertaken for lower distributional response scenario impacts). PVAs are, however, not required for lower or upper distributional response scenario revised impacts.
Guillemot	0.041%	0.118%	0.162%	0.321%	**Large increase to distributional response impact estimates.** PVAs were required for both lower and upper distributional response scenario impacts within the EIAR and are also required for both lower and upper distributional response scenario revised impacts.
Razorbill	0.018%	0.029%	0.034%	0.058%	**Increase to distributional response impact estimates.** PVAs were required for upper distributional response scenario impacts within the EIAR (and also undertaken for lower distributional response scenario impacts). PVAs are required for both lower and upper distributional response scenario revised impacts.
Puffin	0.007%	0.007%	0.006 %	0.011%	**Decrease to lower case distributional response impact estimates. Increase to upper case distributional response impact estimates.** PVAs were not required for lower or upper distributional response scenario impacts within the EIAR and are also not required for lower and upper distributional response scenario revised impacts.

Table 2.12 Cumulative Impact Summary of % Point Reduction to Regional Breeding Adult Survival Rates Resultant from Changes to Distributional Response Impact Quantification Approaches

Species	EIAR Results (Combined SeabORD and Matrix approach for Muir Mhòr)		AIR Results (Matrix approach only for Muir Mhòr)		Summary of Changes to Predicted Impact
	% Point Reduction to Regional Breeding Adult Survival Rate				
Distributional Response Scenario	**Lower**	**Upper**	**Lower**	**Upper**	
Kittiwake	0.549%	0.761%	0.514%	0.516%	**Decrease to cumulative combined distributional response and collision impact estimates.** PVAs were required for upper distributional response scenario impacts within the EIAR (and also undertaken for lower distributional response scenario impacts). PVAs are, however, not required for lower or upper distributional response scenario revised impacts.
Guillemot	0.141%	0.344%	0.262%	0.546%	**Large increase to cumulative distributional response impact estimates.** PVAs were required for both lower and upper distributional response scenario impacts within the original EIA and are also required for both lower and upper distributional response scenario revised impacts.
Razorbill	0.293%	0.565%	0.309%	0.594%	**Increase to cumulative distributional response impact estimates.** PVAs were required for upper distributional response scenario impacts within the EIAR (and also undertaken for lower distributional response scenario impacts). PVAs are required for both lower and upper distributional response scenario revised impacts.
Puffin	0.102%	0.165%	0.101 %	0.168%	**Decrease to lower case cumulative distributional response impact estimates. Increase to upper case cumulative distributional response impact estimates.** PVAs were not required for lower or upper distributional response scenario impacts within the EIAR and are also not required for lower and upper distributional response scenario revised impacts.

Table 2.13 Kittiwake PVA Inputs and Outputs

Impacts to Regional Kittiwake Population		Lower Displacement Mortalities (1%)		Upper Displacement Mortalities (3%)	
		EIAR	Revised Values	EIAR	Revised Values
Regional population (breeding adults)		233139	247137	233139	247137
Year		2023	2023	2023	2023
Project-only Impacts					
PVA inputs - Proportional impacts	Productivity rate	0.00057	Project-only combined distributional response and collision mortality values do not meet advised % point reduction in breeding adult survival rate = 0.014%.	0.00057	Project-only combined distributional response and collision mortality values do not meet advised % point reduction in breeding adult survival rate = 0.017%.
	Adult survival rate	0.00019		0.00021	
	Immature survival rate	0.00013		0.00014	
PVA outputs - Counterfactual values	CGR (25)	1.000 (0.999 - 1.000)		1.000 (0.999 - 1.000)	
	CGR (35)	1.000 (0.999 - 1.000)		1.000 (0.999 - 1.000)	
	CGR (50)	1.000 (0.999 - 1.000)		1.000 (0.999 - 1.000)	
	CPS (25)	0.991 (0.981 - 1.001)		0.991 (0.981 - 1.001)	
	CPS (35)	0.987 (0.976 - 0.998)		0.987 (0.976 - 0.998)	
	CPS (50)	0.982 (0.969 - 0.994)		0.981 (0.969 - 0.993)	
Cumulative Impacts					
PVA inputs - Proportional impacts	Productivity rate	0.00057	0.00000	0.00057	0.00000
	Adult survival rate	0.00550	0.00514	0.00761	0.00716
	Immature survival rate	0.00167	0.00158	0.00304	0.00291
PVA outputs - Counterfactual values	CGR (25)	0.995 (0.995 - 0.996)	0.996 (0.995 - 0.996)	0.994 (0.993 - 0.994)	0.994 (0.993 - 0.994)
	CGR (35)	0.995 (0.995 - 0.996)	0.996 (0.995 - 0.996)	0.994 (0.993 - 0.994)	0.994 (0.993 - 0.994)
	CGR (50)	0.996 (0.995 - 0.996)	0.996 (0.995 - 0.996)	0.994 (0.994 - 0.994)	0.994 (0.994 - 0.994)
	CPS (25)	0.886 (0.876 - 0.896)	0.894 (0.884 - 0.904)	0.848 (0.837 - 0.858)	0.847 (0.838 - 0.856)
	CPS (35)	0.847 (0.835 - 0.857)	0.857 (0.846 - 0.867)	0.796 (0.785 - 0.806)	0.796 (0.785 - 0.805)
	CPS (50)	0.795 (0.783 - 0.806)	0.808 (0.797 - 0.818)	0.730 (0.718 - 0.741)	0.729 (0.719 - 0.739)

Table 2.14 Guillemot PVA Inputs and Outputs

Impacts to Regional Guillemot Population		Lower Displacement Mortalities (1%/3%)		Upper Displacement Mortalities (3%/5%)	
		EIAR	Revised values	EIAR	Revised values
Regional population (breeding adults)		90866.74	90866.74	90866.74	90866.74
Year		2023	2023	2023	2023
Project-only Impacts					
PVA inputs - Proportional impacts	Productivity rate	0.00005	0.00000	0.00005	0.00000
	Adult survival rate	0.00041	0.00162	0.00118	0.00321
	Immature survival rate	0.00044	0.00175	0.00127	0.00345
PVA outputs - Counterfactual values	CGR (25)	1.000 (0.999 - 1.000)	0.998 (0.998 - 0.998)	0.999 (0.998 - 0.999)	0.996 (0.996 - 0.997)
	CGR (35)	1.000 (0.999 - 1.000)	0.998 (0.998 - 0.998)	0.999 (0.998 - 0.999)	0.996 (0.996 - 0.997)
	CGR (50)	1.000 (0.999 - 1.000)	0.998 (0.998 - 0.998)	0.999 (0.998 - 0.999)	0.996 (0.996 - 0.997)
	CPS (25)	0.988 (0.978 - 0.998)	0.953 (0.943 - 0.963)	0.965 (0.955 - 0.975)	0.909 (0.900 - 0.918)
	CPS (35)	0.983 (0.972 - 0.994)	0.935 (0.925 - 0.945)	0.952 (0.942 - 0.963)	0.876 (0.866 - 0.885)
	CPS (50)	0.976 (0.965 - 0.988)	0.909 (0.898 - 0.919)	0.934 (0.923 - 0.945)	0.828 (0.818 - 0.837)
Cumulative Impacts					
PVA inputs - Proportional impacts	Productivity rate	0.00005	0.00000	0.00005	0.00000
	Adult survival rate	0.00141	0.00262	0.00344	0.00546
	Immature survival rate	0.00114	0.00245	0.00281	0.00499
PVA outputs - Counterfactual values	CGR (25)	0.998 (0.998 - 0.999)	0.997 (0.997 - 0.997)	0.996 (0.996 - 0.997)	0.994 (0.994 - 0.994)
	CGR (35)	0.998 (0.998 - 0.999)	0.997 (0.997 - 0.997)	0.996 (0.996 - 0.997)	0.994 (0.994 - 0.994)
	CGR (50)	0.998 (0.998 - 0.999)	0.997 (0.997 - 0.997)	0.996 (0.996 - 0.997)	0.994 (0.994 - 0.994)
	CPS (25)	0.960 (0.950 - 0.970)	0.928 (0.919 - 0.938)	0.911 (0.902 - 0.920)	0.858 (0.848 - 0.866)
	CPS (35)	0.945 (0.935 - 0.955)	0.902 (0.892 - 0.912)	0.879 (0.870 - 0.889)	0.808 (0.799 - 0.817)
	CPS (50)	0.925 (0.914 - 0.935)	0.864 (0.854 - 0.874)	0.836 (0.827 - 0.846)	0.739 (0.730 - 0.748)

Table 2.15 Razorbill PVA Inputs and Outputs

Impacts to Regional Razorbill Population		Lower Displacement Mortalities (1%/3%)		Upper Displacement Mortalities (3%/5%)	
		EIAR	Revised values	EIAR	Revised values
Regional population (breeding adults)		43662.56	43662.56	43662.56	43662.56
Year		2023	2023	2023	2023
Project-only Impacts					
PVA inputs - Proportional impacts	Productivity rate	0.00022	0.00000	0.00022	0.00000
	Adult survival rate	0.00018	0.00034	0.00029	0.00058
	Immature survival rate	0.00015	0.00037	0.00027	0.00062
PVA outputs - Counterfactual values	CGR (25)	1.000 (0.999 - 1.001)	1.000 (0.999 - 1.001)	1.000 (0.999 - 1.001)	0.999 (0.998 - 1.000)
	CGR (35)	1.000 (0.999 - 1.001)	1.000 (0.999 - 1.001)	1.000 (0.999 - 1.001)	0.999 (0.998 - 1.000)
	CGR (50)	1.000 (0.999 - 1.001)	1.000 (0.999 - 1.000)	1.000 (0.999 - 1.001)	0.999 (0.998 - 1.000)
	CPS (25)	0.995 (0.965 - 1.024)	0.989 (0.961 - 1.019)	0.991 (0.963 - 1.021)	0.982 (0.954 - 1.011)
	CPS (35)	0.992 (0.956 - 1.029)	0.985 (0.951 - 1.023)	0.987 (0.953 - 1.024)	0.976 (0.940 - 1.010)
	CPS (50)	0.989 (0.945 - 1.035)	0.979 (0.937 - 1.026)	0.982 (0.936 - 1.029)	0.965 (0.923 - 1.010)
Cumulative Impacts					
PVA inputs - Proportional impacts	Productivity rate	0.00022	0.00000	0.00022	0.00000
	Adult survival rate	0.00292	0.00309	0.00564	0.00594
	Immature survival rate	0.00288	0.00309	0.00535	0.00570
PVA outputs - Counterfactual values	CGR (25)	0.996 (0.995 - 0.997)	0.996 (0.995 - 0.997)	0.993 (0.992 - 0.994)	0.993 (0.992 - 0.994)
	CGR (35)	0.996 (0.995 - 0.997)	0.996 (0.995 - 0.997)	0.993 (0.992 - 0.994)	0.993 (0.992 - 0.994)
	CGR (50)	0.996 (0.995 - 0.997)	0.996 (0.995 - 0.997)	0.993 (0.992 - 0.994)	0.993 (0.992 - 0.994)
	CPS (25)	0.905 (0.878 - 0.932)	0.910 (0.882 - 0.936)	0.836 (0.811 - 0.861)	0.836 (0.809 - 0.862)
	CPS (35)	0.871 (0.839 - 0.902)	0.877 (0.844 - 0.909)	0.780 (0.751 - 0.809)	0.780 (0.750 - 0.809)
	CPS (50)	0.825 (0.784 - 0.864)	0.830 (0.791 - 0.869)	0.707 (0.672 - 0.741)	0.703 (0.666 - 0.737)

Table 2.16 Puffin PVA Inputs and Outputs

Impacts to Regional Puffin Population		Lower Displacement Mortalities (1%/3%)		Upper Displacement Mortalities (3%/5%)	
		EIAR	Revised Values	EIAR	Revised Values
Regional population (breeding adults)		263293	263293	263293	263293
Year		2019	2019	2019	2019
Project-only Impacts					
No PVAs required					
Cumulative Impacts					
PVA inputs - Proportional impacts	Productivity rate	0.00006	0.00000	0.00006	0.00000
	Adult survival rate	0.00102	0.00101	0.00165	0.00168
	Immature survival rate	0.00137	0.00143	0.00229	0.00239
PVA outputs - Counterfactual values	CGR (25)	0.999 (0.998 - 0.999)	0.999 (0.998 - 0.999)	0.998 (0.997 - 0.998)	0.998 (0.997 - 0.998)
	CGR (35)	0.999 (0.998 - 0.999)	0.999 (0.998 - 0.999)	0.998 (0.997 - 0.998)	0.998 (0.997 - 0.998)
	CGR (50)	0.999 (0.998 - 0.999)	0.999 (0.998 - 0.999)	0.998 (0.997 - 0.998)	0.998 (0.997 - 0.998)
	CPS (25)	0.965 (0.952 - 0.978)	0.966 (0.952 - 0.978)	0.943 (0.930 - 0.956)	0.943 (0.930 - 0.956)
	CPS (35)	0.952 (0.936 - 0.968)	0.953 (0.936 - 0.968)	0.922 (0.906 - 0.938)	0.922 (0.906 - 0.937)
	CPS (50)	0.934 (0.913 - 0.954)	0.934 (0.914 - 0.953)	0.893 (0.873 - 0.912)	0.893 (0.873 - 0.911)

SUMMARY

2.4.18. Predicted impacts (as requested by NatureScot as part of the additional information assessment) from the project-alone resulted in smaller impacts than were predicted within the EIA report to the regional breeding population of kittiwakes (Table 2.9) and the threshold for undertaking a PVA was not reached. As such, there was no change to the EIA prediction of a **negligible impact** that was **not significant** (Table 2.17). Updating the cumulative assessment using the project only impacts from the Additional Information assessment requested by NatureScot did not result in a change in the EIA prediction of a **negligible impact** that was **not significant** (Table 2.18).

2.4.19. When the additional information was applied, predicted project-alone impacts to guillemot increased when compared to the EIAR predictions in the EIAR (Table 2.9). This resulted in an increase in the magnitude of the predicted effect on the regional breeding guillemot population from negligible to low. However, this did not result in a change in the significance of the predicted impacts which were **minor** and **not significant** (Table 2.17). Updating the cumulative assessment using the project only impacts from the Additional Information assessment requested by NatureScot did not result in a change in the EIA prediction of a **minor impact** that was **not significant** (Table 2.18).

2.4.20. The project-alone predicted impacts to razorbill increased when the additional information requested by NatureScot was applied when compared to the predictions in the EIAR (Table 2.9). Despite this increase in predicted impact there was no change in the magnitude of the predicted effect on the regional breeding razorbill population. As such, there was no change to the EIA prediction of a **negligible impact** that was **not significant** (Table 2.10). Updating the cumulative assessment using the project only impacts from the Additional Information assessment requested by NatureScot did not result in a change in the EIA prediction of a **negligible impact** that was **not significant** (Table 2.18).

2.4.21. The project-alone predicted impacts to puffin decreased slightly for the lower displacement mortality and increased slightly for the upper displacement mortality when the additional information requested by NatureScot was applied when compared to the predictions in the EIAR (Table 2.9). Despite these changes in predicted impact there was no change in the magnitude of the predicted effect on the regional breeding puffin population. As such, there was no change to the EIA prediction of a **negligible impact** that was **not significant** (Table 2.17). Updating the cumulative assessment using the project only impacts from the Additional Information assessment requested by NatureScot did not result in a change in the EIA prediction of a **negligible impact** that was **not significant** (Table 2.18).

Table 2.17 Project Only Impact Summary of PVA Results from the EIAR and Updated PVAs to Provide Additional Information. A Summary of the Changes to EIA Magnified and Significance is Also Provided. CPS = Counterfactual of Population Size. CGR = Counterfactual of Growth Rate.

Species	EIAR Results (Combined SeabORD and matrix)		Updated Results (Matrix only)		Summary of Changes to Conclusions
	Median Counterfactual Values at 35 years				
	Lower	Upper	Lower	Upper	
Kittiwake	CGR = 1.000 CPS = 0.987	CGR = 1.000 CPS = 0.987	NA	NA	EIAR - impacts were assessed to be of negligible magnitude and negligible significance Additional Information - distributional response impacts were assessed to be of negligible magnitude and negligible significance. **No change to overall project only impact assessment conclusion of not significant.**
Guillemot	CGR = 1.000 CPS = 0.983	CGR = 0.999 CPS = 0.952	CGR = 0.998 CPS = 0.935	CGR = 0.996 CPS = 0.876	EIAR - impacts were assessed to be of negligible magnitude and negligible significance Additional Information - impacts were assessed to be of low magnitude, which corresponds to an impact level of minor and negligible significance. **No change to overall project only impact assessment conclusion of not significant.**
Razorbill	CGR = 1.000 CPS = 0.992	CGR = 1.000 CPS = 0.987	CGR = 1.000 CPS = 0.985	CGR = 0.999 CPS = 0.976	EIAR - impacts were assessed to be of negligible magnitude and negligible significance Additional Information - distributional response impacts were assessed to be of negligible magnitude and negligible significance. **No change to overall project only impact assessment conclusion of not significant.**
Puffin	NA	NA	NA	NA	EIAR - impacts were assessed to be of negligible magnitude and negligible significance Additional Information - distributional response impacts were assessed to be of negligible magnitude and negligible significance. **No change to overall project only impact assessment conclusion of not significant.**

Table 2.18 Cumulative Impact Summary of PVA Output Changes Resulting from Changes to Distributional Response Impact Quantification Approaches and Consequences to Assessment Conclusions

Species	EIAR Results (Combined SeabORD and matrix)		Updated Results (Matrix only)		Summary of Changes to Conclusions
	Median Counterfactual Values at 35 years				
	Lower	Upper	Lower	Upper	
Kittiwake	CGR = 0.995 CPS = 0.847	CGR = 0.994 CPS = 0.796	CGR = 0.996 CPS = 0.857	CGR = 0.994 CPS = 0.796	EIAR - impacts were assessed to be of negligible magnitude and negligible significance Additional Information - distributional response impacts were assessed to be of negligible magnitude and negligible significance. **No change to overall project only impact assessment conclusion of not significant.**
Guillemot	CGR = 0.998 CPS = 0.945	CGR = 0.996 CPS = 0.879	CGR = 0.997 CPS = 0.902	CGR = 0.994 CPS = 0.808	EIAR - impacts were assessed to be of negligible magnitude and negligible significance Additional Information - impacts were assessed to be of low magnitude, which corresponds to an impact level of minor and negligible significance. **No change to overall project only impact assessment conclusion of not significant.**
Razorbill	CGR = 0.996 CPS = 0.871	CGR = 0.993 CPS = 0.780	CGR = 0.996 CPS = 0.877	CGR = 0.993 CPS = 0.780	EIAR - impacts were assessed to be of negligible magnitude and negligible significance Additional Information - distributional response impacts were assessed to be of negligible magnitude and negligible significance. **No change to overall project only impact assessment conclusion of not significant.**
Puffin	CGR = 0.999 CPS = 0.952	CGR = 0.998 CPS = 0.922	CGR = 0.999 CPS = 0.953	CGR = 0.998 CPS = 0.922	EIAR - impacts were assessed to be of negligible magnitude and negligible significance Additional Information - distributional response impacts were assessed to be of negligible magnitude and negligible significance. **No change to overall project only impact assessment conclusion of not significant.**

2.5. UPDATED COLLISION RISK MODELLING INFORMATION

2.5.1. NatureScot identified discrepancies between the monthly, seasonal and annual collision mortality totals for kittiwake and requested that, unless the Applicant is able to justify the identified discrepancy, apportioning and PVA be repeated using corrected seasonal and annual collision mortality totals. It is noted that there is no error in this instance, and that seasonal and annual impacts were not summed by adding the means but calculated from the monthly iterations being complied and an overall mean calculated (the approach taken in the updated sCRM by Caneco *et al*; 2022).

2.5.2. It was acknowledged that updated CRM parameters were made available after these models were run in order to inform the EIA and that the Applicant undertook a qualitative assessment of the implications of not using these updated parameters. NatureScot notes a lack of evidence and conclusions and stated their difficulty in supporting this approach in the absence of a direct comparison between the outputs generated by both parameter outputs.

UPDATED METHOD FOR SUMMING SEASONAL AND ANNUAL PREDICTED COLLISIONS

2.5.3. NatureScot noted that seasonal and annual collision estimates did not match the sum of the reported monthly estimated for the relevant time period. This is due to how collision estimates were aggregated across different temporal periods. Models resulted in a distribution of estimates for each month, from which summary statistics of a median and 95% confidence intervals were derived for each month. To calculate seasonal and annual estimates, the medians of the component months were not summed as appears to have been done in NatureScot's example. Instead, for each collision risk model iteration, the sum of component months (e.g., all months in the season, or all months in the year) estimate was summed, creating a seasonal or annual distribution. These distributions were then used to generate summary statistics (medians and 95% confidence intervals) for that temporal period. This approach allows appropriate propagation of uncertainty when deriving summary statistics for each temporal period reported on. When comparisons are made between the sum of monthly medians and seasonal or annual distribution medians, the magnitude of difference will be dependent upon the shape of the monthly distributions that are being aggregated.

EXAMPLE SPECIES USING UPDATED AVOIDANCE RATE

2.5.4. Due to the timing of the impact assessment and submission of the EIAR, it was not possible to base the collision risk modelling of the Project on newly released guidance from NatureScot on appropriate avoidance rates. A qualitative assessment on the predicted effects of this change in avoidance rate was made in the EIAR.

2.5.5. NatureScot noted, "We acknowledge efforts made to qualitatively assess these differences but note a lack of evidence and conclusions of this assessment in the application. The Applicant states that the qualitative assessment resulted in a conclusion of no difference in impact magnitude for any species assessed in the collision risk model, with all impacts remaining at negligible magnitude. However, it is difficult to support this conclusion without a comparison of model outputs from both parameter sets, and **we would have appreciated at least one species example of this**."

2.5.6. Kittiwake was selected as a suitable example as the recommended avoidance rate decreased from 0.993 to 0.9929 (i.e. a small increase in predicted collisions). This calculation was made using the mean zero avoidance collisions predicted by the sCRM. This value was then either multiplied by the avoidance rate used in the EIAR (0.993) or the update avoidance rate

guidance from NatureScot (0.9929). These results are shown in Table 2.19 and resulted in a 1.4% increase in the predicted collisions. Such a small change in predicted collisions from the Project alone would not change the conclusions of the EIA.

Table 2.19 Change in Predicted Annual Collisions to Kittiwake Using Update Avoidance Rate Guidance from NatureScot

Turbine Scenario	Zero Avoidance Annual Collision Estimate	Avoidance Rate	Annual Impact (EIA)	Updated Avoidance Rate	Updated Predicted Annual Collision Estimate
Scenario 1	9,914.00	0.993	69.40	0.9929	70.39
Scenario 2	8,895.57	0.993	62.27	0.9929	63.16
Scenario 3	8,798.57	0.993	61.59	0.9929	62.47

2.6. UPDATED MAGNITUDE AND SENSITIVITY CLASSIFICATION

2.6.1. NatureScot identified an error with how magnitude has been accounted for within the assessment, stating that the Applicant has presented the percentage point decrease in survival rate and detailing the implications of this.

2.6.2. It was noted by NatureScot that the Applicant does not state the magnitude assigned to the impacts of the high displacement scenario or the combined displacement and collision impacts for relevant species.

2.6.3. NatureScot advocated for the use of Wade *et al*. (2016) in determining vulnerability scores for marine renewable energy developments, incorporating conservation value scoring specific to Scottish seabird populations.

MAGNITUDE

2.6.4. The method for determining of impact magnitude was reviewed and it was confirmed that the approach was correctly applied. This section provides further explanation as to the assessment of impact magnitude within the EIA.

2.6.5. It is important to note that in the EIAR (Section 11.13 Criteria For Assessment) the descriptions for assigning a magnitude value to a level of impact considers more factors than only the percentage point change in adult survival rate. It is described in Table 11-17 of the EIAR Chapter that where a change in adult mortality was included in the assessment of magnitude it was against the percentage point change in adult mortality rate and not the percentage change in adult mortality. The other factors that were considered in the magnitude value were the predicted changes in baseline conditions to the biogeographic population size and the nature of the impact (e.g. extent, short or long term, recovery, impact frequency and intensity).

2.6.6. NatureScot stated that “The Applicant has presented the percentage point decrease in survival rate, which is a substantially lower number than the corresponding increase in baseline mortality.” and that “Change in survival may be used as criteria to inform impact magnitude (with appropriate thresholds), but this was not stated by the Applicant in Table 11-17”. However, we note that, the percentage point change in adult survival rate is identical to the percentage point change in adult mortality rate. Whether the impact is stated as a change

in survival rate or a change in mortality rate, the change in either rate is the same as the change in the other.

2.6.7. NatureScot have stated that, “Our magnitude conclusions are largely based on the thresholds of percentage increase in baseline mortality as defined by the Applicant in Table 11-17”. However, it is stated in Table 11-17 that the metric used (amongst other metrics) for each magnitude value is the change in percentage points, not a percentage change. In the example given, of great black-backed gull, NatureScot is incorrect in stating that the percentage change in mortality (of 0.27%) was used in the assessment. The assessment used the percentage point change in mortality (which is identical to the percentage point change in survival). Thus, a percentage point change in mortality/survival of 0.019% is negligible when assessed against the criteria in Table 11-17, which is stated as “less than a baseline mortality increase of 0.1 percentage points”.

2.6.8. We note that not all species were assessed by using PVA metrics, as stated by NatureScot, as not all species needed to be assessed using a PVA and so those species with impacts below the NatureScot recommended threshold for a PVA were assessed using the criteria in Section 11.13. This was discussed with NatureScot during the meeting on the 13 August 2025, whereupon it was agreed that the EIAR approach still stands.

2.6.9. Thus, the approach taken in the EIAR to assessing the magnitude of the predicted impacts to birds is similar to the approach recommended by NatureScot in their consultation response. As such, no changes to these classifications were taken or made.

SENSITIVITY

2.6.10. NatureScot noted that sensitivity classification was “derived from multiple sources for disturbance, including Bradbury *et al.* (2014) and NatureScot (2023) for displacement, and Bradbury *et al.* (2014) and Furness *et al.* (2013) for collision”. Specifically, NatureScot noted that, “Bradbury *et al.* (2014) is based on birds in English waters only. In the classification of sensitivity to impacts from Offshore Wind Farms (OWFs), Bradbury *et al.* (2014) incorporates scores of conservation value and percent of biogeographic population in England during any particular season. As population number and trends of seabirds and inshore waterbirds differ across the UK, it is likely that the conservation value of a species in England will differ to that in Scotland”. Consequently, NatureScot noted that, **“**we advise the exclusive use of Wade et al. (2016) to derive scores of vulnerability to marine renewable energy developments**”.**

2.6.11. The scores from the supplementary tables in Wade *et al.* (2016) were collated for collision risk (Supplementary Table 6) and Displacement/Disturbance (Supplementary Table 7). However, these scores need to be classified in order to apply them to the EIAR assessment matrix. NatureScot provided advice on the classification of the scores in each table from Wade *et al.* (2016) (Table 2.20).

Table 2.20 Classification of Vulnerability of Seabird to Collisions and Displacement.

Classification	Vulnerability Score - Collision	Vulnerability Score - Displacement
High	501+	30+
Medium	101-500	19-29
Low	16-100	8-18
Negligible	0-15	0-7

2.6.12. These classifications were applied to the scores from Wade et al (2016) and compared with the classifications used in the Project EIAR for collisions (Table 22) and displacement/disturbance (Table 23).

Table 2.21 Vulnerability Scores for Collisions Risk from Wade et al. (2016) and Classifications of Vulnerability based on NatureScot Advice and those used in the EIAR (shaded cells indicate where a difference occurred between the advice from NatureScot and the classification used in the EIAR)

Species	Vulnerability Score	NatureScot Classification	Muir Mhòr EIAR Classification
White-tailed eagle	864	High	Not applicable
Lesser black-backed gull	608	High	Very high
Herring gull	579	High	Very high
Great black-backed gull	578	High	Very high
Common gull	390	Medium	High
Sandwich tern	263	Medium	Medium
Great cormorant	231	Medium	Not applicable
Black-legged kittiwake	229	Medium	High
Great skua	224	Medium	Medium
Arctic skua	163	Medium	Not applicable
Northern gannet	159	Medium	High
Black-headed gull	144	Medium	Not applicable
Roseate tern	105	Medium	Not applicable
Arctic tern	79	Low	Medium
Great northern diver	67	Low	Not applicable
Black-throated diver	67	Low	Not applicable
Common tern	65	Low	Medium
Little tern	61	Low	Not applicable
European shag	60	Low	Not applicable
Red-throated diver	60	Low	Not applicable
Slavonian grebe	46	Low	Not applicable
European storm-petrel	45	Low	Not applicable
Leach's storm-petrel	43	Low	Not applicable
Common eider	39	Low	Not applicable
Common scoter	38	Low	Not applicable
Velvet scoter	35	Low	Not applicable
Common goldeneye	24	Low	Not applicable

Species	Vulnerability Score	NatureScot Classification	Muir Mhòr EIAR Classification
Long-tailed duck	16	Low	Not applicable
Common guillemot	0	Negligible	Not applicable
Razorbill	0	Negligible	Not applicable
Greater scaup	0	Negligible	Not applicable
Black guillemot	0	Negligible	Not applicable
Atlantic puffin	0	Negligible	Not applicable
Great-crested grebe	0	Negligible	Not applicable
Little auk	0	Negligible	Not applicable
Manx shearwater	0	Negligible	Not applicable
Northern fulmar	0	Negligible	Not applicable
Sooty shearwater	0	Negligible	Not applicable

Table 2.22 Vulnerability Scores for Displacement/Disturbance from Wade et al. (2016) and Classifications of Vulnerability based on NatureScot Advice and those used in the EIAR (shaded cells indicate where a difference occurred between the advice from NatureScot and the classification used in the EIAR).

Species	Vulnerability Score	NatureScot Classification	Muir Mhòr EIAR Classification
Black-throated diver	40	High	Not applicable
Red-throated diver	40	High	High
Great northern diver	34	High	Not applicable
Common scoter	30	High	Not applicable
Common goldeneye	24	Medium	Not applicable
Common guillemot	24	Medium	Medium
Razorbill	24	Medium	Medium
Greater scaup	22	Medium	Not applicable
Velvet scoter	21	Medium	Not applicable
Common eider	20	Medium	Not applicable
Black guillemot	20	Medium	Not applicable
Slavonian grebe	20	Medium	Not applicable
Atlantic puffin	19	Medium	Medium
Long-tailed duck	15	Low	Not applicable
Arctic tern	14	Low	Medium
Little tern	13	Low	Not applicable
Roseate tern	12	Low	Not applicable

Species	Vulnerability Score	NatureScot Classification	Muir Mhòr EIAR Classification
Sandwich tern	12	Low	Medium
Common tern	11	Low	Not applicable
European shag	11	Low	Medium
Great-crested grebe	11	Low	Not applicable
Northern gannet	9	Low	Medium
Black-legged kittiwake	8	Low	Medium
Little auk	8	Low	Not applicable
Common gull	8	Low	Not applicable
Great cormorant	8	Low	Not applicable
Great black-backed gull	8	Low	Not applicable
Black-headed gull	7	Very low	Not applicable
White-tailed eagle	5	Very low	Not applicable
Great skua	5	Very low	Not applicable
Herring gull	5	Very low	Not applicable
Lesser black-backed gull	5	Very low	Not applicable
Arctic skua	4	Very low	Not applicable
Manx shearwater	3	Very low	Not applicable
European storm-petrel	3	Very low	Not applicable
Leach's storm-petrel	3	Very low	Not applicable
Northern fulmar	3	Very low	Not applicable
Sooty shearwater	2	Very low	Not applicable

SUMMARY

2.6.13. Comparing the classification advised by NatureScot with the classification used in the EIAR shows that where there was a difference, in all cases the classification used by the Project was more precautionary than the classification advised by NatureScot. Thus, given than that all the conclusions of the EIA were negligible and not significant there were no changes in the magnitude of the predicted impacts or a more precautionary sensitivity used, then updating these factors would not change the conclusions of the EIA for the Project.

2.7. UPDATED CUMULATIVE EFFECTS ASSESSMENT FOR ADDITIONAL SPECIES

2.7.1. In response to the EIA for the Project, NatureScot commented specifically on the need for PVA for some species that, "*PVA – some species have been excluded from cumulative assessment on the basis that proposal-alone effects are below the relevant threshold. This is*

incorrect. We request that cumulative impact values are presented to determine whether a cumulative PVA is required for Arctic tern, great black-backed gull, fulmar, Manx shearwater, and red-throated diver" and "*For Arctic tern, great black-backed gull, fulmar, Manx shearwater, and red-throated diver, we are content with the proposal alone conclusions, whereby impacts are not significant in EIA terms. However, we are unable to provide advice regarding cumulative impacts for these species based on the current information in the application, as above*."

2.7.2. For each species mentioned by NatureScot the approach to be taken to provide Additional Information is summarised below.

ARCTIC TERN

2.7.3. The NatureScot criterion to determine whether CEA is required is whether the total predicted annual mortalities to the regional population exceed 0.2 individuals. The estimated total mortality to the relevant migratory Arctic tern Biologically Defined Minimum Population Size (BDMPS) population slightly exceeds this threshold (0.23 individuals per annum). However, the Applicant considers that, in this circumstance, CEA is unnecessary in order to determine that cumulative effects would not be significant.

2.7.4. A combined total of 18 Arctic tern and unidentified common/Arctic tern were observed within the Array Area during baseline surveys. All of these records were considered to relate to individuals undertaking the autumn migratory passage through the North Sea region. The appropriate regional population against which to assess collision impacts is therefore the 'UK North Sea and Channel' BDMPS adult population (Furness, 2015) which is 115,968 individuals. The project only collision mortality of 0.23 individuals per annum results in a predicted impact of 0.14 adults per annum, using the BDMPS proportion of adults (63%; Furness 2015) would result in a 0.00012% point decrease in the survival rate of the BDMPS regional population. This is 160 times less than the 0.02% point threshold specified by NatureScot to determine whether PVA is necessary.

2.7.5. Furthermore, CEA would not be meaningfully feasible in relation to the migratory population affected. The availability of other project impact estimates to the Arctic tern 'UK North Sea and Channel' BDMPS population is extremely limited. Berwick Bank reported a predicted "scoping" approach impact of 14 birds per annum but did not undertake a cumulative impact assessment on this species. However, both the CRM used here, and Berwick Bank, is based on the Band (2012) model, where aerial densities and daylight hours per month are used in the estimate of the flux of birds through the proposed wind farm. However, not all projects have taken this approach. The approach taken, for example, by Rampion 2 was to use a migratory CRM, where birds pass through the wind farm once per season[1]. Thus, impacts are predicted to be much smaller when using a migratory CRM than Band (2012) when the same aerial density is applied. With different methods being applied by different projects the few predicted impacts available could not be added to provide a meaningful estimate of predicted collisions.

2.7.6. Arctic terns occurring at the Project cannot be actively breeding birds, and therefore the occurrence of birds is likely to be migratory birds. While the overall impact to all age classes is only very slightly above the 0.2 threshold NatureScot advises as being non-tangible, the predicted impact on adults is smaller than this. Thus, it was agreed with NatureScot that a PVA was not needed for the project alone, nor informative for cumulative impacts with other projects (meeting on 17/07/2025).

[1] Rampion 2 ES Appendix 12.4 Offshore ornithology migratory bird collision report

GREAT BLACK-BACKED GULL

2.7.7. The predicted impact from the Project on the regional great black-backed gull population was zero birds in the breeding season and a maximum of 17.4 birds in the non-breeding season. Since this predicted impact on the non-breeding BDMPS North Sea population (Furness 2015) exceeded 0.02% point change in adult survival a PVA was required, and CEA was also needed. NatureScot requested further information on the cumulative effects of other OWF projects on great black-backed gull populations. The approach taken was to follow that used in the application for consent by the Caledonia Offshore Wind Farm. That application provided predicted impacts from 37 additional OWF (Table 2.23).

Table 2.23 Predicted Breeding Season and Non-breeding Season Impacts on Great Black-backed Gulls from the Project Alone and Cumulatively

Development	Breeding	Non-breeding	Total
Beatrice	36.2	145	181.2
Blyth Demonstration Site	0	6.1	6.1
Dogger Bank A & B	0	28	28
Dogger Bank C & Sofia	0	30.6	30.6
Dogger Bank South	0	3.92	3.92
East Anglia One	0	55.2	55.2
East Anglia ONE North	0	1.4	1.4
East Anglia Three	0	41.3	41.3
East Anglia TWO	0	4.1	4.1
European Offshore Wind Development Centre (EOWDC)	0	2.9	2.9
Five Estuaries	0	1.16	1.16
Galloper	0	21.6	21.6
Greater Gabbard	0	200	200
Green Volt	0	4.3	4.3
Hornsea Four	0	10.6	10.6
Hornsea Project One	0	82.3	82.3
Hornsea Project Two	0	24	24
Hornsea Three	0	33.6	33.6
Humber Gateway	0	6.1	6.1
Hywind 2 Demonstration	0	5.4	5.4
Inch Cape	0	44.2	44.2
Kentish Flats Extension	0	0.2	0.2
Methil	0.8	0.8	1.6
Moray Firth EDA	11.4	30.6	42

Development	Breeding	Non-breeding	Total
Moray West	4.8	6	10.8
Neart na Gaoithe	0	4.3	4.3
Norfolk Boreas	0	34.4	34.4
Norfolk Vanguard	0	25.8	25.8
Rampion	0	25	25
Rampion 2	0	13.59	13.59
Salamander	0	0.1	0.1
Seagreen Alpha and Bravo	0	64.1	64.1
SEP & DEP	0	0.3	0.3
Teesside	0	41.8	41.8
Thanet	0	0.5	0.5
Triton Knoll	0	117.1	117.1
Caledonia North	0	9.66	9.66
Caledonia South	0	7.72	7.72
West of Orkney (SEI)	0.81	11.13	11.94
Muir Mhòr	**0**	**17.4**	**17.4**
All Projects (without Muir Mhòr)	**54.01**	**1,144.88**	**1,198.89**
All Projects (plus Muir Mhòr)	**54.01**	**1,162.28**	**1,216.29**

2.7.8. In order to compare the impact from the Project on the annual adult survival rate of the regional population (BDMPS UK North Sea (Sept to March) Adult birds = 32,070 individuals), the proportion of adults predicted to be in the non-breeding BDMPS was calculated based on the proportion of adults to immature birds in the BDMPS (Furness 2015) (0.35). Thus, the predicted adult impact from the Project alone was 6.1 adult birds per annum, all in the non-breeding season (Table 2.24). Since these impacts were all in the non-breeding season no adjustment was made due to a sabbatical rate. This predicted impact results in a predicted change in the adult survival rate of 0.00019 (or a 0.019% point change).

Table 2.24 Calculation of Impact on Adult Survival Rate on the Great Black-backed Gull Regional Non-breeding Population from the Project Alone

Demographic Parameter	Value	Units
BDMPS UK North Sea (Sept to March) Adult birds	32,070	Individuals
Proportion adults (BDMPS adult to immature population ratio)	0.35	n/a
Adult survival rate	0.93	n/a
Baseline mortality rate	0.07	n/a
Sabbatical rate	0.00	n/a
Predicted impact from Muir Mhòr only to adults	6.1	Individuals
Annual adult baseline mortality	2244.9	Individuals
Annual adult baseline + impact mortality (Muir Mhòr only)	2251.0	Individuals
Impacted adult mortality rate (Muir Mhòr only)	0.0702	n/a
Change in adult survival/mortality rate (Muir Mhòr only)	**0.00019**	**n/a**

2.7.9. The predicted impact from the Project alone was added to the predicted cumulative impacts from all other projects of 406.8 adult birds per annum in the non-breeding season. Thus, the predicted change in the adult survival rate was 0.0127 (or a 1.268% point change) to the non-breeding BDMPS for great black-backed gull from the Project cumulatively with the other projects shown in Table 2.23. These predicted impacts were sufficient that a PVA was recommended due to the cumulative impacts exceeded the NatureScot advised threshold of a 0.02% point change in adult survival.

2.7.10. NatureScot advised (email of 08/08/2025) that a PVA should be based on the non-breeding season BDMPS population (32,070 individual adults, 91,399 total birds). The methods used to run the PVA were identical to those shown in Volume 3, Appendix 11.5: Population Viability Analysis Report of the EIAR. Due to the impacts from the project alone resulting in a change in adult survival of less than 0.02% point, no PVA was run for project alone impacts. Since the cumulative impacts exceeded a change in adult survival of 0.02% point a PVA was run for cumulative impact only.

2.7.11. The demographic information used to populate the PVA for great black-backed gull are summarised in Table 2.25. Due to the absence of suitable demographic information, the standard deviation for adult survival and the mean and standard deviation of age specific immature survival were based on values for herring gull (from Horswill and Robinson, 2015). Herring gull was chosen as a suitable proxy as it was considered the species with the most similar life history to great black-backed gull with suitable demographic values available. Lesser black-backed gull was excluded as a suitable proxy species as it is a long-distance migrant and has a more southerly distribution in Scotland than great black-backed gull. These differences could result in important demographic differences between lesser black-backed gull and great black-backed gull.

Table 2.25 Adult and Immature Mean Survival Rates, age at First Breeding and Maximum Brood Size used in the PVA Modelling. Numbers in Brackets Represent the Standard Deviations used. All Values are Taken from Horswill and Robinson, 2015, in line with NatureScot Guidance (NatureScot, 2023a)

Species	Adult Survival Rate	Productivity Rate	Immature Survival Rate**					Age at First Breeding	Maximum Brood Size
			0 to 1	1 to 2	2 to 3	3 to 4	4 to 5		
Great black-backed gull	0.93 (0.034)*	1.139 (0.533)	0.798 (0.092)	0.834 (0.034)	0.834 (0.034)	0.834 (0.034)	0.834 (0.034)	5	3

** SD from herring gull*

*** from herring gull*

2.7.12. PVA projected population change for both the baseline and impact scenarios is shown in Table 2.26. Population increases projected across all three timescales (25, 35 and 50 years) were apparently unrealistically large when compared with recent population trends in Scotland[2]. Growth rates were also large (Table 2.27) across all three projected timescales (25, 35 and 50 years). Input demographic parameters were not of high quality for this species (Horswill and Robinson, 2015) and using another species demographic rates as a proxy is likely to result in a high level of uncertainty in the outputs.

2.7.13. Counterfactuals of population size (Table 2.26) were small for all three projected timescales (25, 35 and 50 years). This was likely to be strongly affected by the combination of unrealistic exponential growth projected by the PVA and the absence of density dependence assumed by the model. In reality, any population with such strong growth would be limited by density dependence and it would therefore be likely that that the difference in population size between the baseline and impact scenarios would be zero, as both populations increase to the carrying capacity of their environment. However, given the concerns with demographic input values described above it is unlikely that the projected population changes for either scenario reflect future population change for this species.

2.7.14. Counterfactuals of population growth rate (Table 2.27) were relatively small, and these values will also be affected by the demographic values and assumption of density independence discussed above. As with population size projections, the growth rates of real populations of great black-backed gull would not continue to increase indefinitely, and so growth rate would reduce to zero as the population reached the limits of the carrying capacity of the environment and the population stopped growing (or declining).

2.7.15. Given the issues with providing reasonably accurate and precise demographic parameters for great black-backed gull the PVA used here is unlikely to be useful in determining future population change either with, or without, cumulative impacts. However, the contribution of the project alone to the overall cumulative impacts was very small and was unlikely to represent a measurable difference from the baseline condition.

2.7.16. The magnitude of the predicted impacts from the project alone were **negligible**, while the sensitivity of the species was **high** (NatureScot sensitivity) or **very high** (EIAR sensitivity) (Table 2.21). This results in a conclusion of **negligible** impact that is **not significant** from the project alone.

2.7.17. Based on the predicted change in adult survival the magnitude of the cumulative impacts were **medium**, with the same sensitivity as above. This results in a conclusion of **moderate** impact that is **significant**. However, as the impact from the project alone is so small any further mitigation would not be able to reduce the cumulative impact below a level that would be

[2] https://www.nature.scot/doc/scottish-biodiversity-indicator-numbers-and-breeding-success-seabirds-1986-2023

assessed as not significant. Indeed, even without the project, the cumulative impact would still be **moderate** and **significant**.

2.7.18. It is likely most of the predicted impacts shown in Table 2.23 used the Band (2012) CRM for estimating impacts. Given the movement of relatively large numbers of great black-backed gulls across the North Sea in autumn to winter in the British Isles, it is likely that the Band (2012) CRM is overestimating collisions. The Band (2012) CRM (also the basis to the more recent sCRM approaches) uses aerial densities of birds within a calendar month and flux through turbines uses the available daylight hours in that month (and a proportion of nighttime hours). Thus, the flux is much larger than would be the case for birds on passage through an offshore wind farm in the North Sea. A different approach would have been the use of a migratory CRM which would assume one passage per bird per season as birds pass through a wind farm on migration, which would result in much smaller predicted collision rate. However, this would not follow existing NatureScot guidance. This would apply to this project and many of the other projects in the cumulative assessment. Based on this, it is expected that the magnitude of impacts from both the project alone and cumulatively is likely to be **negligible** or **minor** and therefore **not significant**.

Table 2.26 Median Simulated Population Sizes (breeding pairs) and Counterfactual Population Sizes for Great Black-backed gull. Values are Median Values with 95% Confidence Intervals in Brackets

Population	Scenario	2031 (reference year)	2057 (25 years operation)		2067 (35 years - intended lease period)		2082 (50 years - intended lease period)	
		Population Size	Population Size	Counterfactual Population Size	Population Size	Counterfactual Population Size	Population Size	Counterfactual Population Size
Regional	Baseline	342,672 (218,088 – 513,875)	2,939,622 (1,471,935 – 5,532,334)		6,686,405 (3,200,480 – 13,439,873)		22,981,928 (10,199,096 – 50,441,542)	
	Collision impact	342,717 (218,529 – 513,820)	1,979,310 (987,763 – 3,712,898)	0.673 (0.664 - 0.682)	3,864,987 (1,846,962 – 7,716,762)	0.577 (0.569 - 0.586)	10,735,626 (4,759,405 – 23,561,978)	0.466 (0.46 - 0.474)

Source: NEPVA outputs – the NEPVA tool generates each iteration for each scenario run independently so that there are small differences in the reference year population sizes due to the stochasticity inherent within the model.

Table 2.27 Simulated Growth Rates and Counterfactual Growth Rates for Great Black-backed gull. Values are Median Values with 95% Confidence Intervals in Brackets

Population	Scenario	2057 (25 years operation)		2067 (35 years - intended lease period)		2082 (50 years - intended lease period)	
		Population Growth Rate	Counterfactual Population Growth Rate	Population Growth Rate	Counterfactual Population Growth Rate	Population Growth Rate	Counterfactual Population Growth Rate
Regional	Baseline	1.086 (1.063 - 1.109)		1.086 (1.068 - 1.105)		1.086 (1.07 - 1.102)	
	Collision impact	1.069 (1.047 - 1.092)	0.985 (0.985 - 0.985)	1.069 (1.051 - 1.089)	0.985 (0.985 - 0.985)	1.07 (1.055 - 1.085)	0.985 (0.985 - 0.985)

Source: NEPVA outputs – the NEPVA tool generates each iteration for each scenario run independently so that there are small differences in the reference year population sizes due to the stochasticity inherent within the model.

FULMAR AND MANX SHEARWATER

2.7.19. Project only collision and direct distributional response impacts to fulmar and Manx shearwater were screened out on the basis of receptor insensitivity to those impacts (Tables 11-22 and 11-23 of the EIAR). Given the insensitivity of these species, project-only levels of quantifiable impact are considered negligible and well below the relevant threshold for inclusion in CEA and therefore do not need a PVA. This was discussed with NatureScot during consultation meetings on 18/06/2025 and 17/07/2025.

2.7.20. A qualitative assessment of the effects of lighting on Manx shearwater was undertaken (Volume 2, Chapter 11: Offshore and Intertidal Ornithology of the EIAR). This found a negligible magnitude and a medium sensitivity, resulting in a negligible significance of this impact to Manx shearwater.

RED-THROATED DIVER

2.7.21. Other than the surveys at the cable landfall, only one red-throated diver was recorded from inside the Array Area plus 4 km buffer in 24 months of surveys in June 2021. In addition, two red-throated divers were recorded outside the 4 km buffer in surveys of the larger Option Area: one in May 2022 and one in July 2022.

2.7.22. Based on very small counts and pelagic habitat red-throated diver were screened out of the assessment. The habitat in the array area is much more pelagic than the habitats used by breeding or non-breeding red-throated divers. It is therefore highly likely that the birds recorded from the surveys of the Array Area and Option Area were migrating rather than making use of the site. Consequently, no CEA was needed. This was discussed with NatureScot during consultation meetings on 18/06/2025 and 17/07/2025.

SUMMARY

2.7.23. Due to the combination of numbers of birds recorded in the Array Area and 2 km buffer and the sensitivity of species no further assessment was needed for Arctic tern, fulmar, Manx shearwater or red-throated diver. This was discussed and agreed with NatureScot during consultation meetings on 18/06/2025 and 17/07/2025.

2.7.24. However, there was sufficient evidence that additional information was needed to assess the cumulative impacts from the Project cumulatively with other projects. While the impacts from the Project alone were very small and **negligible** and **not significant** the cumulative impacts from other offshore wind farm projects were larger.

2.7.25. Predicted impacts on great black-backed gull from the project alone were **negligible** and therefore **not significant**. However, the magnitude of the cumulative impacts were **medium**, resulting in a conclusion of **moderate** impact that was **significant**. However, mitigation would not be able to reduce the cumulative impact below a level that would be assessed as not significant.

2.8. UPDATED INFORMATION ON APPORTIONING IMPACTS

2.8.1. Within their consultation response NatureScot provided several requests for Additional Information on the apportioning of impacts to SPAs. It was noted that, "The Applicant has generally followed the approach advised by NatureScot". However, there were three areas requiring additional information:

- The addition of the "proportion of foraging area at sea" to apportioning tables;
- The distance between the St Abb's Head to Fast Castle SPA and the site; and
- Errors in the provided spreadsheet for kittiwakes in the breeding season.

2.8.2. The proportion of foraging area that is sea has been added to the apportioning tables and these have been provided in Appendix I of the AIR and NatureScot has been provided with an updated spreadsheet with the apportioning calculations.

2.8.3. The distance from the St Abb's Head to Fast Castle SPA was checked and is correct. The same methodology was used as all other SPAs and species using the centroid-to-centroid method. This was discussed with NatureScot (consultation meeting on 13 August 2025) and it was agreed that there was no error in this distance.

2.8.4. NatureScot noted "some errors in the column 'Breeding season displacement mortality of breeding adults - lower displacement (j)'" for kittiwake. However, it was noted by NatureScot that, "these errors are minor, with a decrease in the percentage point change in survival rate ranging from 0.00000 to 0.00008 as a result of correcting the lower displacement mortality of breeding adults in the breeding season". These errors were checked and found to be only rounding errors and had no effect on the conclusions drawn. An updated spreadsheet is provided with this AIR. From discussions on 17/07/2025 and NatureScot were satisfied that no further actions were required.

2.9. OVERALL SUMMARY

2.9.1. The additional information provided in this report relate to:

- Updates to regional population sizes;
- Updates to the assessment of distributional responses;
- Updates to the assessment of CRM;
- Updates to the assessment of impact magnitude and species sensitivity;
- Updates to the CEA for additional species; and
- Updates to information regarding the apportioning of impacts;

2.9.2. Regional population sizes for gannet, puffin and kittiwake were recommended by NatureScot and included a request for further information on why particular colony counts were used in the EIAR and others were not. Overall, the colony counts that NatureScot comments on were likely due to updates to available counts in the SMP database.

2.9.3. The approach to addressing the differences in colony counts for gannet due to HPAI were discussed with NatureScot and a comparison has been made between the predicted impacts from each year of survey data, as these occurred before and during the HPAI epidemic. This comparison shows a relatively large difference in predicted change in adult survival rates between the two years. However, it also shows that the absolute difference in the adult

survival rates between these scenarios is small and so the conclusions of the EIAR are not affected.

2.9.4. Puffin colony counts from the North Caithness Cliffs SPA had been based on reported count information in Burnell *et al*. (2023). However, through consultation with NatureScot colony counts for this location were agreed and used in the additional information assessment.

2.9.5. Kittiwake colony counts also differed between the EIAR and the request for additional information from NatureScot. While some of these differences were due to updates to the SMP database, the colony count for the Fowlsheugh SPA used in the EIAR was incorrect.

2.9.6. While NatureScot agreed that SeabORD was the most biologically accurate approach to assessing the impacts of distributional response, additional information was requested on either updating this modelling by using a recently updated code for SeabORD or by using displacement matrices. The updated SeabORD code was not available at the time of writing and it was agreed with NatureScot that the displacement matrix approach would be used. Changing the breeding season assessment to the displacement matrix resulted in increases in the predicted impacts to guillemot and razorbill, puffin impacts only changing slightly and, a decrease in the predicted impacts on kittiwakes. These changes resulted in updated PVAs being completed. The overall conclusions of the EIAR were not changed as a result of these updates. The Applicant notes that the approach taken in the EIAR remains the most biologically accurate approach and disagree with NatureScot that positive impacts from SeabORD relate to a problem with the SeabORD model. Due to the relative location of the Array Area and the seabird colonies modelled, positive effects are predicted by the model, and this is highlighted by the model developers as a possible outcome in these circumstances. The use of displacement matrices for this situation is more likely to overestimate the predicted impacts to breeding colonies due to the assumptions of connectivity between seabird colonies and the Array Area made using this approach that is not made using the SeabORD model.

2.9.7. NatureScot noted discrepancies between the monthly, seasonal and annual collision mortality totals for kittiwake. However, these values were not summed in the EIAR but calculated from the combined distributions from the sCRM for each relevant timescale. An updated methodology for calculating these values is provided in this report. As such, no changes were made to the calculation of monthly, seasonal or annual kittiwake collision mortalities.

2.9.8. The EIAR was submitted on a timeline that did not allow new guidance from NatureScot on CRM avoidance rates to be used. There was a request from NatureScot that an example of the effects of changes to the avoidance rates be provided. An example for kittiwake is provided, and it was noted that these changes would not change the conclusions of the EIAR.

2.9.9. NatureScot commented that they disagreed with the magnitude and sensitivity approach taken in the EIAR and requested additional information on the assessment of significance using these values. It was noted that NatureScot thought that the approach taken to assessing predicted change in adult survival rate was incorrect as the change in adult mortality rate was used. However, it was demonstrated that these were the same value and therefore there was no error in the approach taken to assigning magnitude to the predicted impacts. While NatureScot based their assessment of magnitude solely on change in adult survival, the EIAR took into account multiple factors in assigning magnitude to predicted impact levels, following the guidance published by The Chartered Institute of Ecology and Environmental Management (CIEEM) (2018).

2.9.10. It was also noted that the sensitivity criteria used in the EIAR did not use Scottish only sources of information to assign sensitivity and vulnerability to seabird species. NatureScot recommended the exclusive use of Wade *et al.* (2016) and a comparison was made between the approach recommended by NatureScot and the approach used in the EIAR. This showed mostly no change for the majority of species. Where changes did occur, these reduced the sensitivity of species compared to the EIAR.

2.9.11. The EIAR did not undertake cumulative impact assessment for several species. NatureScot noted that they would need this information to reach conclusions for Arctic tern, great black-backed gull, fulmar, Manx shearwater and red-throated diver. For all species, except great black-backed gull, it was shown that impacts from the Project alone were sufficiently small that no cumulative assessment was needed. However, Project alone impacts, despite occurring only in the non-breeding season, were sufficient to require a cumulative assessment and associated PVA. These results showed that under that assumption that the PVA was a reasonable reflection of the population and that the predicted impacts were estimated using a reasonably accurate methodology, the cumulative impacts would be significant. However, the application suggests that the PVA was not suitable for great black-backed gull due to the absence of specific demographic inputs for some values and that the sCRM model would likely overestimate impacts on a population from individuals that were likely on migration through the array area.

2.9.12. A minor exclusion in the information on apportioning of impacts between seabird colonies was noted by NatureScot. The absence of information of the proportion of foraging area that is sea was noted and updated tables have provided this information.

CONCLUSIONS

2.9.13. The requests for additional information from NatureScot have been provided in this report. It is noted by the applicant that that the conclusions of the EIA have not changed following the changes applied here and that for all species the predicted impacts from the Project alone and cumulative remain **not significant,** with the exception of great black-backed gull.

2.10. REFERENCES

Band, B. (2012). Using a collision risk model to assess bird collision risks for offshore windfarms. British Trust for Ornithology.

Bradbury, G., Trinder, M., Furness, B., Banks, A. N., Caldow, R. W. & Hume, D. (2014). Mapping seabird sensitivity to offshore wind farms. PloS one, 9, e106366.

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

Caneco, B., Humphries, G., Cook, A., and Masden, E. (2022). Estimating bird collisions at offshore windfarms with StochLAB URL: https://github.com/MarineScotlandScience/stochLAB [Accessed: 31 July 2025].

Furness, R. W. & Wade, H. M. 2012. Vulnerability of Scottish Seabirds to Offshore Wind Turbines.

Natural Power Consultants Ltd. (2024). Muir Mhòr Offshore Wind Farm, Environmental Impact Assessment Report. Volume 2, Chapter 11: Offshore and Intertidal Ornithology.

NatureScot (2023) Guidance to support Offshore Wind Applications: Marine Ornithology- Overview. Available online at: https://www.nature.scot/professional-advice/planning-and-development/planning-and-development-advice/renewable-energy/marine-renewables/advice-marine-renewables-development [Accessed 31 July 2025].

Searle, K. R., Mobbs, D. C., Butler, A., Furness, R. W., Trinder, M. N., & Daunt, F. (2018). Finding out the Fate of Displaced Birds. Scottish Marine and Freshwater Science, Vol. 9, No. 8, 149 pp.

Wade, H. M., Masden, E. A., Jackson, A. C. and Furness R. W. (2016). Incorporating data uncertainty when estimating potential vulnerability of Scottish seabirds to marine renewable energy developments. Marine Policy, Volume 70, pp. 108-113. ISSN 0308-597X.

Woodward, I., Thaxter, C. B., Owen, E. and Cook, A. S. C. P. (2019). Desk-based revision of seabird foraging ranges used for HRA screening. BTO research report No. 724.

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