MONA OFFSHORE WIND PROJECT

Offshore Ornithology Cumulative Effects Assessment and In-combination Gap-filling Historical Projects Technical Note

F02 (Clean)

Deadline: 4

Application Reference: EN010137

Document Reference: S_D3_12 F02

Document Number: MOCNS-J3303-RPS-10311

4 November 2024

F02

Image of an offshore wind farm

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Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
F01	Submission at Deadline 3	RPS	Mona Offshore Wind Ltd	Mona Offshore Wind Ltd	30 Sept 2024
F02	Submission at Deadline 4	RPS	Mona Offshore Wind Ltd	Mona Offshore Wind Ltd	04 November 2024

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Contents

Tables

Appendices

Appendix Tables

Appendix Tables

Appendix Figures

Glossary

Term	Meaning
The Applicant	Mona Offshore Wind Limited. Mona Offshore Wind Limited is a joint venture between two leading energy companies (bp Alternative Energy Investments (hereafter referred to as bp) and Energie Baden-Württemberg AG (hereafter referred to as EnBW)).
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for one or more Nationally Significant Infrastructure Project (NSIP).
Mona Offshore Wind Project	The Mona Offshore Wind Project is comprised of both the generation assets, offshore and onshore transmission assets, and associated activities.
The Planning Inspectorate	The agency responsible for operating the planning process for Nationally Significant Infrastructure Projects.

Acronyms

Acronym	Description
AEoI	Adverse Effect on Integrity
BDMPS	Biologically Defined Minimum Population Scales
CEA	Cumulative Effects Assessment
CRM	Collision Risk Model
DAS	Digital Aerial Surveys
DCO	Development Consent Order
EWG	Expert Working Group
HRA	Habitats Regulations Assessment
ISAA	Information to Support Appropriate Assessment
JNCC	Joint Nature Conservation Committee
MERP	Marine Ecosystems Research Programme
NRW	Natural Resources Wales
PEIR	Preliminary Environmental Information Report
PVA	Population Viability Analysis
SeaMaST	Seabird Mapping and Sensitivity Tool
SNCB	Statutory Nature Conservation Body
SPAs	Special Protection Areas
UK	United Kingdom

Units

Unit	Description
%	Percentage

Unit	Description
kJ	Kilojoules
km^2	Square kilometres
km	Kilometres
m	Metres
MW	Megawatts
nm	Nautical mile

1 OFFSHORE ORNITHOLOGY CUMULATIVE EFFECTS ASSESSMENT AND IN-COMBINATION GAP-FILL OF HISTORICAL PROJECTS RESULTS

1.1 Introduction

1.1.1 Background and context

1.1.1.1 This technical note quantifies the impacts from historical offshore wind projects for which quantitative analyses were not presented in the Mona Offshore Wind Project application due to data availability. These historical projects were therefore considered qualitatively in the offshore ornithology Cumulative Effects Assessment (CEA) presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and the in-combination assessment presented in the HRA Stage 2 ISAA Part Three: Special Protection Areas and Ramsar sites Assessments (REP2-010). The 'Offshore Ornithology Cumulative Effects Assessment and In-combination Gap-fill of Historical Projects' methodology note provided in Appendix D: was developed collectively by the Mona Offshore Wind Project, Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Wind Farm: Generation Assets; however, this technical note quantifies the impacts from historical offshore wind projects for the Mona Offshore Wind Project only.

1.1.1.2 During the Statutory Consultation for the Mona Preliminary Environmental Information Report (PEIR), Natural Resources Wales (NRW), the Joint Nature Conservation Committee (JNCC) and Natural England did not consider it appropriate for Mona Offshore Wind Limited (hereafter referred to as 'The Applicant') to undertake the cumulative (and hence also in-combination) with the inclusions of several 'unknowns' for impacts from historical offshore wind projects. The Applicant was provided with advice from Natural England and endorsed by NRW and JNCC (hereafter referred to as the 'SNCB Advice Note') regarding suggested methodologies for 'gap filling' historical offshore wind projects in October 2023. It was requested that indicative estimates for currently 'unknown' displacement and collision impacts be generated for inclusion in the CEAs and in-combination assessments to further facilitate the SNCB's understanding of the total quantitative cumulative and in-combination impact for offshore ornithology.

1.1.1.3 As set out in section 1.1.3, the Applicant considered, during the pre-application phase, the SNCBs Advice Note (provided in October 2023) around 'gap-filling' for historical offshore wind projects and further verbal advice given by SNCBs during the eighth Mona and Morgan Expert Working Group (EWG) held on 15 February 2024. Further consultation details regarding the assessment of historical projects are presented in section D.8.5 of Technical Engagement Plan Appendices - Part 1 (A to E) (APP-042).

1.1.1.4 As part of the Evidence Plan Process, the Applicant circulated the technical note titled 'Cumulative Effects Assessment (CEA) and In-combination Historical Projects Note – Environmental Statement and Habitats Regulations Assessments Approach' to the SNCBs (emailed on 26 January 2024 and included in Section D8.5 of the Technical Engagement Plan Appendices - Part 1 (A to E) (APP-042)). This previous technical note set out that the approach taken in the Development Consent Order (DCO) application was robust, precautionary, and provided sufficient detail to conclude no significant effects within the Environmental Statement and no Adverse Effect on Integrity (AEOI) beyond reasonable scientific doubt for the purposes of the Habitats Regulations Assessments (HRAs) undertaken for the Mona Offshore Wind Project.

This approach is consistent with information provided in similar recent offshore wind applications. The Applicant's approach to considering historical offshore wind projects within the CEA and in-combination assessment at application is presented in section 1.1.3.

1.1.1.5 Since the DCO application was submitted, NRW and the JNCC have made relevant representations (RR-011 and RR-033, respectively) and written representations (REP1-056 and REP1-066/REP1-067, respectively) on the Mona Offshore Wind Project examination. They commented that the qualitative assessment included in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03) does not adequately account for the impacts of historical projects and that a quantitative assessment is required. The Applicant responded to the relevant representations at the Procedural Deadline within the Applicant's Response to Relevant Representations (PDA-008) and to written representations at Deadline 2 (see Appendix to Response to WRs: NRW (REP2-080) and Appendix to Response to WRs: JNCC (REP2-081)) (see Table 1.1 below).

1.1.1.6 This technical note presents a quantitative assessment of the relevant historical projects, as requested by the SNCBs. The methodology used to generate indicative numbers for currently unquantified impacts from historical projects accords with that recommended in the SNCB Advice Note (provided to the Applicant in October 2023).

1.1.1.7 The Applicant's approach is briefly set out in sections 1.1.4 and 1.2. This includes details of how the approach takes account of SNCB advice whilst also ensuring a robust and defensible methodology (the full, detailed methodology is presented in Appendix D:). It is acknowledged within the SNCBs Advice Note that "*the approach detailed…is flawed*", and while the Applicant also acknowledges the limitations (which are set out in section 1.5), the approach presented in this technical note is considered to be the most robust and repeatable for the purposes of producing indicative estimates for currently unquantified impacts from historical projects, as requested by SNCBs.

1.1.1.8 The Applicant notes that Natural England originally tendered a quantitative assessment of historical projects as a strategic project (as acknowledged in the sixth Expert Working Group (EWG) meeting on 19 October 2023 – see D.7.1 of Technical Engagement Plan Appendices - Part 1 (A to E) (APP-042)), but this has not been awarded and completed in time for the Mona DCO application and examination. The Applicant agrees that data gaps associated with historic offshore wind projects are an aspect of cumulative impact assessments that would be better addressed at the strategic level rather than the project level. The Applicant notes NRW's relevant representation (RR-011) states: "*There are ongoing internal discussions surrounding the development of an approach that may help to address this issue, which will be shared with the Applicant for consideration in due course*". The Applicant is continuing to engage with NRW to understand any proposals forthcoming from NRW. However, the Applicant considers that the quantitative assessment approach using a methodology recommended in the SNCBs Advice Note and the results presented in this technical note provide the required information to resolve this matter in the absence of the anymore information or guidance forthcoming from the SNCBs.

1.1.1.9 An initial draft of this technical note was circulated to the SNCBs on 15 August 2024, and a summary of the methodology and results were presented to the SNCBs on 29 August 2024. The Applicant acknowledges that NRW(A) and the JNCC have identified discrepancies within the Mona Environmental Statement and HRA application materials in their relevant representations (RR-011 and RR-033, respectively) and written representations (REP1-056 and REP1-066/REP1-067, respectively). Appreciating the need for clarity in the application material, the Applicant submitted revised offshore ornithology application EIA and HRA material (as tracked and clean versions) at Deadline 2 to address the errata. Given that the draft technical note was issued to SNCBs ahead of Deadline 2 (27 August 2024), it was considered appropriate to retain the use of the total abundances presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03), which have already been seen by the SNCBs, rather than introduce new, unseen material in addition to the information on the gap-filled historical projects. For this reason, the draft technical note did not account for errata or Written Representations.

1.1.1.10 However, this technical note submitted at Deadline 4 has been updated to reflect the revised application material submitted at Deadline 4 (Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and Volume 6, Annex 5.2: Offshore Ornithology Displacement Technical Report (F6.5.2 F03)), and SNCB feedback where appropriate. Table 1.1 provides the consultation history for this specific technical note and details where amendments have been made following specific SNCB advice. The main update requested by the SNCBs following the Deadline 3 submission is to use the full breeding season for great black-backed gull, black legged kittiwake and northern gannet to be in line with the Volume 2, Chapter 5: Offshore Ornithology (F2.5 F02).

1.1.1.11 In addition, the in-combination assessment section presented within the Offshore Ornithology Cumulative Effects Assessment and In-combination Gap-filling Historical Projects Technical Note (REP3-044) at Deadline 3 has now been removed and moved to Offshore Ornithology Supporting Information in line with SNCB Advice (S_D3_19 F02) so the gap-filled projects are considered within the in-combination assessments.

1.1.2 Consultation

1.1.2.1 Table 1.1 summarises the key feedback received from NRW (A) and the JNCC post-application with respect to gap-filling of historical projects and how this has been considered by the Applicant. This includes verbal advice received by SNCBs during the meeting on 29 October 2024

Table 1.1: Post-application consultation regarding the quantification of historical projects within the cumulative effects assessment and in-combination assessment and the Applicant's response.

Consultee and form of consultation	Comment summary	Response to issue raised and/or were considered in this technical note
NRW relevant representations (RR-011) JNCC relevant representations (RR-033) RSPB relevant representation (RR-071) NRW written representation (REP1-056) JNCC written representation (REP1-066/REP1-067)	Request for the Applicant to undertake gap-filling for historical offshore wind projects in the eastern Irish Sea, in line with the SNCB advice note.	The Applicant's response to written representations (Appendix to Response to WRs: NRW(REP2-080) and Appendix to Response to WRs: JNCC (REP2-081)) confirmed that a 'gap-filling' exercise was being undertaken in line with the SNCB advice (which is presented in Section D.6.13 of Appendix D of Technical Engagement Plan (APP-042)) to generate indicative estimates for impacts from historical projects that were unquantified at application. This technical note presents the results of this 'gap-filling' exercise and is intended to further facilitate the SNCB's understanding of the total quantitative cumulative and in-combination impact for offshore ornithology.

Consultee and form of consultation	Comment summary	Response to issue raised and/or were considered in this technical note
Meeting with NRW, the JNCC and Natural England on 29 August 2024 (Appendix E:Appendix E:)	Natural England feedback: Agree that broadly the approach provides the information requested by SNCBs, but clarification is required on a few points. The results suggest that some of the historic projects do contribute to the cumulative effect so SNCBs maintain their position that this quantification was necessary. We are happy with the general approach and the use of MERP makes sense. Agree that the risk of adverse effects from these projects is low and they are well sited.	The Applicant welcomes this feedback and, on this basis, has made no changes to the methodology outside of addressing the SNCBs comments made during the meeting (see below in this table). The Applicant welcomes agreement that the MERP data is the best evidence available to characterise baseline abundance for historical projects given its spatial coverage and more recent temporal coverage (see paragraph 1.2.1.4). The Applicant also welcomes the SNCBs agreement that the results of this assessment are unlikely to alter the conclusions presented in the ornithological assessments at application and that the risk of adverse effects is low.
	NRW feedback: The use of the MERP data is certainly more repeatable and defensible than the proxy approach, but clarification is required on a few points. In general, NRW feel the risk of adverse effects is low but need clarity on a few points to ensure it can be ruled out beyond reasonable scientific doubt.	
	The JNCC feedback: Agree with Natural England. Clarification is needed to rule out adverse effects, but agree risk is low.	
	Request for the project to consider further justification for the use of percentage of birds in flight from Mona, Morgan Generation Assets and Morecambe Generation Assets surveys for projects that are closer to the coast and may have different percentages of birds in flight.	The Awel y Môr, Burbo Bank Extension and Walney Extension offshore wind projects are closer to the coast than the Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Generation Assets and, therefore, provide a good comparison to determine whether there is any difference in the proportions of birds in flight at inshore projects versus those further offshore. Section 1.2.2 discusses the available data from Awel y Môr, Walney Extension and Burbo Bank Extension and Table 1.8 presents the percentage of birds flying at the Awel y Môr offshore wind project in addition to the percentage of birds in flight from Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Generation Assets. As shown in section 1.2.2, the proportions of birds in flight for the Awel y Môr offshore wind project are similar to those in Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Generation Assets; therefore, the use of those percentages of birds in flight for the gap-filled projects is robust and justified.

Consultee and form of consultation	Comment summary	Response to issue raised and/or were considered in this technical note
	Request for the project to present a month-by-month breakdown if possible or using seasonal values if this is not feasible.	It was not possible to include a seasonal and monthly breakdown of the proportions of flying birds within Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Generation Assets Digital Aerial Surveys (DAS) within the technical note submitted at Deadline 3. The report is presented within Appendix F:
	Request from Natural England for the project to consider the updated reference populations and parameters in the NRW and Natural England interim advice note (advice letter provided to Morgan Generation Assets by Natural England and NRW on 21 March 2024, post submission of the Mona Offshore Wind Project DCO application), particularly in relation to great black-backed gull.	See paragraphs 1.1.2.5 to 1.1.2.11 below.
	Request from the JNCC to consider if Atlantic puffin should be included in the gap-filling exercise following updates to Volume 2, Chapter 5: Offshore ornithology (REP2-016) at Deadline 2.	Atlantic puffin has been included within the displacement section 1.3.1 of this technical note.
JNCC, Natural England and NRW joint written feedback received via email (dated 6 September 2024) Summary of Natural England's comments made in the meeting on 29 August 2024, received 18 September 2024.	Request for justification for the use of deterministic CRM as opposed to stochastic CRM	An explanation is provided in paragraph 1.2.2.21. The CRMs for the projects that required gap-filling were run deterministically as the data sources used to quantify density did not provide any parameter variation around the mean value. Similarly, the wind turbine parameters (e.g. rotor speed, wind availability etc.) are not presented with variation and therefore a stochastic model cannot be run.
	Request for all wind farm parameters to be presented for added clarity and reproducibility of the CRM	Table 1.9 presents all information necessary to run the CRMs, including the wind farm width (km) and latitude.
	Request for clarification on Burbo Bank OWF predicted collision impacts being higher when using as-built parameters compared to consented	As shown in Table 1.9, the air gap for Burbo Bank reduced from 29m to 26m between consented and as-built, respectively. CRM outputs are highly sensitive to the air gap variable and therefore, a reduction of air gap would increase the predicted impact to offshore ornithological receptors.

Consultee and form of consultation	Comment summary	Response to issue raised and/or were considered in this technical note
	The SNCB's note that the Marine Licence application for Llyr Offshore Wind Farm has been submitted to NRW licensing and is now available on the public register.	The Applicant welcomes this information. The Marine Licence application for Llyr Offshore Wind Farm became available on 2 September 2024 and is included in the Review of Cumulative Effects Assessment and In-Combination Assessment (REP3-058) submitted at Deadline 3. However, Llyr Offshore Wind Farm has not been included in this technical note as this exercise is intended to gap-fill the CEA / in-combination assessment undertaken at application (which did not include Llyr Offshore Wind Farm as there was no information in the public domain at that time). The Applicant has submitted a Review of Offshore Ornithology Cumulative and In-combination Assessments (S_D4_9) which reviews the quantitative information from the Llyr Offshore Wind Farm.
The JNCC provided written feedback via email on the 24 October 2024 for a meeting on 14 October. NRW agreed with many of the JNCC's points during a subsequent meeting with both JNCC and NRW (A) on 29 October 2024.	The note submitted at Deadline 3, used the migration-free breeding season, the SNCBs would like to see the full breeding season for black-legged kittiwake, great black-backed gull and kittiwake.	The Applicant has updated the bioseasons for northern gannet, black-legged kittiwake and great black-backed gull from the migration-free breeding to the full migration period at the request of the SNCBs.
	The inclusion of the gap-filled projects within the in-combination assessment using the SNCBs advised parameters.	Within Offshore Ornithology Cumulative Effects Assessment And In-Combination Gap-Fill Of Historical Projects Technical Note (REP3-044) the Applicant presented an updated in-combination assessment (section 1.4) for the five sites which were taken through to the in-combination assessment within HRA Stage 2 Information to Support an Appropriate Assessment Part Three: Special Protection Areas and Ramsar sites Assessments (REP2-010). Following the SNBCs request to include the gap-filled projects within the in-combination assessments and in line with the SNCB advice, the full range of impacts is presented within the updated Offshore Ornithology Supporting Information in line with SNCB Advice (S_D3_19 F02). Therefore, this note no longer covers in-combination assessments, including the gap-filled projects.

1.1.2.2

1.1.2.3 The Applicant maintains that the approach in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and the in-combination assessment of the HRA Stage 2 ISAA Part Three: Special Protection Areas and Ramsar sites Assessments (REP2-010) is robust and includes sufficient detail to conclude no significant effects within the Environmental Statement and no AEOI beyond reasonable scientific doubt. The Applicant considers that this technical note is above and beyond the requirements for a robust assessment but has provided the information requested by SNCBs via the SNCB Advice Note (i.e. indicative estimates for currently unquantified impacts from historical projects) to further facilitate the SNCBs understanding of the total cumulative and in-combination impact for offshore ornithology.

1.1.2.4 This note provides the breakdown of the gap-filled projects and the associated impacts at an EIA scale as part of the cumulative assessments and should be read in conjunction with the Offshore Ornithology Supporting Information in line with SNCB Advice (S_D3_19 F02) where the gap-filled projects have been presented as part of the in-combination assessments which use the full range of the SNCBs advised impact scenarios.

Natural England and Natural Resources Wales Interim Advice

1.1.2.5 The Applicant undertook extensive pre-application consultation on offshore ornithology through the Evidence Plan Process (EPP) (see Technical Engagement Plan APP-041). The SNCBs provided advice on various parameters to be used in the assessments, and some parameters used in the offshore ornithology application documents (such as reference populations for some species) were provided directly by the SNCBs and not taken directly from guidance. The parameters provided by the SNCBs through the EPP were all used in the offshore ornithology application documentation and assessment. This is a standard approach as SNCBs advise projects on a case-by-case basis and there is no one set of guidance that covers all aspects of offshore ornithology assessments for offshore wind projects.

1.1.2.6 Table 1.1The SNCBs highlighted a new NE and NRW interim advice note 'NE and NRW interim advice regarding demographic rates, EIA scale mortality rates and reference populations for use in offshore wind impact assessments' (the interim advice note (March 2024)) in the Joint Mona and Morgan Generation Assets: Offshore Wind Project Meeting with NRW, the JNCC and Natural England on 29 August 2024. Whilst this interim advice note was shared directly with Morgan Generation Assets on 21 March 2024, post submission of the Mona Offshore Wind Project consent application, to date it has not been shared directly with the Mona Offshore Wind Project and is not a publicly available document.

1.1.2.7 In the SNCB meeting on 29 August 2024, the Applicant was made aware that the annual regional breeding population for great black-backed gull which the SNCBs had previously advised during the EPP, and used in the offshore ornithology application documents (44,753 birds), was an inaccurate representation of the annual regional breeding population for this species and (13,424 birds) presented for great black-backed gull in the interim advice note. In light of this, an additional assessment using the updated reference population (17,742) was presented in Appendix D of the Offshore Ornithology Cumulative Effects Assessment and In-combination Gap-filling Historical Projects Technical Note (REP2-044) submitted at Deadline 3. An assessment against the original reference population used within the application (44,473) was also provided to enable a direct comparison between what was assessed at application and the updated CEA and in-combination so the contribution of the gap-filled projects could be easily identified.

1.1.2.8 The Offshore Ornithology Cumulative Effects Assessment and In-combination Gap-filling Historical Projects Technical Note (S_D3_12 F02) has subsequently been updated for Deadline 4 to only consider the reference population from the interim advice note noting that SNCBs advice. The Applicant confirms that the great black-backed gull assessment presented in the Offshore Ornithology Supporting Information in line with SNCB advice (S_D3_19 F02) submitted at Deadline 4 also considers the reference population from the interim advice note and so the approach taken with respect to great black-backed gull is consistent across these two documents.

1.1.2.9 Volume 2, Chapter 5: Offshore ornithology has been updated at Deadline 4 to address errata but has not been updated to use the great black-backed gull reference population from the NRW and Natural England interim advice note as this is not considered to be errata.

1.1.2.10 The Applicant has undertaken a full review of the Natural England and NRW interim advice note and can confirm that where other parameters differ to those used by the Applicant in its assessments, these differences are minor and would not alter the conclusions drawn.

1.1.3 Approach at application

1.1.3.1 The scope of any assessment and information presented within a Report to Inform the Appropriate Assessment or Information to Support Appropriate Assessment (ISAA) must be considered in the context of what is required by the legal regime under the Conservation of Offshore Marine Habitats and Species Regulations 2017 (Marine Habitats Regulations). The appropriate test is whether it can be ascertained beyond reasonable scientific doubt that there will be no AEOI of European sites. That conclusion must be reached by considering the best available scientific evidence. The Courts have re-iterated on a number of occasions that the conclusion reached in an appropriate assessment “cannot realistically require ascertainment of absolute certainty that there will be no adverse effects"[1]. It is entirely appropriate for an Appropriate Assessment to be undertaken, working with estimates and expert judgement, provided that there is sufficient information available to allow a conclusion to be reached beyond reasonable scientific doubt.

1.1.3.2 The Applicant’s approach for the DCO application was developed to ensure that the assessments of the Mona Offshore Wind Project are robust and precautionary. The assessments are considered to provide sufficient detail to enable a conclusion of no significant effects within the Environmental Statement and no AEOI beyond reasonable scientific doubt for the purposes of the HRA undertaken for the Mona Offshore Wind Project. This includes consideration of all projects that may act cumulatively/in-combination with Mona, either quantitatively or qualitatively, depending on the availability of data.

1.1.3.3 Following detailed Section 42 comments on the PEIR and receipt of the SNCB Advice Note, the Applicant updated the CEA and in-combination assessments ahead of application. The updates took account of the first approach outlined in the SNCB Advice Note (see section 1.1.4 below) which involved the review of project-specific documentation for historical projects to ascertain whether quantitative information was available. In the absence of a quantitative assessment for historical projects, a qualitative assessment was presented using project-specific documentation. For each project and species considered in the CEA, the reasons why quantitative estimates of impacts were unavailable, the results of the qualitative assessment and the final conclusion were presented in the application. A qualitative assessment was presented at application for six historical projects which had previously (within the PEIR) not been assessed quantitatively or qualitatively.

1.1.3.4 Full justification for the approach presented in the application is set out in section D8.5 of Technical Engagement Plan Appendices - Part 1 (A to E) (APP-042).

[1] See decision of the Court of Justice of the European Union in Waddenzee (C-127/02)

1.1.3.5 The Applicant considers the application methodology to be precautionary and robust for assessing impacts from historical offshore wind farm projects, using the best available scientific information with appropriate consideration of the SNCB advice.

1.1.3.6 The approach provides an understanding of the cumulative or in-combination impacts stemming from these historical offshore wind farm projects, thereby enabling a suitable assessment of the risks associated with significant effects or AEOI with greater certainty.

1.1.3.7 The CEA presented within the application is consistent with the approach taken for previous offshore wind farm projects in UK waters. The Applicant considers the CEA presented within the application goes beyond other projects and plan level HRAs (e.g. Crown Estate, 2024) with the presentation of the qualitative assessment of historical projects, which has not been required previously. The Secretary of State has been able to conclude that other developments would not have an AEOI on European sites without such information being provided, including the recently consented Awel y Môr offshore wind farm.

1.1.4 Approach to updating CEA / In-combination assessment

1.1.4.1 As set out above, written advice was provided by the SNCBs around 'gap-filling' for historical offshore wind projects. The SNCB Advice Note recommended three approaches to quantifying impacts for historical projects:

1. Review the submitted environmental statement. It is accepted that displacement mortality / collision risk estimates may not be presented. However, if there is abundance data, utilise this to populate project-specific displacement matrices / run project-specific collision risk models (CRMs) for relevant species.
2. If no abundance data is available, use a nearby wind farm as a proxy. Scale the impact to the size of the historical project when compared to the proxy.
3. If no abundance data is available and to provide a more rigorous assessment, use the best available bird density estimates and known array footprint plus buffers to generate refined project-specific assessments of displacement and collision.

1.1.4.2 The first approach was considered in the application offshore ornithology documents whereby site-specific abundance data for historical projects from submitted Environmental Statements were used to generate a quantified impact. The impacts from historical offshore wind projects for which quantitative analyses were not possible due to data availability were considered qualitatively. It should be noted that post application, the Applicant undertook a further review of all available documentation for historical wind projects considered within this technical note. A breakdown of which projects have been gap-filled using either original documentation or other sources has been presented in Section 1.2.

1.1.4.3 The Applicant has not progressed with the second approach (i.e. use of proxy data) due to very high levels of variation presented within nearby wind farms. After considering this approach in consultation with the Morgan Generation Assets and Morecambe Generation Assets ornithology consultants, it was concluded that there is no pragmatic or consistent way to use proxy wind farms due to differences in site-specific conditions between projects; therefore, that approach has not been pursued further. The Applicant received agreement on the broad methodology and justification for not progressing the use of proxy data in a meeting with the SNCBs on 29 August

2024 (see Table 1.1). Further detail on why proxy data is not considered appropriate is presented in Appendix D:.

1.1.4.4 The Applicant has therefore undertaken what the SNCB Advice Note describes as a "*more rigorous assessment*" to gap-fill these historical projects in line with the third approach outlined in paragraph 1.1.4.1 above. As stated within the SNCB Advice Note "*If baseline characterisation data are not available for a given "gap-filling" project, MERP, strategic VAS of OWF areas, or the recent Welsh Atlas data could be considered*'. The Applicant considered it more appropriate to use the data outputs of the Marine Ecosystems Research Programme (MERP) (Waggitt *et al*., 2020) (hereafter referred to as MERP data), as recommended by the SNCBs. The MERP data produces average density estimates at a 10x10 km grid square resolution of the entire north east Atlantic using data from aerial and boat-based surveys from 1980 to 2018. This large temporal and spatial coverage represents the best available data within this area. Using a published data source also removes potential differences in reproduction and analysis of the data.

1.1.4.5 Further information on the gap-filling methodology used by the Applicant and the species and historical projects that this has been applied to is provided in Section 1.2 and is supported by the methodology technical note provided to the SNCBs on 2 August 2024 (see Appendix D:).

1.1.5 Structure of report

1.1.5.1 This report is structured as follows:

- Section 1.2 presents the methods on how the displacement and collision risk assessments for the gap-filled projects have been undertaken
- Section 1.3 presents the results for the following assessments:
  - cumulative displacement assessment (section 1.3.1)
  - cumulative collision risk assessment (section 1.3.2)
  - combined cumulative displacement and collision risk assessment (section 1.3.3)
- Section1.4 represents updated population viability analysis (PVA) where required following the cumulative assessment including the gap-filled projects.
- Section 1.5 sets out the conclusions and implications for the assessments presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and HRA Stage 2 ISAA Part Three: Special Protection Areas and Ramsar sites Assessments (REP2-010), including key limitations.

1.1.5.2 The following information is also presented in the appendices:

- Appendix A: presents the detailed results of the gap-filled projects for both displacement (A.1) and collision (A.2);
- Appendix B: provides the PVA inputs for the cumulative PVA for common guillemot;
- Appendix C: provides the PVA inputs for the cumulative PVA for great black-backed gull;
- Appendix D: provides the methodology note sent to the SNCBs for this gap-filling exercise.

- Appendix E: presents the minutes of a meeting between the SNCBs and the Applicant from 6 September 2024.
- Appendix F: provides the proportion of birds in flight report.

1.2 Method

1.2.1 Cumulative displacement assessment

Projects included within the displacement assessment

1.2.1.1 Several of the historical projects included within the CEA (Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)) did not present abundance data in a comparable format and it was not possible for these to be included quantitatively within the CEA at application. For these projects where a comparable abundance estimate was not available, the CEA presented a qualitative assessment. Table 1.2 clarifies which project had a quantitative (highlighted in green) or qualitative assessment (highlighted in orange) within the CEA (Volume 2, Chapter 5: Offshore ornithology (F2.5 F03)).

1.2.1.2 The species assessed for cumulative displacement impacts in the Environmental Statement (Volume 2, Chapter 5: Offshore ornithology (F2.5 F03)) were common guillemot *Uria aalge*, razorbill *Alca torda*, Atlantic puffin *Fratercula arctica*, northern gannet *Morus bassanus*, black-legged kittiwake *Rissa tridactyla* and Manx shearwater *Puffinus puffinus*.

Table 1.2: Projects partially or fully quantified (highlighted in green) and those unquantified (highlighted in blue) within the CEA for displacement presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) at application.

Projects	Atlantic puffin	Black-legged kittiwake	Common guillemot	Razorbill	Manx shearwater	Northern gannet
Awel y Môr Offshore Wind Farm	Fully	Fully	Fully	Fully	Fully	Fully
Burbo Bank Extension Offshore Wind Farm	Fully	Partially - breeding only	Fully	Fully	Partially - breeding only	Fully
Burbo Bank Offshore Wind Farm	None	None	None	None	None	None
Erebus Floating Wind Demo	Fully	Fully	Fully	Fully	Fully	Fully
Gwynt y Môr Offshore Wind Farm	None	None	None	None	None	None
Morecambe Offshore Windfarm Generation Assets	Fully	Fully	Fully	Fully	Fully	Fully
Morgan Offshore Wind Project Generation Assets	Fully	Fully	Fully	Fully	Fully	Fully
Ormonde Wind Farm	Fully	Partially - breeding only	Partially - breeding only	Partially - breeding only	None	Partially – breeding only
Rampion 2 (Rampion Extension) Offshore Wind Farm	No connectivity	Fully	No connectivity		Fully	No connectivity
Rampion Offshore Wind Farm	No connectivity	Fully	No connectivity		Fully	No connectivity
Rhyl Flats Offshore Wind Farm	None	None	None	None	None	None
Robin Rigg Offshore Wind Farm	Fully	None	Partially - breeding only	Partially - breeding only	None	None
TwinHub (Wave Hub Floating Wind Farm)	Fully	Fully	Fully	Fully	Fully	Fully
Walney Extension Offshore Wind Farm	Fully	Fully	Fully	Fully	Fully	Fully
Walney 1 & 2 Offshore Wind Farms	None	None	None	None	None	None
West of Duddon Sands Offshore Wind Farm	Fully	Partially – breeding only	Fully	Fully	Partially – breeding only	Partially – breeding only
West of Orkney Windfarm	Fully	Fully	Fully	Fully	Fully	Fully
White Cross Offshore Windfarm	Fully	Fully	Fully	Fully	Fully	Fully

Data sources used for abundance estimates

1.2.1.3 The initial step in undertaking this gap-filling exercise was to undertake a further review of the original environmental statements and documentation that had been identified since the submission of the Mona Offshore Wind Project DCO application for the historical projects which had a qualitative assessment presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). For example, additional documentation for Ormonde Offshore Wind Farm (Percival, 2005) and West of Duddon Sands (Morecambe Wind, 2005) was sourced and used as part of this gap-filling technical note.

1.2.1.4 If baseline characterisation data from project-specific documentation were not available for a given historical project or were not presented in a usable format (e.g. raw counts for all surveys combined) to allow for the calculation of displacement impacts, the Applicant obtained data on seabird distribution from the Marine Ecosystems Research Programme (MERP) (Waggitt *et al*., 2020) as specified by the SNCB's Advice Note from October 2023. The Applicant considers the MERP data the best evidence available to characterise baseline abundance given its spatial coverage (the northeast Atlantic) and more recent temporal coverage (1980 and 2018). However, MERP data represents relative and not absolute density estimates; therefore, any predicted impacts presented should be taken as potential and not absolute impacts.

1.2.1.5 A full breakdown of what data has been used to gap-fill each historical project is provided in Table 1.3 and the data is presented in full in Appendix A:.

1.2.1.6 The species-specific matrix tables in Appendix A: reproduce the total abundances presented within the corresponding CEA tables from Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03).

Table 1.3: Data source used to gap-fill historical projects not quantified in the CEA for displacement presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) at application.

Project	Species requiring gap-filling	Season requiring gap-filling	Data used to gap-fill historical project
Burbo Bank	All	All	MERP data are used for Burbo Bank for all species and all seasons.
Burbo Bank Extension	Black-legged kittiwake, Manx shearwater and northern gannet	Non-breeding	MERP data are used for Burbo Bank Extension for black-legged kittiwake, Manx shearwater and northern gannet for the non-breeding season.
Gwynt y Môr	All	All	MERP data are used for Gwynt y Môr for all species and all seasons.
Ormonde	All	Non-breeding	Site-specific data from the project's reports has been used for all species for the breeding season (Percival, 2005) and MERP data are used in the non-breeding season.
Robin Rigg	Black-legged kittiwake, Manx shearwater and northern gannet	All	MERP data are used for Robin Rigg for black-legged kittiwake, Manx shearwater and northern gannet for all seasons and for

Project	Species requiring gap-filling	Season requiring gap-filling	Data used to gap-fill historical project
	Common guillemot and razorbill during	Non-breeding	common guillemot and razorbill during the non-breeding season.
Rhyl Flats Offshore Wind Farm	All	All	MERP data are used for Rhyl Flats for all species and all seasons.
Walney 1 & 2 Offshore Wind Farms	All	All	MERP data are used for Walney 1 & 2 for all species and all seasons.
West of Duddon Sands	Black-legged kittiwake, Manx shearwater and northern gannet	Non-breeding	MERP data are used in the non-breeding season.

1.2.1.7 Data were extracted from the publicly available MERP data which included monthly density estimates at a 10 x 10 km resolution (Waggitt *et al.*, 2020). Each gap-filled project was loaded into QGIS (version 3.34) and overlaid with the MERP data. The MERP data was then clipped to each of the projects (plus a 2 km buffer) for which gap-filling was undertaken. The spatial overlap (km^2) was then calculated for each of the 10 x 10 km grid squares, which allowed the abundance to be estimated.

1.2.1.8 A worked example is presented below for northern gannet at the Gwynt y Môr Project.

1.2.1.9 The Gwynt y Môr Array Area plus 2 km buffer overlaps with five 10 x 10 km squares. Each of the five squares has a different density estimate for northern gannet (Table 1.4). The area of the grid square that overlaps with the Gwynt y Môr Array Area plus 2 km buffer is then multiplied by the density of birds to provide an abundance estimate. The summed total of all abundances within each 10 x 10 km grid square provides a relative abundance estimate of birds present within Gwynt y Môr Array Area plus 2 km buffer.

1.2.1.10 Each species and each historical project have been calculated this way, with the outputs presented at a monthly resolution (Table 1.4).

Table 1.4: Worked example of the MERP data for northern gannet within the Gwynt y Môr Array Area plus 2 km buffer.

Grid square	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Area (km^2)
Density (birds per km^2)													
1	0.079	0.074	0.088	0.111	0.125	0.147	0.172	0.190	0.187	0.141	0.101	0.088	55.13
2	0.065	0.061	0.072	0.091	0.103	0.122	0.143	0.159	0.156	0.117	0.083	0.072	81.89
3	0.060	0.056	0.067	0.085	0.096	0.114	0.134	0.149	0.147	0.110	0.078	0.067	5.42
4	0.067	0.063	0.075	0.094	0.106	0.126	0.149	0.165	0.162	0.122	0.086	0.075	11.86
5	0.062	0.058	0.068	0.087	0.098	0.116	0.137	0.153	0.150	0.112	0.080	0.069	8.13
Abundance													
1	4.372	4.099	4.869	6.133	6.874	8.114	9.476	10.453	10.311	7.789	5.581	4.849	N/A
2	5.312	4.973	5.911	7.473	8.401	9.972	11.724	12.986	12.801	9.600	6.826	5.905	N/A

Grid square	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Area (km^2)
3	0.327	0.306	0.364	0.460	0.518	0.616	0.726	0.806	0.794	0.594	0.422	0.364	N/A
4	0.796	0.744	0.885	1.121	1.261	1.499	1.764	1.955	1.927	1.444	1.025	0.885	N/A
5	0.50	0.47	0.56	0.70	0.79	0.95	1.12	1.24	1.22	0.91	0.65	0.56	N/A
Total	**11.31**	**10.59**	**12.58**	**15.89**	**17.85**	**21.15**	**24.81**	**27.44**	**27.06**	**20.34**	**14.50**	**12.56**	**N/A**

Displacement and mortality rates

1.2.1.11 Parameters used in the displacement matrices (e.g. displacement and mortality rates) are identical to the parameters used in the Environmental Statement. The parameters are presented in table 1.5 of Volume 6, Annex 5.2: Offshore Ornithology Displacement Technical Report (F6.5.2 F03) and provided again in Table 1.5.

1.2.1.12 Table 1.5 presents the displacement and mortality rate ranges for the species assessed in the displacement assessment and used within the assessment of offshore ornithology receptors in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). Displacement and mortality rates during the operational period for common guillemot, razorbill and northern gannet have been obtained from the Joint SNCB note (JNCC *et al*., 2022). For auk species: common guillemot and razorbill, the SNCBs advise a displacement level of 30 to 70%. Black-legged kittiwake rates have been taken from the relevant literature (Table 1.5). As Manx shearwater has a disturbance susceptibility score of one, the recommended rates of 1 to 10% for displacement and 1 to 10% mortality from SNCBs (JNCC *et al.,* 2022) guidance were originally considered within the Mona PEIR. However, the Offshore Ornithology EWG02 (meeting held 13 July 2022) advised that the 30% to 70% displacement rates be applied (the same rates for auk species) instead.

Table 1.5: Displacement and mortality rates for use in the assessment during the operations and maintenance phase.

Species	Displacement rates	Mortality rates	Source
Common guillemot	30 to 70%	1 to 10%	Joint SNCB Note (JNCC *et al*., 2022)
Razorbill	30 to 70%	1 to 10%	Joint SNCB Note (JNCC *et al*., 2022)
Northern gannet	60 to 80%	1 to 10%	Cook *et al.* (2018), Skov *et al*. (2018), Leopold *et al*. (2011) and Furness & Wade (2012)
Black-legged kittiwake	30 to 70%	1 to 10%	Peschko *et al.* (2020; Vanermen *et al.* (2016); Leopold *et al*. (2011)
Manx shearwater	30 to 70%	1 to 10%	SNCBs (discussed at EWG meeting 2, 13 July 2022)

1.2.1.13 It should be noted that NRW and Natural England do not require any assessment of displacement impacts on black-legged kittiwake for English and Welsh offshore wind projects (Appendix D of the Technical Engagement Plan Appendices Part 1 (A to E) (APP-042)). Whilst an assessment is required for Scottish projects, NatureScot recommends using 30% displacement and 1-3% mortality (NatureScot, 2023). During pre-application engagement, NRW did not indicate a preferred displacement rate but advised that a 1-10% mortality rate should be used (see Appendix D of the Technical

Engagement Plan Appendices Part 1 (A to E) (APP-042) for full consultation with the SNCBs) however NRW have confirmed within their Written Representations (REP1-056) that they do not believe there is sufficient evidence to conclude that black-legged kittiwake are displaced by offshore wind farms. Therefore, there is no precedent to assume 70% displacement and 10% mortality for black-legged kittiwake for the purpose of impact assessments. However, to replicate what is presented within Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03) assessment of displacement from black-legged kittiwake is included within this document.

1.2.1.14 The cumulative results are presented as displacement matrices ranging from 1% to 100% mortality and 5% to 100% displacement within Appendix A:. Each cell presents potential cumulative bird mortality following displacement from the Mona Offshore Wind Project and the other offshore wind farm projects during each bio-season. Light blue highlighted cells are based on the displacement and mortality rates used in the project alone assessment. Additionally, orange highlighted cells represent the Applicant's identified impact. Cells to the right of the red line indicate a >1% increase in baseline mortality.

1.2.1.15 The increase in baseline mortality as a result of the predicted mortality from displacement as presented within the CEA of the Environmental Statement (section 5.9 of Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and CEA with gap-filled projects are compared in a table per species (section 1.3.1). The resulting difference in baseline mortality between the CEA of the Environmental Statement and the CEA with gap-filled projects is also presented.

1.2.2 Cumulative collision risk assessment

Projects included within collision risk assessment

1.2.2.1 The species assessed for cumulative collision risk in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) were black-legged kittiwake, great black-backed gull *Larus marinus*, herring gull *Larus argentatus,* lesser black-backed gull *Larus fuscus* and northern gannet. Table 1.6 clarifies which project had a quantitative (highlighted in green) or qualitative assessment (highlighted in orange) within the CEA (Volume 2, Chapter 5: Offshore ornithology (F2.5 F03)).

Table 1.6: Projects partially or fully quantified (highlighted in green) and those unquantified (highlighted in blue) within the CEA for collision risk in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) at application.

Projects	Black-legged kittiwake	Great black-backed gull	Herring gull	Lesser black-backed gull	Northern gannet
Awel y Môr Offshore Wind Farm	Fully	Fully	Fully	Fully	Fully
Burbo Bank Extension Offshore Wind Farm	Partial - annual only	None	Partial - annual only	Partial - annual only	Partial - annual only
Burbo Bank Offshore Wind Farm	None	None	None	None	None
Erebus Floating Wind Demo	Fully	Fully	Fully	Fully	Fully
Gwynt y Môr Offshore Wind Farm	None	None	None	Partial – annual only	None
Morecambe Offshore Windfarm Generation Assets	Fully	Fully	Fully	Fully	Fully

Projects	Black-legged kittiwake	Great black-backed gull	Herring gull	Lesser black-backed gull	Northern gannet
Morgan Offshore Wind Project Generation Assets	Fully	Fully	Fully	Fully	Fully
Ormonde Wind Farm	Partial - annual only	Partial - annual only	Partial - breeding only	Partial – annual only	Partial – annual only
Rampion 2 (Rampion Extension) Offshore Wind Farm	Fully	Fully	No connectivity	No connectivity	No connectivity
Rampion Offshore Wind Farm	Fully	Fully	No connectivity	No connectivity	No connectivity
Rhyl Flats Offshore Wind Farm	None	None	None	Partial – annual only	None
Robin Rigg Offshore Wind Farm	None	None	None	None	None
TwinHub (Wave Hub Floating Wind Farm)	Fully – annual only	Fully – annual only	Fully – annual only	Fully – annual only	Fully – annual only
Walney Extension Offshore Wind Farm	Fully	Fully	Fully	Fully	None
Walney 1 & 2 Offshore Wind Farms	None	None	None	Partial – annual only	None
West of Duddon Sands Offshore Wind Farm	None	None	None	Partial – annual only	None
West of Orkney Windfarm	Fully	No – number of birds present did not constitute the need for assessment.	Fully	No – number of birds present did not constitute the need for assessment.	Fully
White Cross Offshore Windfarm	Fully	Fully	Fully	Fully	Fully

1.2.2.2 The Applicant is aware of additional offshore wind farms within the Irish Sea which were not included within the CEA within Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03) nor are they included within this gap-filling technical note. These three wind farms are Arklow Bank (Phase 1) (decommissioning in 2026; SSE Renewables, 2024), Barrow (Marine License lapses in 2026; L/2016/00297/4) and North Hoyle (Marine License lapses in 2025; CML1465). Each of these wind farms have predicted project lifespans which end before the construction of the Mona Offshore Wind Farm Project commences, according to each project's original documentation or Marine Licence. As there is no temporal overlap between these projects and the Mona Offshore Wind Farm Project, they have not been included within the CEA, nor this gap-filling exercise. This is in line with the recommended advice within the SNCB Advice Note (see D.6.13 of Technical Engagement Plan Appendices - Part 1 (A to E) (APP-042)).

1.2.2.3 Removal of historic projects from the CEA which are not expected to temporally overlap is in line with the SNCBs guidance, as set out in the SNCB Advice Note received in October 2023.

Data sources used for density estimates

1.2.2.4 The initial step in undertaking this gap-filling exercise was to undertake a further review of the original environmental statements and documentation which have been highlighted since the submission of the Mona Offshore Wind Project DCO application for the historical projects which had a qualitative assessment presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03).

1.2.2.5 If collision risk data from project-specific documentation were not available for a given historical project, the Applicant obtained data on seabird densities from MERP (Waggitt *et al*., 2020) as specified by the SNCB's advice note from October 2023.

1.2.2.6 The calculation of densities used for input into collision risk modelling for northern gannet, black-legged kittiwake, lesser black-backed gull and herring gull followed the same method as for displacement and aligns with the recommended method from the SNCBs whereby the density of the birds within each of the 10 x 10 km grid squares presented within the MERP data was extracted (Waggitt *et al*., 2020). An average density was used per month, with the average taken from the different squares overlapping each historical project.

1.2.2.7 There is no predicted density estimate for great black-backed gull within the MERP data. Therefore, a different data source has been used to quantify the density of this species within the Irish Sea. The Seabird Mapping and Sensitivity Tool (SeaMaST) was identified as the most appropriate due to spatial and temporal coverage (Bradbury *et al*., 2014).

1.2.2.8 The SeaMaST data is presented at 3 x 3 km resolution for both flying and sitting birds and with a breakdown for boat-based and aerial surveys data. As the great black-backed gull densities presented from the aerial surveys were negligible, the boat-based survey data was used for collision risk modelling to be precautionary. It should be acknowledged that boat-based surveys consistently record larger densities of gull species compared to the aerial data outputs of Bradbury *et al*. (2014). The Applicant considers that using the boat-based data may overestimate the risk, but using this data is deemed more precautionary than aerial survey data.

1.2.2.9 Unlike MERP, SeaMaST presents the data in the breeding and non-breeding season and not monthly. Therefore, the seasonal definition from Furness (2015) was used with April to August as breeding and September to March as non-breeding. The density was considered consistent for each of these months.

1.2.2.10 Similarly to the MERP data, the SeaMaST data has multiple grid squares covering the historical projects, and therefore, the average density across the squares was used in the CRM.

1.2.2.11 A full breakdown of the data that has been used to gap-fill each historical project is provided in Table 1.7 and is presented in full in Appendix A:.

Table 1.7: Data sources used to gap-fill historical projects not quantified in the CEA of collision risk within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) at application.

Project	Species requiring gap-filling	Season requiring gap-filling	Data used to gap-fill historical project
Burbo Bank	Northern gannet, black-legged kittiwake and herring gull	All	MERP data are used for Burbo Bank for northern gannet, black-legged kittiwake and herring gull.
	Great black-backed gull		SeaMaST data are used for Burbo Bank for great black-backed gull.
Burbo Bank Extension	Great black-backed gull	All	SeaMaST data are used for Burbo Bank Extension for great black-backed gull.
Gwynt y Môr	Northern gannet, black-legged kittiwake and herring gull.	All	MERP data are used for Gwynt y Môr for northern gannet, black-legged kittiwake and herring gull.
	Great black-backed gull		SeaMaST data are used for Gwynt y Môr for great black-backed gull.
Robin Rigg	Northern gannet, black-legged kittiwake, lesser black-backed gull and herring gull.	All	MERP data are used for Robin Rigg for northern gannet, black-legged kittiwake, lesser black-backed gull and herring gull.
	Great black-backed gull		SeaMaST data are used for Robin Rigg for great black-backed gull.
Rhyl Flats Offshore Wind Farm	Northern gannet, black-legged kittiwake and herring gull	All	MERP data are used for Rhyl Flats for northern gannet, black-legged kittiwake and herring gull.
	Great black-backed gull		SeaMaST data are used for Rhyl Flats for great black-backed gull.
Walney 1 & 2 Offshore Wind Farms	Northern gannet, black-legged kittiwake and herring gull.	All	MERP data are used for Walney 1 and 2 for northern gannet, black-legged kittiwake and herring gull.
	Great black-backed gull		SeaMaST data are used for Walney 1 and 2 for great black-backed gull.
Walney Extension	Northern gannet	All	Project specific data was used for northern gannet (Ørsted, 2023)
West of Duddon Sands	Northern gannet, black-legged kittiwake and herring gull.	All	MERP data are used for West of Duddon Sands for northern gannet, black-legged kittiwake and herring gull.
	Great black-backed gull		SeaMaST data are used for West of Duddon Sands for great black-backed gull.

Correction factors for flying birds (MERP)

1.2.2.12 The MERP dataset incorporates all bird behaviours (i.e. sitting and flying birds). Only birds in flight are at risk of collision and therefore correction of the densities obtained from the MERP dataset is required.

1.2.2.13 The MERP data was corrected by using the average number of birds flying as recorded within the Mona Offshore Wind Project, Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Wind Farm: Generation Assets Digital Aerial Surveys (DAS) (Table 1.8), with data provided by each project. These three projects were considered to provide the best estimate as these recent surveys collectively cover a large proportion of the Irish Sea close to the historical projects to be gap-filled. The Applicant also considers these surveys to be the most valid, as each DAS programme was undertaken over a period of two years. Baseline characterisation surveys for older projects often lack appropriate sampling design and monthly coverage and, therefore, not considered as robust.

1.2.2.14 As advised during the meeting with NRW, the JNCC and Natural England on 29 August 2024, the Applicant has considered nearshore projects, specifically Awel y Môr, Burbo Bank Extension and Walney Extension. These projects being located in the eastern Irish Sea having used survey methods comparable to those undertaken for the Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Generation Assets.

1.2.2.15 Whist the application documentation for Burbo Bank Extension (Dong Energy, 2013a) and Walney Extension (Dong Energy, 2013b) presents information on the behaviour of birds during site-specific surveys, these data are not in a format to allow for direct comparison with the data available for the Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Generation Assets.

1.2.2.16 Given that birds in flight data was not available for the Walney extension or Burbo Bank Extension, the annual averages were calculated using monthly data from Awel y Môr, compared to Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Generation Assets (Table 1.8). As the differences between the Awel y Môr and the Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Generation Assets average would not make a material change to the conclusion of the assessment (see Table 1.8), the correction factors used within this technical note are based on the Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Generation Assets average and were applied to the MERP data to derive densities of birds in flight.

1.2.2.17 All densities used in the collision risk modelling are presented in section A.2. For clarity, the CRMs were run using the non-corrected densities and the average percentage of flying birds per species was applied to the CRM outputs. The collisions are presented to two decimal places, therefore when annual impacts should be used which take account of rounding.

Table 1.8: Percentage of birds recorded flying during Awel y Môr, Mona, Morgan and Morecambe DAS.

Species		Mona[1]	Morgan[2]	Morecambe[3]	Mona, Morgan and Morecambe Average	Awel y Môr[4]
Northern gannet	Percentage flying	45.35%	48.81%	26.88%	**40.35%**	27.76%
	Number of birds flying	434	307	268	N/A	98
	Total number of birds recorded	957	629	997	N/A	353
Black-legged kittiwake	Percentage flying	65.26%	59.21%	36.44%	**53.64%**	67.68%
	Number of birds flying	2,262	1,832	1,750	N/A	377
	Total number of birds recorded	3,466	3,094	4,803	N/A	557
Lesser black-backed gull	Percentage flying	61.82%	57.43%	61.22%	**60.16%**	N/A[5]
	Number of birds flying	34	58	90	N/A	N/A
	Total number of birds recorded	55	101	147	N/A	N/A
Herring gull	Percentage flying	50.00%	47.88%	29.59%	**42.49%**	33.91%
	Number of birds flying	36	158	87	N/A	39
	Total number of birds recorded	72	330	294	N/A	115

Footnotes

[1] Percentage of flying birds within Mona DAS taken from Volume 6, Annex 5.1: Offshore Ornithology Baseline Characterisation Technical Report (APP-093)

[2] Percentage of flying birds within Morgan DAS taken from Volume 5 - Appendix 12.1 - Offshore Ornithology Technical Report (Morgan Offshore Wind Project, 2024)

[3] Percentage of flying birds within Morecambe DAS taken from Volume 4, Annex 5.1: Offshore ornithology baseline characterisation (Morecambe Offshore Windfarm, 2024). Total number of birds presented is from modelled estimates.

[4] Percentage of flying birds within Awel y Môr DAS taken from Volume 4, Annex 4.1: Offshore Ornithology Baseline Characterisation Report (Awel Y Môr Offshore Wind Farm, 2022). Total number of birds presented is from modelled estimates.

[5] Awel y Môr DAS reported a very low number of lesser black-backed gull (nine individuals throughout all surveys) and therefore has not been included.

Wind farm parameters

1.2.2.18 Wind farm parameters for additional projects (both as-built and consented parameters) were sourced from the MacArthur Green database (Crown Estate, 2019). This database summarises offshore ornithological collision risk modelling data for all UK offshore wind farms. The database presents the consented and as-built scenarios if there is a difference. For some projects (e.g. Robin Rigg and Rhyl Flats), there is no consented parameter information available either within the MacArthur Green database or within the original submissions to deviate from the as-built scenario and therefore when undertaking CRM for these historical projects, only the as-built impact is presented.

1.2.2.19 The Crown Estate (2019) database does not include some of the parameters required for modelling the consented turbine scenarios for the Walney 1, Walney 2 and West of Duddon Sands offshore wind farms (namely hub height, which is required to calculate air gap). As-built parameters for these projects were used and accepted by the regulators for the gap-filled assessment of lesser black-backed gull by Walney Extension Offshore Wind Farms (Dong Energy, 2014). The Applicant has only presented as-built impacts for these two wind farms as this approach was accepted in the consenting of the Walney Extension Offshore Wind Farm.

Table 1.9: Wind farm parameters used within the CRMs for the historical projects gap-filling.

Project	Consented or as-built	Number of turbines	Turbine capacity (mw)	Hub height (m from HAT)	Rotor radius (m)	Average RPM	Maximum blade width (m)	Blade pitch (°)	Latitude (decimal degrees)	Width (km)
Burbo Bank	Consent	30	3	74	45	16.1	3.5	6	53.48	5.3
	As-built	25	3.6	79.5	53.5	13	4.2	15	53.48	5.3
Burbo Bank Extension	Consent	69	3.6	81	60	13	4.2	6	53.48	13.4
	As-built	32	8	103	82	10.5	5.4	15	53.48	13.4
Gwynt y Môr	Consent	250	3	67.5	45	16.1	3.6	15	53.45	15.2
	As-built	160	3.6	94	53.5	13	4.2	15	53.45	15.2
Robin Rigg	Consented	Parameters not presented in The Crown Estate (2019).								
	As-built	60	3	76	45	16.1	3.5	15	54.75	6.01
Rhyl Flats Offshore Wind Farm	Consented	Parameters not presented in The Crown Estate (2019).								
	As-built	25	3.6	76	53.5	13.5	4.2	15	53.38	5.6
Walney 1 & 2 Offshore Wind Farms	Consented	There is precedent that the as-built parameters have been used when undertaking gap-filled analysis for collision impacts. See Dong Energy (2014).								
	As-built	102	3.6	78.5 to 86	53.5 to 60	13	4.2	15	54.03 and 54.08	7.8 to 8.9
West of Duddon Sands	Consented	There is precedent that the as-built parameters have been used when undertaking gap-filled analysis for collision impacts. See Dong Energy (2014).								
	As-built	108	3.6	86	60	13	4.2	15	53.98	11.9

Avoidance rates used

1.2.2.20 Within this document, both the species-group and species-specific avoidance rates have been used, both of which come from Ozsanlev-Harris *et al.* (2023). The SNCBs have shown a preference for species-group avoidance rates (section D.3.13 of Technical Engagement Plan Appendices Part 1 (A to E) (APP-042) whilst the Applicant believes the species-specific avoidance rates are robust and should be used. Section 1.5.2 of Volume 6, Annex 5.3: Offshore Ornithology Collision Risk Modelling Technical Report (REP2-020) provides the justification as to why the species-specific avoidance rates are robust and should form the basis of the assessment. Not all species considered within the collision risk assessment have species-specific avoidance rates (e.g. northern gannet). The species-specific and species-group avoidance rates are presented within Table 1.10 below.

1.2.2.21 The CRM was run deterministically, as there was no variation presented for the density estimates or the wind turbine parameters and therefore, a stochastic CRM could not be run. The avoidance rates presented in Table 1.10 also do not have a specific standard deviation.

Table 1.10: Avoidance rates used within the collision risk assessment for historical projects.

Project	Species-group avoidance rate (%) – section D.3.13 of Technical Engagement Plan Appendices - Part 1 (A to E) (APP-042)	Species-specific avoidance rate (%) – table 2 of from Ozsanlev-Harris *et al.* (2023)
Black-legged kittiwake	99.28 (gull rate)	99.70
Great black-backed gull	99.39 (large gull rate)	99.91
Herring gull	99.39 (large gull rate)	99.52
Lesser black-backed gull	99.39 (large gull rate)	99.54
Northern gannet	99.28 (gull rate)	None

Collision risk model used

1.2.2.22 Collision risk modelling was undertaken using the stochastic CRM (sCRM) developed by Marine Scotland (McGregor et al., 2018). The sCRM provides a user-friendly ‘Shiny App’ online interface, allowing input parameter variability to be incorporated into the model, producing predicted collision estimates with associated uncertainty. Additionally, the sCRM provides a useful audit trail of input parameters and outputs, enabling reviewers to easily assess and reproduce the results of any modelling scenario. The User Guide for the sCRM Shiny App provided by Marine Scotland (Donovan, 2017) has been followed for modelling collision impacts predicted for the Mona Array Area.

1.2.2.23 Collision risk models were run deterministically as there was no variation metric available for the density estimates or wind farm and wind turbine parameters, and therefore, a stochastic CRM could not be run, using Band Option 2 of the sCRM. The proportion of birds flying at collision risk height was determined using generic flight height data rather than site-based data. These generic data were taken from Johnston et al. (2014a; 2014b), who analysed flight height measurements from surveys conducted at 32 sites around the UK.

1.3 Results

1.3.1 Displacement during the operation and maintenance phase

Atlantic puffin

1.3.1.1 Full results of the gap-filled displacement CEA for Atlantic puffin are presented in section A.1.1 and summarised here.

1.3.1.2 During the breeding season, the cumulative abundance of Atlantic puffin is estimated at 6,966 individual birds. This compares to 6,960 individual birds presented within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.013 % (0.008 to 0.187%; Table 1.11). The increase in baseline mortality has not changed from 0.013 % (0.008 to 0.187%), as presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). There is no difference in the increase in baseline mortality between the original CEA and the CEA with gap-filled historical projects. The range presented in brackets represents between 30% displacement and 1% mortality and 70% displacement and 10% mortality, with the Applicant’s identified impact presented using 50% displacement and 1% mortality.

1.3.1.3 During the non-breeding season, the cumulative abundance of Atlantic puffin is estimated at 1,557 individual birds. This compares to 1,554 individual birds presented within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.015% (0.009 to 0.203%;Table 1.11). The increase in baseline mortality has not changed from 0.015% (0.009 to 0.203%), as presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). There is no difference in the increase in baseline mortality between the original CEA and the CEA with gap-filled historical projects.

1.3.1.4 Annually, the cumulative abundance of Atlantic puffin is estimated at 8,523 individual birds. This compares to 8,514 individual birds presented within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.016% (0.010% to 0.229%; Table 1.11). The increase in baseline mortality has not changed from 0.016% (0.010% to 0.228%) presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). There is no difference in the increase in baseline mortality between the original CEA and the CEA with gap-filled historical projects.

1.3.1.5 Due to no change occurring (Table 1.11) in the increase in baseline mortality between the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and the CEA with gap-filled historical projects, there is no change in the magnitude of impact on Atlantic puffin presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03).

1.3.1.6 Within Table 1.11 the range presented in brackets represents between 30% displacement and 1% mortality and 70% displacement and 10% mortality, with the Applicant’s identified impact presented using 50% displacement and 1% mortality.

Table 1.11: Atlantic puffin annual and seasonal increase in baseline mortality from displacement presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and re-calculated including all projects (including gap-filled projects).

	Increase in baseline mortality - Annual	Increase in baseline mortality – Breeding	Increase in baseline mortality – Non-breeding
CEA Environmental Statement – excluding collision estimates from tidal projects	0.016% (0.010% to 0.228%)	0.013 % (0.008 to 0.187%)	0.015% (0.009 to 0.203%)
CEA gap-filled	0.016% (0.010% to 0.229%)	0.013 % (0.008 to 0.187%)	0.015% (0.009 to 0.203%)
Difference in baseline mortality	**No change**	**No change**	**No change**

1.3.1.7 Based on there being no differences in baseline mortalities (Table 1.11), the additional historical projects do not affect the conclusions of the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) for Atlantic puffin, which concluded minor adverse effect.

1.3.1.8 Furthermore, very small differences in overall displacement mortalities, if applied to individual SPAs, would not lead to material changes in the HRA Stage 2 Information to Support an Appropriate Assessment (ISAA) Part Three: Special Protection Areas and Ramsar sites Assessments (REP2-010) and therefore would not affect the overall conclusions of no AEOI on any SPAs designated for Atlantic puffin.

Black-legged kittiwake

1.3.1.9 Full results of the gap-filled displacement CEA for black-legged kittiwake are presented in section A.1.2 and summarised here.

1.3.1.10 During the pre-breeding season, the cumulative abundance of black-legged kittiwake is estimated at 7,615 individual birds. This compares to 7,235 individual birds presented within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.035% (0.021 to 0.494%; Table 1.12). The increase in baseline mortality has changed from 0.034% (0.020 to 0.469%), as presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). The difference in increase in baseline mortality between the original CEA and the CEA with gap-filled historical projects is predicted to be 0.001%. The range presented in brackets represents between 30% displacement and 1% mortality and 70% displacement and 10% mortality, with the Applicant's identified impact presented using 50% displacement and 1% mortality.

1.3.1.11 During the breeding season, the cumulative abundance of black-legged kittiwake is estimated at 10,701 individual birds. This compares to 10,022 individual birds presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.140% (0.084 to 1.958%; Table 1.12). The increase in baseline mortality has changed from 0.131% (0.078 to 1.835%), as presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). The difference in increase in baseline mortality between the original CEA and the CEA with gap-filled historical projects is predicted to be 0.009%.

1.3.1.12 During the post-breeding season, the cumulative abundance of black-legged kittiwake is estimated at 9,754 individual birds. This compares to 9,40810,022 individual birds presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.034% (0.021 to 0.480%; Table 1.12). The increase in baseline mortality has changed from 0.033% (0.020 to 0.463%), as presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). The difference in increase in baseline mortality between the original CEA and the CEA with gap-filled historical projects is predicted to be 0.001%.

1.3.1.13 Annually, the cumulative abundance of black-legged kittiwake is estimated at 28,070 individual birds. This compares to 26,665 individual birds presented within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.099% (0.059 to 1.382%; Table 1.12). The increase in baseline mortality has changed from 0.094% (0.056 to 1.313%), as presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). The difference in increase in baseline mortality between the original CEA and the CEA with gap-filled historical projects is predicted to be 0.005%.

1.3.1.14 Due to the relatively small change (between a 0.001 and 0.018% increase; Table 1.12) in mortality between the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and the CEA considering all projects (including those gap-filled), there is no change in the magnitude of impact on black-legged kittiwake presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03).

1.3.1.15 Within Table 1.12, the range presented in brackets represents between 30% displacement and 1% mortality and 70% displacement and 10% mortality, with the Applicant's identified impact presented using 50% displacement and 1% mortality.

Table 1.12: Black-legged kittiwake annual and seasonal increase in baseline mortality from displacement presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03) and re-calculated including all projects (including gap-filled projects).

	Increase in baseline mortality - Annual	Increase in baseline mortality – Pre-breeding	Increase in baseline mortality – Breeding	Increase in baseline mortality – Post-breeding
CEA Environmental Statement	0.094% (0.056 to 1.313%)	0.034% (0.020 to 0.469%)	0.131% (0.078 to 1.835%)	0.033% (0.020 to 0.463%)
CEA gap-filled	0.099% (0.059 to 1.382%)	0.035% (0.021 to 0.494%)	0.140% (0.084 to 1.958%)	0.034% (0.021 to 0.480%)
Difference in baseline mortality	**0.005%**	**0.001%**	**0.009%**	**0.001%**

1.3.1.16 Based on the small differences in baseline mortalities (Table 1.12), the additional historical projects do not affect the conclusions of the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) for black-legged kittiwake, which concluded a negligible effect.

1.3.1.17 Furthermore, small differences in overall displacement mortalities, if applied to individual Special Protection Areas (SPA), would not lead to material changes in the HRA Stage 2 Information to Support an Appropriate Assessment Part Three: Special Protection Areas and Ramsar Sites Assessments (REP2-010) and therefore would not affect the overall conclusions of no AEOI on any SPAs designated for black-legged kittiwake.

Common guillemot

1.3.1.18 Full results of the gap-filled displacement CEA for common guillemot are presented in section A.1.3 and summarised here.

1.3.1.19 During the breeding season, the cumulative abundance of common guillemot is estimated at 37,877 individual birds. This compares to 37,477 individual birds presented within the Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.124% (0.075 to 1.740%; Table 1.13). The increase in baseline mortality has changed from 0.123% (0.074 to 1.722%), as presented in the Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). The difference in the increase in baseline mortality between the original CEA and the CEA with gap-filled historical projects is predicted to be 0.001%. The range presented in brackets represents between 30% displacement and 1% mortality and 70% displacement and 10% mortality, with the Applicant's identified impact presented using 50% displacement and 1% mortality.

1.3.1.20 During the non-breeding season, the cumulative abundance of common guillemot is estimated at 56,668 individual birds. This compares to 55,800 individual birds presented within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.187% (0.112 to 2.618%; Table 1.13). The increase in baseline mortality has changed from 0.184% (0.110 to 2.578%), as presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). The difference in increase in baseline mortality between the original CEA and the CEA with gap-filled historical projects is predicted to be 0.003%.

1.3.1.21 Annually, the cumulative abundance of common guillemot is estimated at 94,545 individual birds. This compares to 93,278 individual birds presented within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.310% (0.186% to 4.344%; Table 1.13). The increase in baseline mortality has changed from 0.306% (0.184% to 4.285%) presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). The difference in the increase in baseline mortality between the original CEA and the CEA with gap-filled historical projects is predicted to be 0.004%.

1.3.1.22 Due to the negligible change (between a 0.001 and 0.004% increase; Table 1.13) in the increase in baseline mortality between the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and the CEA with gap-filled historical projects, there is no change in the magnitude of impact on common guillemot presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03).

1.3.1.23 Within Table 1.13 the range presented in brackets represents between 30% displacement and 1% mortality and 70% displacement and 10% mortality, with the Applicant's identified impact presented using 50% displacement and 1% mortality.

Table 1.13: Common guillemot annual and seasonal increase in baseline mortality from displacement presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and re-calculated including all projects (including gap-filled projects).

	Increase in baseline mortality - Annual	Increase in baseline mortality – Breeding	Increase in baseline mortality – Non-breeding
CEA Environmental Statement – excluding collision estimates from tidal projects	0.306% (0.184 to 4.285%)	0.123% (0.074 to 1.722%)	0.184% (0.110 to 2.578%)
CEA gap-filled	0.310% (0.186% to 4.344%)	0.124% (0.075 to 1.740%)	0.187% (0.112 to 2.618%)
Difference in baseline mortality	**0.004%**	**0.001%**	**0.003%**

1.3.1.24 Based on the very small differences in baseline mortalities (Table 1.13), the additional historical projects do not affect the conclusions of the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) for common guillemot, which concluded minor adverse effect.

1.3.1.25 Furthermore, very small differences in overall displacement mortalities, if applied to individual SPAs, would not lead to material changes in the HRA Stage 2 Information to Support an Appropriate Assessment (ISAA) Part Three: Special Protection Areas and Ramsar sites Assessments (REP2-010) and therefore would not affect the overall conclusions of no AEOI on any SPAs designated for common guillemot.

Manx shearwater

1.3.1.26 Full results of the gap-filled displacement CEA for Manx shearwater are presented in section A.1.4 and summarised here.

1.3.1.27 During the pre-breeding season, the cumulative abundance of Manx shearwater is estimated at 12,386 individual birds. This compares to 12,383 individual birds presented within Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.030% (0.018 to 0.422%; Table 1.14). The increase in baseline mortality has not changed from 0.030% (0.018 to 0.422%), as presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). The range presented in brackets represents between 30% displacement and 1% mortality and 70% displacement and 10% mortality, with the Applicant's identified impact presented using 50% displacement and 1% mortality.

1.3.1.28 During the breeding season, the cumulative abundance of Manx shearwater is estimated at 14,815 individual birds. This compares to 14,779 individual birds presented within Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.031% (0.002 to 0.438%; Table 1.14). The increase in baseline mortality has changed from 0.031% (0.019 to 0.437%), as presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). The difference in the increase in baseline mortality between the original CEA and the CEA with gap-filled historical projects is predicted to be 0.002%.

1.3.1.29 During the post-breeding season, the cumulative abundance of Manx shearwater is estimated at 1,627 individual birds. This compares to 1,612 individual birds presented within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.004% (0.002 to 0.055%; Table 1.14). The increase in baseline mortality has not changed from 0.004% (0.002 to 0.055%), as presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03).

1.3.1.30 Annually, the cumulative abundance of Manx shearwater is estimated at 28,827 individual birds. This compares to 28,774 individual birds presented Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.061% (0.037 to 0.852%; Table 1.14). The increase in baseline mortality has not changed from 0.061% (0.036 to 0.850%), as presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03).

1.3.1.31 Due to very small changes (0.002% increase; Table 1.14) in mortality between the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and the CEA considering all projects (including those gap-filled), there is no change in the magnitude of impact on Manx shearwater presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03).

1.3.1.32 Within Table 1.14 the range presented in brackets represents between 30% displacement and 1% mortality and 70% displacement and 10% mortality, with the Applicant's identified impact presented using 50% displacement and 1% mortality.

Table 1.14: Manx shearwater annual and seasonal increase in baseline mortality from displacement presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and re-calculated including all projects (including gap-filled projects).

	Increase in baseline mortality - Annual	Increase in baseline mortality – Pre-breeding	Increase in baseline mortality – Breeding	Increase in baseline mortality – Post-breeding
CEA Environment Statement	0.061% (0.036 to 0.852%)	0.030% (0.018 to 0.422%)	0.031% (0.019 to 0.437%)	0.004% (0.002 to 0.055%)
CEA gap-filled	0.061% (0.037 to 0.851%)	0.030% (0.018 to 0.422%)	0.031% (0.002 to 0.438%)	0.004% (0.002 to 0.055%)
Difference in baseline mortality	**No change**	**No change**	**No change**	**No change**

1.3.1.33 Based on the very small differences in baseline mortalities (Table 1.14), the additional historical projects do not affect the conclusions of the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03), which concluded negligible effect.

1.3.1.34 Furthermore, very small differences in overall displacement mortalities if applied to individual SPAs would not lead to material changes in the HRA Stage 2 Information to Support an Appropriate Assessment Part Three: Special Protection Areas and Ramsar sites Assessments (REP2-010) and therefore would not affect the overall conclusions of no AEOI on any SPAs designated for Manx shearwater.

Northern gannet

1.3.1.35 Full results of the gap-filled displacement CEA for northern gannet are presented in section A.1.5 and summarised here.

1.3.1.36 During the pre-breeding season, the cumulative abundance of northern gannet is estimated at 483 individual birds. This compares to 430 individual birds presented within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.002% (0.002 to 0.030%; Table 1.15) when considering 70% displacement and 1% mortality (range shown is from 60% displacement and 1% mortality to 80% displacement and 10% mortality). The increase in baseline mortality has not changed from 0.002% (0.002 to 0.027%), as presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). The range presented in brackets represents between 60% displacement and 1% mortality and 80% displacement and 10% mortality, with the Applicant's identified impact presented using 70% displacement and 1% mortality.

1.3.1.37 During the breeding season, the cumulative abundance of northern gannet is estimated at 4,717 individual birds. This compares to 4,629 individual birds presented within Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.033% (0.028 to 0.374%; Table 1.15). The increase in baseline mortality has changed from 0.032% (0.028 to 0.370%), as presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). The difference in the increase in baseline mortality between the original CEA and the CEA with gap-filled historical projects is predicted to be 0.001%.

1.3.1.38 During the post-breeding season, the cumulative abundance of northern gannet is estimated at 2,718 individual birds. This compares to 2,630 individual birds presented within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.018% (0.015 to 0.206%; Table 1.15). The increase in baseline mortality has changed from 0.017% (0.015 to 0.199%), as presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). The difference in the increase in baseline mortality between the original CEA and the CEA with gap-filled historical projects is predicted to be 0.001%.

1.3.1.39 Annually, the cumulative abundance of northern gannet is estimated at 7,918 individual birds. This compares to 7,689 individual birds presented within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.043% (0.037 to 0.496%; Table 1.15). The increase in baseline mortality has changed from 0.042% (0.036 to 0.481%), as presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). The difference in the increase in baseline mortality between the original CEA and the CEA with gap-filled historical projects is predicted to be 0.001%.

1.3.1.40 Due to the very small change (a 0.001 increase; Table 1.15) in mortality between the CEA presented in the Environmental Statement and the CEA considering all projects (including those gap-filled), there is no change in the magnitude of impact on northern gannet presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03).

1.3.1.41 Within Table 1.15 the range presented in brackets represents between 60% displacement and 1% mortality and 80% displacement and 10% mortality, with the Applicant's identified impact presented using 70% displacement and 1% mortality.

Table 1.15: Northern gannet annual and seasonal increase in baseline mortality from displacement presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03) and re-calculated including all projects (including gap-filled projects).

	Increase in baseline mortality - Annual	Increase in baseline mortality – Pre-breeding	Increase in baseline mortality – Breeding	Increase in baseline mortality – Post-breeding
CEA Environmental Statement	0.042% (0.036 to 0.481%)	0.002% (0.002 to 0.027%)	0.032% (0.028% to 0.367%)	0.017% (0.015 to 0.199%)
CEA gap-filled	0.043% (0.037 to 0.496%)	0.002% (0.002 to 0.030%)	0.033% (0.028 to 0.374%)	0.018% (0.015 to 0.206%)
Difference in baseline mortality	**0.001%**	**No change**	**0.001%**	**0.001%**

1.3.1.42 Based on the very small differences in baseline mortalities (Table 1.15), the additional historical projects do not affect the conclusions of the CEA presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03) for northern gannet, which concluded negligible effect.

1.3.1.43 Furthermore, very small differences in overall displacement mortalities, if applied to individual SPAs, would not lead to material changes in the HRA Stage 2 Information to Support an Appropriate Assessment Part Three: Special Protection Areas and Ramsar sites Assessments (REP2-010) and therefore would not affect the overall conclusions of no AEOI on any SPAs designated for northern gannet.

Razorbill

1.3.1.44 Full results of the gap-filled displacement CEA for razorbill are presented in section A.1.6 and summarised here.

1.3.1.45 During the pre-breeding season, the cumulative abundance of razorbill is estimated at 4,279 individual birds. This compares to 4,153 individual birds presented within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.020% (0.012 to 0.287%; Table 1.16). The increase in baseline mortality has not changed from 0.020% (0.012 to 0.278%), as presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). The range presented in brackets represents between 30% displacement and 1% mortality and 70% displacement and 10% mortality, with the Applicant's identified impact presented using 50% displacement and 1% mortality.

1.3.1.46 During the breeding season, the cumulative abundance of razorbill is estimated at 1,289 individual birds. This compares to 1,258 individual birds presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.019% (0.011 to 0.264%; Table 1.16). The increase in baseline mortality has changed from 0.018% (0.012 to 0.287%), as presented Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). The difference in the increase in baseline mortality between the original CEA and the CEA with gap-filled historical projects is predicted to be 0.001%.

1.3.1.47 During the post-breeding season, the cumulative abundance of razorbill is estimated at 3,777 individual birds. This compares to 3,700 individual birds presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.018% (0.011 to 0.253%; Table 1.16). The increase in baseline mortality has not changed from 0.018% (0.011 to 0.248%), as presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03).

1.3.1.48 During the non-breeding season, the cumulative abundance of razorbill is estimated at 6,302 individual birds. This compares to 6,195 individual birds presented within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.054% (0.032 to 0.751%; Table 1.16). The increase in baseline mortality has changed from 0.053% (0.032 to 0.738%), as presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). The difference in the increase in baseline mortality between the original CEA and the CEA with gap-filled historical projects is predicted to be 0.001%.

1.3.1.49 Annually, the cumulative abundance of razorbill is estimated at 15,647 individual birds. This compares to 15,306 individual birds presented within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). When considering the population, including the gap-filled historical projects, the increase in baseline mortality could be 0.075% (0.045 to 1.049%; Table 1.16). The increase in baseline mortality has changed from 0.073% (0.044 to 1.026%), as presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). The difference in the increase in baseline mortality between the original CEA and the CEA with gap-filled historical projects is predicted to be 0.002%.

1.3.1.50 Due to the very small change (between a 0.001 and 0.002% increase; Table 1.16) in mortality between the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and the CEA considering all projects (including those gap-filled), there is no change in the magnitude of impact on razorbill presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03).

1.3.1.51 Within Table 1.16 the range presented in brackets represents between 30% displacement and 1% mortality and 70% displacement and 10% mortality, with the Applicant's identified impact presented using 50% displacement and 1% mortality.

Table 1.16: Razorbill annual and seasonal increase in mortality from displacement baseline presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03) and re-calculated including all projects (including gap-filled projects).

	Increase in baseline mortality - Annual	Increase in baseline mortality – Pre-breeding	Increase in baseline mortality – Breeding	Increase in baseline mortality – Post-breeding	Increase in baseline mortality – Non-breeding
CEA Environmental Statement	0.073% (0.044 to 1.026%)	0.020% (0.012 to 0.278%)	0.018% (0.012 to 0.287	0.018% (0.011 to 0.248%)	0.053% (0.032 to 0.738%)
CEA gap-filled	0.075% (0.045 to 1.049%)	0.020% (0.012 to 0.287%).	0.019% (0.011 to 0.264%)	0.018% (0.011 to 0.253%)	0.054% (0.032 to 0.751%)
Difference in baseline mortality	**0.002%**	**No change**	**0.001%**	**No change**	**0.001%**

1.3.1.52 Based on the very small differences in baseline mortalities (Table 1.16), the additional historical projects do not affect the conclusions of the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) for razorbill, which concluded negligible effect.

1.3.1.53 Furthermore, very small differences in overall displacement mortalities, if applied to individual SPAs, would not lead to material changes in the HRA Stage 2 Information to Support an Appropriate Assessment Part Three: Special Protection Areas and Ramsar sites Assessments (REP2-010) and therefore would not affect the overall conclusions of no AEOI on any SPAs designated for razorbill.

1.3.2 Collision risk assessment during the operation and maintenance phase

Black-legged kittiwake

1.3.2.1 Full results of the gap-filled collision CEA for black-legged kittiwake are presented in section A.2.1 and summarised here.

1.3.2.2 When considering the species-group avoidance rate (99.28) and the consented and as-built parameters of the historical projects, the updated collision total could be 617.17 birds annually. This is an increase of 57.93 birds compared with the CEA within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). This would result in an increase in baseline mortality of 0.434% (up from 0.393% from the CEA within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03)), as shown in Table 1.17.

1.3.2.3 Due to the marginal increase in baseline morality of 0.041% predicted when using the species-group avoidance rate (99.28), it was not deemed necessary to rerun the CRM for the species-specific avoidance rate (99.79). Any impact using the species-specific avoidance rate would be less than what is presented using the species-grouped avoidance rate and therefore the conclusions will stay the same.

1.3.2.4 When considering the as-built parameters of the historical projects, this would reduce the impact on the population and result in a smaller predicted mortality and subsequent increase in baseline mortality (Table 1.17).

1.3.2.5 The increase in baseline mortality, when considering the historical projects (up to 0.434%), would still be considered to be of low magnitude in EIA terms. Therefore, this small change in mortality between the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and the CEA considering all projects (including those gap-filled) would not result in a change in the magnitude of impact on black-legged kittiwake presented in the Environmental Statement. As the impact is predicted to be <1% increase in baseline mortality a PVA is not required (Parker *et al*., 2022).

Table 1.17: Black-legged kittiwake annual increase in baseline mortality from collision impacts presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and re-calculated including gap-filled projects using the species-group avoidance rate (99.2).

	Wind farm parameters	Annual increase in baseline mortality – Avoidance rate 99.28
CEA Environmental Statement	Consented	0.393%
CEA gap-filled	Consented and as-built parameters for the historical projects	0.434%
	As-built parameters for the historical projects	0.416%
Difference in baseline mortality	Consented and as-built parameters for the historical projects	**0.041%**
	As-built parameters for the historical projects	**0.023%**

1.3.2.6 Based on the small differences in baseline mortalities (Table 1.17), the additional historical projects do not affect the conclusions of the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) for black-legged kittiwake, which concluded of minor adverse effect.

1.3.2.7 Furthermore, small differences in overall collision mortalities, if applied to individual SPAs, would not lead to material changes in the HRA Stage 2 Information to Support an Appropriate Assessment Part Three: Special Protection Areas and Ramsar sites Assessments (REP2-010) and therefore would not affect the overall conclusions of no AEOI on any SPAs designated for black-legged kittiwake.

Great black-backed gull

1.3.2.8 Full results of the gap-filled collision CEA for great black-backed gull are presented in section 0 and summarised here.

1.3.2.9 When considering the species-group avoidance rate (99.39) and the consented and as-built parameters of the historical projects, the updated collision total would be 171.41 birds annually. This is an increase of 42.05 birds compared with the CEA within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). This would result in an increase in baseline mortality of 10.170%. (up 2.495% from 7.675% from the impact presented in CEA within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) but with the revised population size). Within Table 1.18 the percentage increase in baseline mortality differs to that presented within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) as the Applicant has taken Natural England and NRW's advice and revised the population size used for the CEA (see Table 1.1 and the entry for 29 August 2024). The population size presented within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) was provided to the Applicant during the EPP (see D.6.5 of Technical Engagement Plan Appendices - Part 1 (A to E) (APP-042), but the Applicant has been subsequently been made aware of a revised population size and has applied it within this document.

1.3.2.10 When considering the species-specific avoidance rate (99.91) and the consented and as-built parameters of the historical projects, the updated collision total could be 25.29 birds annually. This is an increase of 4.66 birds compared with the CEA within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). This would result in an increase in baseline mortality of 1.500% (up 0.368% from 1.132% in the CEA within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) but with the revised population size).

1.3.2.11 When considering the as-built parameters of the historical projects, this would reduce the impact on the population and result in a smaller predicted mortality and subsequent increase in baseline mortality (Table 1.18).

1.3.2.12 This estimated annual impact from historical projects could change the predicted increase in baseline mortality by up to 2.495% (Table 1.18), compared to the impact presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and a decrease in the population size.

1.3.2.13 Due to the change in mortality between the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and the gap-filled CEA, there is the need to undertake further assessment (PVA) of the impact to see if the magnitude of impact presented within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) is still valid. Further assessment (PVA) on great black-backed gull is presented within section 1.4.

Table 1.18: Great black-backed gull annual increase in baseline mortality from collision impacts presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and re-calculated including all projects (including gap-filled projects).

	Wind farm parameters	Annual increase in baseline mortality – Avoidance rate 99.39	Annual increase in baseline mortality – Avoidance rate 99.91
CEA Environmental Statement – updated in line with new SNCB population size guidance	Consented	7.675%	1.132%
CEA gap-filled	Consented and as-built parameters for the historical projects	10.170%	1.500%
	As-built parameters for the historical projects	9.551%	1.409%
Difference in baseline mortality	Consented and as-built parameters for the historical projects	2.495%	0.368%
	As-built parameters for the historical projects	1.876%	0.277%

Herring gull

1.3.2.14 Full results of the gap-filled collision CEA for herring gull are presented in section A.2.3 and summarised here.

1.3.2.15 When considering the species-group avoidance rate (99.39) and the consented and as-built parameters of the historical projects, the updated collision total could be 278.43 birds annually, compared with 148.07 in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03) submitted at Deadline 4. This is an increase of 130.36 birds compared with the Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). This would result in an increase in baseline mortality of 0.750% (up from 0.399% from Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)).

1.3.2.16 When considering the species-specific avoidance rate (99.52) and the consented and as-built parameters of the historical projects, the updated collision total could be 196.16 birds annually. This is an increase of 79.65 birds compared with the Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). This would result in an increase in baseline mortality of 0.528% (up from 0.314% from Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)).

1.3.2.17 When considering the as-built parameters of the historical projects, this would reduce the impact on the population and result in a smaller predicted mortality and subsequent increase in baseline mortality (Table 1.19).

1.3.2.18 This estimated annual impact from historical projects could change the predicted increase in baseline mortality by up to 0.339% (Table 1.19), compared to the impact presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). As the impact is predicted to be <1% increase in baseline mortality, a PVA is not required (Parker *et al.*, 2022).

Table 1.19: Herring gull annual increase in baseline mortality from collision impacts presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03) and re-calculated including all projects (including gap-filled projects).

	Wind farm parameters	Annual increase in baseline mortality – Avoidance rate 99.39	Annual increase in baseline mortality – Avoidance rate 99.52
Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)	Consented	0.399%	0.314%
CEA gap-filled	Consented and as-built parameters for the historical projects	0.750%	0.590%
	As-built parameters for the historical projects	0.671%	0.528%
Difference in baseline mortality	Consented and as-built parameters for the historical projects	**0.351%**	**0.276%**
	As-built parameters for the historical projects	**0.272%**	**0.214%**

1.3.2.19 Based on the differences in baseline mortalities (Table 1.19), the additional historical projects do not affect the conclusions of the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) for herring gull, which concluded minor adverse effect.

1.3.2.20 Furthermore, very small differences in overall collision mortalities, if applied to individual SPAs, would not lead to material changes in the HRA Stage 2 Information to Support an Appropriate Assessment Part Three: Special Protection Areas and Ramsar sites Assessments (REP2-010) and therefore would not affect the overall conclusions of no AEOI on any SPAs designated for herring gull.

Lesser black-backed gull

1.3.2.21 Full results of the gap-filled collision CEA for lesser black-backed gull are presented in section A.2.4 and summarised here.

1.3.2.22 When considering the species-group avoidance rate (99.39) and the as-built parameters of the historical projects, the updated collision total could be 285.29 birds annually compared with 275.76 from Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). This is an increase of 9.53 birds compared with the CEA within Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). This would result in an increase in baseline mortality of 0.978% (up from 0.945% from Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)).

1.3.2.23 When considering the species-specific avoidance rate (99.54) and the as-built parameters of the historical projects, the updated collision total could be 215.58 birds annually compared with 208.97 from Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). This is an increase of 6.61 birds compared with the Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). This would result in an increase in baseline mortality of 0.737% (up from 0.716% from Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)).

1.3.2.24 The increase in baseline mortality, when considering the historical projects (up to 0.978%), would still be considered to be of low magnitude in EIA terms. Therefore, this change in mortality between the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and the CEA considering all projects (including those gap-filled) would not result in a change in the magnitude of impact on lesser black-backed gull presented in the Environmental Statement. As the impact is predicted to be <1% increase in baseline mortality, a PVA is not required (Parker *et al*., 2022).

Table 1.20: Lesser black-backed gull annual increase in baseline mortality from collision impacts presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03) and re-calculated including all projects (including gap-filled projects).

	Wind farm parameters	Annual increase in baseline mortality – Avoidance rate 99.39	Annual increase in baseline mortality – Avoidance rate 99.54
CEA Environmental Statement	Consented and as-built parameters	0.947%	0.717%
CEA gap-filled	As-built parameters for the historical projects	0.979%	0.739%
Difference in baseline mortality	As-built parameters for the historical projects	**0.032%**	**0.021%**

1.3.2.25 Based on the very small differences in baseline mortalities (Table 1.20), the additional historical projects do not affect the conclusions of the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) for lesser black-backed gull, which concluded of minor adverse effect.

1.3.2.26 Furthermore, very small differences in overall collision mortalities, if applied to individual SPAs, would not lead to material changes in the HRA Stage 2 Information to Support an Appropriate Assessment Part Three: Special Protection Areas and Ramsar sites Assessments (REP2-010) and therefore would not affect the overall conclusions of no AEOI on any SPAs designated for lesser black-backed gull.

Northern gannet

1.3.2.27 Full results of the gap-filled collision CEA for northern gannet are presented in section A.2.5 and summarised here.

1.3.2.28 When considering the avoidance rate (99.28) and the consented and as-built parameters of the historical projects, the updated collision total could be 177.48 birds annually, compared to 159.87 birds in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). This is an increase of 17.61 birds compared with the CEA in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). This would result in an increase in baseline mortality of 0.139% (up from 0.125% from the CEA within Volume 2, Chapter 5: Offshore ornithology (F2.5 F03)).

1.3.2.29 When considering the as-built parameters of the historical projects, this would reduce the impact on the population and result in a smaller predicted mortality and subsequent increase in baseline mortality (Table 1.21).

1.3.2.30 The increase in baseline mortality, when considering the historical projects (up to 0.139%), would still be considered to be of low magnitude in EIA terms. Therefore, this small change in mortality between the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and the CEA considering all projects (including those gap-filled) would not result in a change in the magnitude of impact on northern gannet presented in the Environmental Statement. As the impact is predicted to be <1% increase in baseline mortality a PVA is not required (Parker *et al*., 2022).

Table 1.21: Northern gannet annual increase in baseline mortality from collision impacts presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and re-calculated including all projects (including gap-filled projects) using species-group avoidance rate of 99.28.

	Wind farm parameters	Annual increase in baseline mortality – Avoidance rate 99.28
CEA Environmental Statement	Consented	0.125%
CEA gap-filled	Consented and as-built parameters for the historical projects	0.139%
	As-built parameters for the historical projects	0.132%
Difference in baseline mortality	Consented and as-built parameters for the historical projects	**0.014%**
	As-built parameters for the historical projects	**0.007%**

1.3.2.31 Based on the small differences in baseline mortalities (Table 1.21), the additional historical projects do not affect the conclusions of the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) for northern gannet, which concluded a minor adverse effect.

1.3.2.32 Furthermore, very small differences in overall collision mortalities, if applied to individual SPAs would not lead to material changes in the HRA Stage 2 Information to Support an Appropriate Assessment Part Three: Special Protection Areas and Ramsar sites Assessments (REP2-010) and therefore would not affect the overall conclusions of no AEOI on any SPAs designated for northern gannet.

1.3.3 Combined displacement and collision risk during the operation and maintenance phase

Black-legged kittiwake

1.3.3.1 During the pre-breeding season, the combined impacts of displacement and collision from the cumulative operation and maintenance phase on black-legged kittiwake when using a displacement rate of 50%, a mortality rate of 1% and a species-group avoidance rate of 99.28 would increase the baseline mortality by 0.195% when considering all projects. When compared to the increase in mortality of 0.138% presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03), this represented a small change in baseline mortality of 0.057% (Table 1.22).

1.3.3.2 During the breeding season, the combined impacts of displacement and collision from the cumulative operation and maintenance phase on black-legged kittiwake assuming the same parameters as outlined above would increase the baseline mortality by 0.606% when considering all projects. When compared to the increase in mortality of 0.538% presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03), this represented a change in baseline mortality of 0.068% (Table 1.22).

1.3.3.3 During the post-breeding season, the combined impacts of displacement and collision from the cumulative operation and maintenance phase on black-legged kittiwake assuming the same parameters as outlined above would increase the baseline mortality by 0.192% when considering all projects. When compared to the increase in mortality of 0.177% presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03), this represented a small change in baseline mortality of 0.016% (Table 1.22).

1.3.3.4 The annual predicted mortality of black-legged kittiwake resulting from the combined impacts of displacement and collision from the cumulative operation and maintenance phase would increase the baseline mortality by 0.532% when considering all projects. When compared to the increase in mortality of 0.487% presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03), this represented a small change in baseline mortality of 0.045% (Table 1.22).

Table 1.22: Black-legged kittiwake combined displacement and collision cumulative impacts presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and re-calculated including all projects (including gap-filled projects).

Impact	Annual	Spring migration season	Breeding season	Autumn migration season
Combined impact presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03)				
Displacement impact using 50% displacement and 1% mortality (range of displacement impacts using 30% displacement and 1% mortality to 70% displacement and 10% mortality)	133 (80 to 1,867)	36 (22 to 506)	47 (28 to 652)	47 (28 to 659)
Collisions from consented wind farm parameters (species-group avoidance rate of 99.28)	559	160	159	205
Combined predicted impact (using 50% displacement and 1% mortality)	692	196	206	252
Range of predicted impacts (using 30% displacement and 1% mortality to 70% displacement and 10% mortality)	639 to 2,426	182 to 666	187 to 811	233 to 864
Increase in baseline mortality using the predicted impact (using 50% displacement and 1% mortality)	**0.487%**	**0.138%**	**0.538%**	**0.177%**
Combined impact considering all historical projects including gap-filled projects				
Displacement impact using 50% displacement and 1% mortality (Range of displacement impacts using 30% displacement and 1% mortality to 70% displacement and 10% mortality)	140 (84 to 1,965)	38 (23 to 533)	49 (32 to 749)	49 (29 to 683)

Impact	Annual	Spring migration season	Breeding season	Autumn migration season
Collisions from consented and as-built historical wind farm parameters (species-group avoidance rate of 99.28) – see Table 1.9 for clarification on wind farm parameters	617	172	183	226
Total combined predicted impact (using 50% displacement and 1% mortality)	757	210	232	275
Range of combined predicted impacts (using 30% displacement and 1% mortality to 70% displacement and 10% mortality)	701 to 2,582	195 to 705	215 to 932	255 to 909
Increase in baseline mortality using 50% displacement and 1% mortality	**0.532%**	**0.195%**	**0.606%**	**0.193%**
Comparison with and without the gap-filled projects				
Difference in baseline mortality using 50% displacement and 1% mortality	**0.045%**	**0.057%**	**0.068%**	**0.016%**

1.3.3.5 Based on the small differences in baseline mortalities (Table 1.22), the additional historical projects do not affect the conclusions of the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) for black-legged kittiwake, which concluded negligible effect for the combined impact of both displacement and collisions.

1.3.3.6 Furthermore, small differences in overall combined displacement and collision mortalities, if applied to individual SPAs, would not lead to material changes in the HRA Stage 2 Information to Support an Appropriate Assessment Part Three: Special Protection Areas and Ramsar sites Assessments (REP2-010) and therefore would not affect the overall conclusions of no AEOI on any SPAs designated for black-legged kittiwake.

Northern gannet

1.3.3.7 During the pre-breeding season, the combined impacts of displacement and collision from the cumulative operation and maintenance phase on northern gannet when using a displacement rate of 70%, a mortality rate of 1% and a collision avoidance rate of 99.28 would increase the baseline mortality by 0.010% when considering all projects (including gap-filled projects using consented and as-built wind farm parameters). When compared to the increase in mortality of 0.008% presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03), this represented a small change in baseline mortality of 0.002% (Table 1.23).

1.3.3.8 During the breeding season, the combined impacts of displacement and collision from the cumulative operation and maintenance phase on northern gannet would increase the baseline mortality by 0.118% when considering all projects (including gap-filled projects using as-built wind farm parameters). When compared to the increase in mortality of 0.108% presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03), this represented a small change in baseline mortality of 0.010% (Table 1.23).

1.3.3.9 During the post-breeding season, the combined impacts of displacement and collision from the cumulative operation and maintenance phase on northern gannet would increase the baseline mortality by 0.045% when considering all projects (including gap-filled projects using as-built wind farm parameters). When compared to the increase in mortality of 0.042% presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03), this represented a small change in baseline mortality of 0.003% (Table 1.23).

1.3.3.10 The annual predicted mortality of northern gannet resulting from the combined impacts of displacement and collision from the cumulative operation and maintenance phase would increase the baseline mortality by 0.182% when considering all projects (including gap-filled projects using as-built wind farm parameters). When compared to the increase in mortality of 0.171% presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03), this represented a small change in baseline mortality of 0.011% (Table 1.23).

Table 1.23: Northern gannet combined displacement and collision cumulative impacts presented in the Environmental Statement and re-calculated including all projects (including gap-filled projects).

Impact	Annual	Spring migration season	Breeding season	Autumn migration season
Combined impact presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03)				
Displacement impact using 70% displacement and 1% mortality (range of displacement impacts using 60% to 1% displacement to 80% to 10% mortality)	54 (46 to 615)	3 (3 to 34)	31 (27 to 354)	18 (16 to 210)
Collisions from consented wind farm parameters (avoidance rate 99.28)	160	4	75	35
Combined predicted impact (range of displacement impacts using 60% to 1% displacement to 80% to 10% mortality)	214 (206 to 775)	7 (7 to 38)	106 (102 to 429)	53 (51 to 245)
Increase in baseline mortality using the predicted impact (using 70% displacement, 1% mortality)	**0.168%**	**0.005%**	**0.105%**	**0.050%**
Combined impact considering all historical projects including gap-filled projects				
Displacement impact using 70% displacement and 1% mortality (range of displacement impacts using 60% displacement and 1% mortality to 80% displacement and 10% mortality)	55 (48 to 633)	3 (3 to 39)	33 (28 to 377)	19 (16 to 217)

Impact	Annual	Spring migration season	Breeding season	Autumn migration season
Collisions from consented and as-built historical wind farm parameters (avoidance rate 99.28) – see Table 1.9 for clarification on wind farm parameters	177	6	89	37
Combined predicted impact (range of displacement impacts using 60% displacement and 1% mortality to 80% displacement and 10% mortality)	232 (225 to 810)	9 (9 to 45)	122 (117 to 466)	56 (53 to 25)
Increase in baseline mortality using the predicted impacts (70% displacement and 1% mortality)	**0.174%**	**0.007%**	**0.121%**	**0.053%**
Comparison with and without the gap-filled projects				
Difference in baseline mortality	**0.006%**	**0.002%**	**0.016%**	**0.003%**

1.3.3.11 Based on the very small differences in baseline mortalities (Table 1.23), the additional historical projects do not affect the conclusions of the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) for north gannet, which concluded negligible effect for the combined impact of both displacement and collisions.

1.3.3.12 Furthermore, small differences in overall combined displacement and collision mortalities, if applied to individual SPAs, would not lead to material changes in the HRA Stage 2 Information to Support an Appropriate Assessment Part Three: Special Protection Areas and Ramsar sites Assessments (REP2-010) and therefore would not affect the overall conclusions of no AEOI on any SPAs designated for northern gannet.

1.4 Cumulative PVA for common guillemot and great-black backed gull

1.4.1.1 Following this gap-filling exercise, the increase in baseline mortality for the cumulative impacts of both of common guillemot and great black-backed gull tt exceed the threshold for undertaking PVA, and therefore, PVAs have been presented below. All input parameters are presented in Appendix B: and Appendix C:, for common guillemot and great black-backed gull, respectively.

1.4.2 Common guillemot

1.4.2.1 As described in section 1.3.1, the cumulative displacement impact on common guillemot surpasses the 1% threshold for further assessment. A PVA was run considering the annual cumulative impact (including the predicted collisions from tidal projects) and subsequent change in baseline mortality on the largest regional population (breeding season UK Western Waters Biologically Defined Minimum Population Scale (BDMPS) population, 1,145,528 individuals) as defined by the SNCBs and derived from Furness (2015). The results of the PVA using cumulative displacement impacts as presented in the CEA in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) is presented and compared to the results of a PVA using cumulative displacement impacts after the gap-filling exercise.

1.4.2.2 Gap-filling for cumulative projects resulted in a small increase in the annual cumulative predicted mortalities (Table 1.13) from displacement impacts of common guillemot from the UK Western Waters breeding season BDMPS, relative to that presented in the CEA in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03), presented in Table 1.24. When considering displacement impact scenarios of 50% displacement and 1% mortality (30% displacement and 1% mortality to 70% displacement and 10% mortality) and considering the impact of predicted collisions from tidal energy projects, the cumulative adult mortalities increased from 520 (334 to 6,583) to 527 (338 to 6,674). The annual cumulative increase in baseline mortality from cumulative displacement impacts presented in the CEA in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) is predicted to be 0.34% (0.22% to 4.32%), increasing to 0.35% (0.22% to 4.38%) after gap-filling of cumulative projects. Table 1.25 provides a summary of the parameters used in the PVA, with the full PVA log presented in Appendix B:.

Table 1.24: Annual increases in common guillemot baseline mortality rate as a result of displacement mortality from cumulative projects (including gap-filled projects).

Scenario	Cumulative predicted adult mortalities	Increase in baseline mortality (%)	Decrease in survival rate
A: 30% displacement and 1% mortality (plus predicted collisions from tidal projects)	284	0.22%	0.00029474
B: 50% displacement and 1% mortality (plus predicted collisions from tidal projects)	473	0.35%	0.00045981
C: 70% displacement and 10% mortality (plus predicted collisions from tidal projects)	6,618	4.38%	0.00582452

1.4.2.3 The results of the PVA for the annual impacts from the Mona Offshore Wind Project cumulatively with other offshore wind farms to the common guillemot UK Western Waters breeding season BDMPS population at the start of operation (2030) and for the duration of the project (35 years), when considering a range-based approach of displacement impact scenarios, are presented in Table 1.25 and Table 1.26. The baseline ‘unimpacted’ scenario (i.e. assuming no additional mortality other than baseline mortality exists) is also shown for comparison purposes.

1.4.2.4 The counterfactual of growth rate is a more realistic metric than population size to review the impact when undertaking density independent PVAs. When considering all three impact scenarios, there is a marginal change in the counterfactual of growth rate (0.993 to 1.000) when compared to the baseline (unimpacted) scenario. Even when considering the larger impact (70% displacement and 10% mortality plus the collision impact from tidal projects), the predicted median growth rate of the common guillemot population is >1 and therefore, the modelled population is predicted to grow under all impact scenarios. Similarly, the upper and lower confidence intervals indicate that after 35 years and under all impact scenarios the population is predicted to increase in size (>1 median growth rate).

Table 1.25: Common guillemot PVA results for the three impact scenarios presented in Table 1.24

Year	Impact scenario	Median adult population size	Population change (%) since 2015	Median growth rate	2.5 percentile of growth rate	97.5 percentile of growth rate	Median counterfactual of population size	Median counterfactual of growth rate
2030	Baseline	1,685,733	47%	1.027	0.955	1.092	-	-
2030	A (284 annual mortalities)	1,684,965	47%	1.027	0.955	1.091	1.000	1.000
2030	B (473 annual mortalities)	1,685,332	47%	1.027	0.955	1.091	0.999	0.999
2030	C (6,618 annual mortalities)	1,674,475	46%	1.020	0.949	1.085	0.993	0.993
2065	Baseline	4,140,502	261%	1.026	1.017	1.034	-	-
2065	A (284 annual mortalities)	4,088,674	257%	1.026	1.017	1.034	0.988	1.000
2065	B (473 annual mortalities)	4,061,025	255%	1.025	1.017	1.034	0.982	0.999
2065	C (6,618 annual mortalities)	3,271,903	186%	1.019	1.011	1.027	0.790	0.993

1.4.2.5 The results of the PVA when compared between the cumulative displacement impacts presented in the CEA in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and the impacts derived after gap-filling show a very small difference in annual impact to the common guillemot UK Western Waters breeding season BDMPS. Based on the updated PVA, the addition of historical projects to the CEA will have no effect on the conclusions of the CEA presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03), which concluded a minor adverse effect.

1.4.3 Great black-backed gull

1.4.3.1 As described in section 1.3.2, the cumulative collision impact on great black-backed gull surpasses the 1% threshold for further assessment. A PVA was run considering the annual cumulative increase in baseline mortality on the regional non-breeding population (17,742 individuals) and using demographic rates presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03). The increase in baseline mortality from cumulative project impacts (including gap-filled projects) is predicted to be 10.170% (when using the species-group avoidance rate of 99.39) and 1.500% (when using the species-specific avoidance rate of 99.91). Table 1.26 provides a summary of the parameters used in the PVA, with the full PVA log presented in Appendix C.

Table 1.26: Annual increases in great black-backed gull regional breeding population baseline mortality rate as a result of collision mortality from cumulative projects (including gap-filled projects using consented wind farm parameters) using species-group (99.39) and species-specific (99.91) avoidance rates.

Scenario	Cumulative predicted adult mortalities	Increase in baseline mortality %	Decrease in survival rate
Avoidance rate 99.39	171.41	10.170%	0.0096615
Avoidance rate 99.91	25.29	1.500%	0.0014255

1.4.3.2 The results of the PVAs for predicted impacts from the Mona Offshore Wind Project cumulatively with other offshore wind farms to the great black-backed gull regional population at the start of operation (2030) and for the duration of the project (35 years) are presented in Table 1.27 using the species-group and species-specific avoidance rates. The baseline 'unimpacted' scenario (i.e. assuming no additional mortality other than baseline mortality) is also shown for comparison purposes.

1.4.3.3 The SNCBs requested that the annual impact be assessed against the largest population, which in the case of the great black-backed gull is the non-breeding population (17,742 birds)). This population estimate was taken from Furness (2015) using colony counts from 1990's to 2012. 2000 was used as the base year due the 'UK Western non-SPA colonies' being counted in this year and this 'colony' contributing the majority of the birds to the whole BDMPS.

1.4.3.4 The productivity used within this technical note differs from that within Volume 6, Annex 5.6: Offshore ornithology population viability analysis technical report (APP-096) which uses the 'Regional Seas – Irish Sea' productivity within Natural England's PVA tool. The productivity rate used here is 1.011 compared to 1.061, as presented in Volume 6, Annex 5.6: Offshore ornithology population viability analysis technical report (REP2-024). The British Trust of Ornithology (BTO) provided the productivity value of 1.061 used within Volume 6, Annex 5.6: Offshore ornithology population viability analysis technical report (REP2-024). However, the lower productivity was chosen for this PVA due to comments received as part of the SNCBs Relevant Representations (from both NRW and the JNCC, RR-011 and RR-034, respectively), which commented on the unrealistic outputs of the density-independent PVA.

1.4.3.5 The counterfactual of growth rate is a more realistic metric than population size to review the impact when undertaking density independent PVAs. When considering the species-specific avoidance rate (99.91%), there is a marginal change in the counterfactual of growth rate (0.998) when compared to the baseline (unimpacted) scenario. Similarly, when considering the species-group avoidance rate (99.39%), the counterfactual growth rate is 0.998. Even when considering the larger impact (when using the species-group avoidance rate of 99.39), the median growth rate of the great black-backed gull population is >1 and therefore, the modelled population is predicted to grow under the two impact scenarios.

Table 1.27: Annual great black-backed gull PVA results using species-group (99.39) and species-specific (99.91) avoidance rates.

Year	Impact scenario	Median adult population size	Population change (%) since 2000	Median growth rate	2.5 percentile of growth rate	97.5 percentile of growth rate	Median CPS	Median CGR
2030	Baseline	531,327	2895%	1.110	0.949	1.368		
2030	Avoidance rate 99.39	526,210	2866%	1.098	0.939	1.353	0.989	0.989
2030	Avoidance rate 99.91	529,675	2885%	1.108	0.948	1.365	0.998	0.998
2065	Baseline	28,064,597	158082%	1.120	1.101	1.138		
2065	Avoidance rate 99.39	19,114,444	107636%	1.108	1.089	1.126	0.682	0.989
2065	Avoidance rate 99.91	26,541,457	149497%	1.118	1.099	1.137	0.945	0.998

1.4.3.6 Based on the updated PVA, the addition of historical projects to the CEA will have no effect on the conclusions of the CEA presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03), which concluded a minor adverse effect.

1.4.3.7 The PVA presented considers the consented wind farm parameters from the original environmental statements (as presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)) and the consented and as-built parameters of the historical projects (see Table 1.9 for relevant projects) as a greater impact. If as-built wind farm parameters were used for all wind farms within the CEA, the impact would be reduced from that presented here. Using the as-built parameters is considered a more realistic assessment than using the worst-case consented parameters, as it is highly unlikely that developments will be modified more than a decade into the operational phase (as is the case with many of the historical projects). The Applicant is not currently aware of any offshore wind projects that, following completion of construction and energisation, have added further wind turbines without additional consents being required.

1.5 Conclusion

1.5.1.1 The Applicant has considered the three gap-filling approaches recommended in the SNCB Advice Note (received October 2023) and, where relevant site-specific data for a historical project was not available, has undertaken a 'more rigorous assessment' using MERP data to provide abundance data. The Applicant has not progressed with the use of proxy data due to very high levels of variation recorded during site-specific surveys from wind farms within close proximity of historical projects and there being no pragmatic or consistent way to use proxy wind farms in a manner that is robust and justifiable.

1.5.1.2 The abundance estimates from the MERP data used to gap-fill these projects were used as the best available data, with its limitations noted in Section 1.1 and below. Although the gap-filled methodology used within this note follows the approach proposed by the SNCBs Advice Note and provides indicative estimates for currently unquantified impacts from historical projects, some key caveats should be highlighted.

1.5.1.3 The main caveat is that the MERP data provide relative and not absolute density estimates. Combining the absolute abundances from site-specific data with relative abundances (MERP data) is provided to indicate the potential impacts but not a true reflection of the absolute impacts.

1.5.1.4 An additional important point is that the density estimates per 10 km x 10 km square within the MERP data are average densities over 30+ years. The mathematical calculation to generate average densities over multiple years compared to using the mean peak from two years will inherently reduce the abundance. However, given the length of time this dataset covers, it is considered representative of the average relative abundance of birds using an area and sufficient to generate the indicative impact estimates as requested in the SNCBs Advice Note.

1.5.1.5 The additional impact presented for displacement during operation and maintenance when considering the eight historical projects which had a qualitative assessment at application (Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)) does not change the predicted magnitude of impact for any of the species considered in this note.

1.5.1.6 Similarly, the impact presented following site-specific CRM for both consented and as-built parameters for the seven historical projects which had a qualitative assessment at application (Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)) does not change the predicted magnitude of impact for any of the species considered in this note.

1.5.1.7 PVA was undertaken for great black-backed gull and common guillemot due to a cumulatively predicted impact of >1% increase in baseline mortality and therefore further investigation was required. The PVA presented in this technical note, results in the same magnitude of impact as presented within Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03), and no difference has occurred due to the inclusion of the gap-filled projects.

1.5.1.8 The inclusion of quantitative estimates for historical projects is, therefore, not considered to alter the conclusions presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03).

1.5.1.9 The full assessment of the effect on SPAs is included within the Offshore Ornithology Supporting Information in line with SNCB Advice (S_D3_19 F02). It can be concluded that the addition of the quantitative estimates for historical projects does not alter the conclusions within the HRA Stage 2 ISAA Part Three: Special Protection Areas and Ramsar sites Assessments (REP2-010).

1.5.1.10 As such, the Applicant maintains that there are no significant cumulative effects and no AEoI in-combination with other plans and projects beyond reasonable scientific doubt and that the assessments presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and the HRA Stage 2 ISAA Part Three: Special Protection Areas and Ramsar sites Assessments (REP2-010) are robust.

1.5.1.11 The Applicant considers that this technical note, and the Offshore Ornithology Supporting Information in line with SNCB Advice (S_D3_19 F02) (for in-combination assessments) provides a level of detail and analysis that exceeds the requirements for a robust application but provides the information requested by SNCBs (i.e. indicative estimates for currently unquantified impacts from historical projects). It is intended to further facilitate the SNCB's understanding of the total quantitative cumulative and in-combination impact for offshore ornithology and view with respect to the conclusions presented in Volume 2, Chapter 5: Offshore ornithology (F2.5 F03) and the Habitats Regulations Assessment (HRA) Stage 2 Information to Support Appropriate Assessment (ISAA) Part Three: Special Protection Areas and Ramsar sites Assessments (REP2-010).

1.6 References

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Appendix A: Results of the gap-filling of historical projects

A.1 Displacement during operation and maintenance

A.1.1 Atlantic puffin

A.1.1.1.1 Atlantic puffin abundance estimates from the historical projects that have been gap filled are shown in Table A. 1. Within Table A. 1 the blue cells indicate that the gap-filled abundance has been derived from the MERP data.

A.1.1.1.2 Within the matrix tables, the blue cells indicate the range of displacement and mortality ranges requested by the SNCBs. The orange cell is the Applicant's identified mortality and displacement rate. The thick red line indicates the 1% threshold of increase in baseline mortality with cells to the right of the red line indicating a >1% increase in baseline mortality.

Table A. 1 Atlantic puffin cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.

Project	Annual Abundance	Breeding Abundance	Non-breeding Season Abundance
Total abundance presented in table 5.93 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)	8,514	6,960	1,554
Burbo Bank Offshore Wind Farm	0.7	0.4	0.3
Gwynt y Môr Offshore Wind Farm	2.9	2.0	0.8
Rhyl Flats Offshore Wind Farm	1.1	0.7	0.4
Walney 1 & 2 Offshore Wind Farms	4.6	2.8	1.8
Cumulative total (all projects)	**8,523**	**6,966**	**1,557**

Table A. 2: Operations and maintenance phase cumulative Atlantic puffin mortality following displacement from offshore wind farms in the breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	7	14	35	70	174	348	697
20%	14	28	70	139	348	697	1,393
30%	21	42	104	209	522	1,045	2,090
40%	28	56	139	279	697	1,393	2,786
50%	35	70	174	348	871	1,741	3,483
60%	42	84	209	418	1,045	2,090	4,180
70%	49	98	244	488	1,219	2,438	4,876

80%	56	111	279	557	1,393	2,786	5,573
90%	63	125	313	627	1,567	3,135	6,269
100%	70	139	348	697	1,741	3,483	6,966

Table A. 3: Operations and maintenance phase cumulative Atlantic puffin mortality following displacement from offshore wind farms in the non-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	**2%**	**5%**	**10%**	**25%**	**50%**	**100%**
10%	2	3	8	16	39	78	156
20%	3	6	16	31	78	156	311
30%	5	9	23	47	117	234	467
40%	6	12	31	62	156	311	623
50%	8	16	39	78	195	389	779
60%	9	19	47	93	234	467	934
70%	11	22	55	109	273	545	1,090
80%	12	25	62	125	311	623	1,246
90%	14	28	70	140	350	701	1,402
100%	16	31	78	156	389	779	1,557

Table A. 4: Operations and maintenance phase cumulative Atlantic puffin mortality following displacement from offshore wind farms annually.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	**2%**	**5%**	**10%**	**25%**	**50%**	**100%**
10%	9	17	43	85	213	426	852
20%	17	34	85	170	426	852	1,705
30%	26	51	128	256	639	1,278	2,557
40%	34	68	170	341	852	1,705	3,409
50%	43	85	213	426	1,065	2,131	4,262
60%	51	102	256	511	1,278	2,557	5,114
70%	60	119	298	597	1,492	2,983	5,966
80%	68	136	341	682	1,705	3,409	6,819
90%	77	153	384	767	1,918	3,835	7,671
100%	85	170	426	852	2,131	4,262	8,523

A.1.1.1.3 During the breeding season, the displacement from operation when using the displacement rate of 50% (range of 30 to 70%) and a mortality rate of 1% (range of 1 to 10%), results in an additional loss of 35 (21 to 488) individuals from the breeding population). The regional seas UK Western Waters BDMPS population of Atlantic puffin within the breeding season is estimated to be 1,482,791 individuals. Assuming an average baseline mortality rate of 0.176 (Horswill and Robinson, 2015), background mortality in the breeding season is 260,971 individuals. The addition of 35 (21 to 488) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the mortality relative to the baseline mortality by 0.013 % (0.008 to 0.187%).

A.1.1.1.4 During the non-breeding season, the displacement from operation results in an additional loss of eight (five to 109) individual from the non-breeding population (Table A. 3). The regional seas UK Western Waters BDMPS population of common guillemots within the non-breeding season is estimated to be 304,557 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.176, background mortality in the non-breeding season is 53,602 individuals. The addition of eight (five to 109) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the mortality relative to the baseline mortality by 0.015% (0.009 to 0.203%).

A.1.1.1.5 The annual estimated mortality resulting from displacement during operation is 43 (26 to 597) individuals (Table A. 4). Using the largest UK Western Waters BDMPS population of 1,482,791 Atlantic puffin and, using the average baseline mortality rate of 0.176, the background predicted mortality would be 260,971 individuals. The addition of 43 (26 to 596) mortalities would increase the baseline mortality rate by 0.016% (0.010% to 0.229%). The annual predicted mortality from the cumulative assessment is below the 1% threshold increase in baseline mortality.

A.1.2 Black-legged kittiwake

A.1.2.1.1 Black-legged kittiwake abundance estimates from the historical projects that have been gap filled are shown in Table A. 5. Within Table A. 5 the blue cells indicate that the gap-filled abundance has been derived from the MERP data, a green cell indicates that the abundance was derived from the site-specific documentation, and a yellow cell indicates that the number was presented within Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). Therefore, when calculating the updated cumulative total yellow cells do not need to be included.

A.1.2.1.2 Within the matrix tables, the blue cells indicate the range of displacement and mortality ranges requested by the SNCBs. The orange cell is the Applicant’s referred mortality and displacement rate. The thick red line indicates the 1% threshold of increase in baseline mortality with cells to the right of the red line indicating a >1% increase in baseline mortality.

Table A. 5: Black-legged kittiwake cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance
Total abundance presented table 5.104 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03))	26,665	7,235	10,022	9,408
Burbo Bank Offshore Wind Farm	56	22	14	20
Burbo Bank Extension Offshore Wind Farm	802	50	707	45
Gwynt y Môr Offshore Wind Farm	188	72	51	65
Ormonde Wind Farm	102	22	60	20
Robin Rigg Offshore Wind Farm	79	30	21	28
Rhyl Flats Offshore Wind Farm	58	22	16	20
Walney 1 & 2 Offshore Wind Farms	243	94	63	86
West of Duddon Sands Offshore Wind Farm	584	68	454	62
Cumulative total (all projects)	**28,070**	**7,615**	**10,701**	**9,754**

Table A. 6: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the pre-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	8	15	38	76	190	381	762
20%	15	30	76	152	381	762	1,523
30%	23	46	114	228	571	1,142	2,285
40%	30	61	152	305	762	1,523	3,046
50%	38	76	190	381	952	1,904	3,808
60%	46	91	228	457	1,142	2,285	4,569
70%	53	107	267	533	1,333	2,665	5,331
80%	61	122	305	609	1,523	3,046	6,092
90%	69	137	343	685	1,713	3,427	6,854
100%	76	152	381	762	1,904	3,808	7,615

Table A. 7: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	11	21	54	107	268	535	1,070
20%	21	43	107	214	535	1,070	2,140
30%	32	64	161	321	803	1,605	3,210
40%	43	86	214	428	1,070	2,140	4,280
50%	54	107	268	535	1,338	2,675	5,351
60%	64	128	321	642	1,605	3,210	6,421
70%	75	150	375	749	1,873	3,745	7,491
80%	86	171	428	856	2,140	4,280	8,561
90%	96	193	482	963	2,408	4,815	9,631
100%	107	214	535	1,070	2,675	5,351	10,701

Table A. 8: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the post-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	10	20	49	98	244	488	975
20%	20	39	98	195	488	975	1,951
30%	29	59	146	293	732	1,463	2,926
40%	39	78	195	390	975	1,951	3,902
50%	49	98	244	488	1,219	2,439	4,877
60%	59	117	293	585	1,463	2,926	5,852
70%	68	137	341	683	1,707	3,414	6,828
80%	78	156	390	780	1,951	3,902	7,803
90%	88	176	439	878	2,195	4,389	8,779
100%	98	195	488	975	2,439	4,877	9,754

Table A. 9: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms annually.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	28	56	140	281	702	1,404	2,807
20%	56	112	281	561	1,404	2,807	5,614
30%	84	168	421	842	2,105	4,211	8,421
40%	112	225	561	1,123	2,807	5,614	11,228
50%	140	281	702	1,404	3,509	7,018	14,035
60%	168	337	842	1,684	4,211	8,421	16,842
70%	196	393	982	1,965	4,912	9,825	19,649
80%	225	449	1,123	2,246	5,614	11,228	22,456
90%	253	505	1,263	2,526	6,316	12,632	25,263
100%	281	561	1,404	2,807	7,018	14,035	28,070

A.1.2.1.3 During the pre-breeding season the displacement (range of 30 to 70%) and a mortality rate of 1% (range of 1 to 10%), results in an additional loss of 38 (23 to 533) individuals (Table A. 6). The regional seas UK Western Waters & Channel BDMPS population of black-legged kittiwake in the spring migration period is estimated to be 691,526 individuals. Assuming an average baseline mortality rate of 0.156, background mortality during spring migration is 107,878 individuals. The addition of 38 (23 to 533) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the baseline mortality by 0.035% (0.021 to 0.494%).

A.1.2.1.4 During the breeding season, the displacement during the operational phase results in a loss of 54 (32 to 749) individuals from the migratory population (Table A. 7). The regional seas UK Western Waters & Channel BDMPS population of black-legged kittiwake within the breeding season is estimated to be 245,234 individuals. Assuming an average baseline mortality rate of 0.156, background mortality in the breeding season is 38,256 individuals. The addition of 54 (32 to 749) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the baseline mortality by 0.140% (0.084 to 1.958%).

A.1.2.1.5 During the autumn migration season (post-breeding), displacement during the operational phase results in a loss of 49 (29 to 683) individuals from the migratory population (Table A. 8). The regional seas UK Western Waters & Channel BDMPS population of black-legged kittiwake during the autumn migration period is estimated to be 911,586 individuals. Assuming an average baseline mortality rate of 0.156, background mortality during autumn migration is 142,207 individuals. The addition of 49 (29 to 683) individual mortalities due to cumulative displacement from construction activities would increase the baseline mortality by 0.034% (0.021 to 0.480%).

A.1.2.1.6 The annual estimated mortality resulting from displacement during the operational phase is 140 (84 to 1, 965) individuals (Table A. 9). Using the largest UK Western Waters & Channel BDMPS population of 911,586 individuals, with an average baseline mortality rate of 0.156, the background predicted mortality would be 142,207. The addition of 140 (84 to 1,965) mortalities would increase the baseline mortality rate by 0.099% (0.059 to 1.382%).

A.1.3 Common guillemot

A.1.3.1.1 Common guillemot abundance estimates from the historical projects that have been gap-filled are shown in Table A. 10. Within Table A. 10, the blue cells indicate that the abundance has been derived from the MERP data, a green cell indicates that the abundance was derived from the site-specific documentation, and a yellow cell indicates that the number was presented for that bioseason within Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). Therefore, when calculating the updated cumulative total yellow cells do not need to be included.

A.1.3.1.2 Within the matrix tables, the blue cells indicate the range of displacement and mortality ranges requested by the SNCBs. The orange cell is the Applicant's referred mortality and displacement rate. The thick red line indicates the 1% threshold of increase in baseline mortality with cells to the right of the red line indicating a >1% increase in baseline mortality.

Table A. 10: Common guillemot cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase

Project	Annual Abundance	Breeding Season Abundance	Non-breeding Season Abundance
Total abundance presented in table 5.81 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)	93,278	37,477	55,800
Burbo Bank Offshore Wind Farm	99	41	58
Gwynt y Môr Offshore Wind Farm	354	149	205
Ormonde Wind Farm	968	912	56
Robin Rigg Offshore Wind Farm	226	138	88
Rhyl Flats Offshore Wind Farm	117	49	68
Walney 1 & 2 Offshore Wind Farms	388	161	227
West of Duddon Sands Offshore Wind Farm	1,487	1,321	166
Cumulative total abundance (all projects)	**94,545**	**37,877**	**56,668**

Table A. 11: Operations and maintenance phase cumulative guillemot mortality following displacement from offshore wind farms in the breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	38	76	189	379	947	1,894	3,788
20%	76	152	379	758	1,894	3,788	7,575
30%	114	227	568	1,136	2,841	5,682	11,363
40%	152	303	758	1,515	3,788	7,575	15,151
50%	189	379	947	1,894	4,735	9,469	18,939
60%	227	455	1,136	2,273	5,682	11,363	22,726
70%	265	530	1,326	2,651	6,628	13,257	26,514
80%	303	606	1,515	3,030	7,575	15,151	30,302
90%	341	682	1,704	3,409	8,522	17,045	34,089
100%	379	758	1,894	3,788	9,469	18,939	37,877

Table A. 12: Operations and maintenance phase cumulative guillemot mortality following displacement from offshore wind farms in the non-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	57	113	283	567	1,417	2,833	5,667
20%	113	227	567	1,133	2,833	5,667	11,334
30%	170	340	850	1,700	4,250	8,500	17,000
40%	227	453	1,133	2,267	5,667	11,334	22,667
50%	283	567	1,417	2,833	7,084	14,167	28,334
60%	340	680	1,700	3,400	8,500	17,000	34,001
70%	397	793	1,983	3,967	9,917	19,834	39,668
80%	453	907	2,267	4,533	11,334	22,667	45,334
90%	510	1,020	2,550	5,100	12,750	25,501	51,001
100%	567	1,133	2,833	5,667	14,167	28,334	56,668

Table A. 13: Operations and maintenance phase cumulative guillemot mortality following displacement from offshore wind farms annually.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	95	189	473	945	2,364	4,727	9,455
20%	189	378	945	1,891	4,727	9,455	18,909
30%	284	567	1,418	2,836	7,091	14,182	28,364
40%	378	756	1,891	3,782	9,455	18,909	37,818
50%	473	945	2,364	4,727	11,818	23,636	47,273
60%	567	1,135	2,836	5,673	14,182	28,364	56,727
70%	662	1,324	3,309	6,618	16,545	33,091	66,182
80%	756	1,513	3,782	7,564	18,909	37,818	75,636
90%	851	1,702	4,255	8,509	21,273	42,545	85,091
100%	945	1,891	4,727	9,455	23,636	47,273	94,545

A.1.3.1.3 During the breeding season, the displacement during the operational phase when using a displacement of 50% (range of 30 to 70%) and a mortality of 1% (range of 1 to 10%) results in an additional loss of 189 (114 to 2,651) individuals from the breeding population (Table A. 11). The regional seas UK Western Waters BDMPS population of common guillemots within the breeding season is estimated to be 1,145,528 individuals. Assuming an average baseline mortality rate of 0.133, background mortality in the breeding season is 152,355 individuals. The addition of 189 (114 to 2,651) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the baseline mortality by 0.124% (0.075 to 1.740%).

1.6.1.1 During the non-breeding season, the displacement during the operational phase results in an additional loss of 283 (170 to 3,967) individuals from the non-breeding population (Table A. 12). The regional seas UK Western Waters BDMPS population of common guillemots within the non-breeding season is estimated to be 1,139,200 individuals. Assuming an average baseline mortality rate of 0.133, background mortality in the non-breeding season is 151,516 individuals. The addition of 284 (170 to 3,967) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the baseline mortality by 0.187% (0.112 to 2.618%).

A.1.3.1.4 The annual estimated mortality resulting from displacement during the operational phase is 473 (284 to 6,618) individuals (Table A. 13). Using the largest BDMPS UK Western Waters population of 1,145,528 individuals and the average baseline mortality rate of 0.133, the annual background predicted mortality would be 152,355. The additional of 473 (284 to 6,618) mortalities would increase the baseline mortality rate by 0.310% (0.186% to 4.344%).

A.1.4 Manx shearwater

A.1.4.1.1 Manx shearwater abundance estimates from the historical projects that have been gap-filled are shown in Table A. 14. Within Table A. 14 the blue cells indicate that the gap-filled abundance has been derived from the MERP data and a yellow cell indicates that the number was presented within Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). Therefore, when calculating the updated cumulative total yellow cells do not need to be included.

A.1.4.1.2 Within the matrix tables, the blue cells indicate the range of displacement and mortality ranges requested by the SNCBs. The orange cell is the Applicant's referred mortality and displacement rate. The thick red line indicates the 1% threshold of increase in baseline mortality with cells to the right of the red line indicating a >1% increase in baseline mortality.

Table A. 14: Manx shearwater cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance
Total abundance presented in table 5.110 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)	28,774	12,383	14,779	1,612
Burbo Bank Offshore Wind Farm	3	0	2	1
Burbo Bank Extension Offshore Wind Farm	444	0	443	1

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance
Gwynt y Môr Offshore Wind Farm	17	1	13	3
Ormonde Wind Farm	1,002	0	1,001	1
Robin Rigg Offshore Wind Farm	4	0	3	1
Rhyl Flats Offshore Wind Farm	5	0	4	1
Walney 1 & 2 Offshore Wind Farms	19	1	14	4
West of Duddon Sands Offshore Wind Farm	548	1	544	3
Cumulative total abundance (all projects)	**28,827**	**12,386**	**14,815**	**1,627**

Table A. 15: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the pre-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	12	25	62	124	310	619	1,239
20%	25	50	124	248	619	1,239	2,477
30%	37	74	186	372	929	1,858	3,716
40%	50	99	248	495	1,239	2,477	4,954
50%	62	124	310	619	1,548	3,097	6,193
60%	74	149	372	743	1,858	3,716	7,432
70%	87	173	434	867	2,168	4,335	8,670
80%	99	198	495	991	2,477	4,954	9,909
90%	111	223	557	1,115	2,787	5,574	11,147
100%	124	248	619	1,239	3,097	6,193	12,386

Table A. 16: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the breeding season.

Di s	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%

	10%	15	30	74	148	370	741	1,481
	20%	30	59	148	296	741	1,481	2,963
	30%	44	89	222	444	1,111	2,222	4,444
	40%	59	119	296	593	1,481	2,963	5,926
	50%	74	148	370	741	1,852	3,704	7,407
	60%	89	178	444	889	2,222	4,444	8,889
	70%	104	207	519	1,037	2,593	5,185	10,370
	80%	119	237	593	1,185	2,963	5,926	11,852
	90%	133	267	667	1,333	3,333	6,667	13,333
	100%	148	296	741	1,481	3,704	7,407	14,815

Table A. 17: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the post-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)							
		1%	2%	5%	10%	25%	50%	100%
	10%	2	3	8	16	41	81	163
	20%	3	7	16	33	81	163	325
	30%	5	10	24	49	122	244	488
	40%	7	13	33	65	163	325	651
	50%	8	16	41	81	203	407	813
	60%	10	20	49	98	244	488	976
	70%	11	23	57	114	285	569	1,139
	80%	13	26	65	130	325	651	1,301
	90%	15	29	73	146	366	732	1,464
	100%	16	33	81	163	407	813	1,627

Table A. 18: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms annually.

Displacement level	Mortality level (% of displaced birds at risk of mortality)							
		1%	2%	5%	10%	25%	50%	100%
	10%	29	58	144	288	721	1,441	2,883
	20%	58	115	288	577	1,441	2,883	5,765
	30%	86	173	432	865	2,162	4,324	8,648
	40%	115	231	577	1,153	2,883	5,765	11,531

Mortality level (% of displaced birds at risk of mortality)							
50%	144	288	721	1,441	3,603	7,207	14,414
60%	173	346	865	1,730	4,324	8,648	17,296
70%	202	404	1,009	2,018	5,045	10,090	20,179
80%	231	461	1,153	2,306	5,765	11,531	23,062
90%	259	519	1,297	2,594	6,486	12,972	25,945
100%	288	577	1,441	2,883	7,207	14,414	28,827

A.1.4.1.3 During the spring migration (pre-breeding) season the displacement during the operational phase when using the displacement rate of 50% (range of 30 to 70%) and a mortality rate of 1% (range of 1 to 10%), results in an additional loss of 62 (37 to 867) individuals (Table A. 15). The regional seas UK Western Waters & Channel BDMPS population of Manx shearwater in the spring migration period is estimated to be 1,580,895 individuals. Assuming an average baseline mortality rate of 0.130, background mortality during spring migration is 205,516 individuals. The addition of 62 (37 to 867) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the baseline mortality by 0.030% (0.018 to 0.422%).

During the breeding season, displacement during the operational phase results in a loss of 74 (44 to 1,037) individuals from the migratory population (

A.1.4.1.4 Table A. 16). The regional seas UK Western Waters & Channel BDMPS population of Manx shearwater within the breeding season is estimated to be 1,821,544 individuals. Assuming an average baseline mortality rate of 0.130, background mortality in the breeding season is 236,801 individuals. The addition of 74 (44 to 1,037) individual mortalities due to cumulative displacement from construction activities would increase the baseline mortality by 0.031% (0.002 to 0.438%).

A.1.4.1.5 During the autumn migration season (post-breeding), displacement from during the operational phase results in a loss of eight (five to 114) individuals from the migratory population (Table A. 17). The regional seas UK Western Waters & Channel BDMPS population of Manx shearwater during the autumn migration period is estimated to be 1,580,895 individuals. Assuming an average baseline mortality rate of 0.130, background mortality during autumn migration is 205,516 individuals. The addition of eight (five to 1114) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the baseline mortality by 0.004% (0.002 to 0.055%).

A.1.4.1.6 The annual estimated mortality resulting from displacement during the operational phase is 144 (86 to 2,018) individuals (Table A. 18). Using the largest population of 1,821,544 individuals, with an average baseline mortality rate of 0.130, the background predicted mortality would be 236,801. The addition of 144 (86 to 2,018) mortalities would increase the baseline mortality rate by 0.061% (0.037 to 0.852%).

A.1.5 Northern gannet

A.1.5.1.1 Northern gannet abundance estimates from the historical projects that have been gap filled are shown in Table A. 19. Within Table A. 19 the blue cells indicate that the gap-filled abundance has been derived from the MERP data, a yellow cell indicates that the number was presented within Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). Therefore, when calculating the updated cumulative total yellow cells do not need to be included.

A.1.5.1.2 Within the matrix tables, the blue cells indicate the range of displacement and mortality ranges requested by the SNCBs. The orange cell is the Applicant's referred mortality and displacement rate. The thick red line indicates the 1% threshold of increase in baseline mortality with cells to the right of the red line indicating a >1% increase in baseline mortality.

Table A. 19: Northern gannet cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase. Blue cells indicate new relative abundances presented as part of the gap-filling.

Project	Annual Abundance	Pre-breeding Season	Breeding Season Abundance	Post-breeding Season Abundance
Total abundance presented in table 5.98 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)	7,689	430	4,629	2,630
Burbo Bank Offshore Wind Farm	14	3	6	5
Gwynt y Môr Offshore Wind Farm	60	13	27	20
Ormonde Wind Farm	208	3	199	6
Robin Rigg Offshore Wind Farm	22	4	11	7
Rhyl Flats Offshore Wind Farm	18	4	8	6
Walney 1 & 2 Offshore Wind Farms	77	15	36	26
West of Duddon Sands Offshore Wind Farm	460	11	431	18
Cumulative total (all projects)	**7,918**	**483**	**4,717**	**2,718**

Table A. 20: Operations and maintenance phase cumulative northern gannet mortality following displacement from offshore wind farms in the pre-breeding season.

Displacement level (% at risk of)	Mortality level (% of displaced birds at risk of mortality)							
		1%	2%	5%	10%	25%	50%	100%
	10%	0	1	2	5	12	24	48
	20%	1	2	5	10	24	48	97
	30%	1	3	7	14	36	72	145
	40%	2	4	10	19	48	97	193
	50%	2	5	12	24	60	121	242

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)							
	60%	3	6	14	29	72	145	290
	70%	3	7	17	34	85	169	338
	80%	4	8	19	39	97	193	386
	90%	4	9	22	43	109	217	435
	100%	5	10	24	48	121	242	483

Table A. 21: Operations and maintenance phase cumulative northern gannet mortality following displacement from offshore wind farms in the breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)							
		1%	2%	5%	10%	25%	50%	100%
	10%	5	9	24	47	118	236	472
	20%	9	19	47	94	236	472	943
	30%	14	28	71	142	354	708	1,415
	40%	19	38	94	189	472	943	1,887
	50%	24	47	118	236	590	1,179	2,359
	60%	28	57	142	283	708	1,415	2,830
	70%	33	66	165	330	825	1,651	3,302
	80%	38	75	189	377	943	1,887	3,774
	90%	42	85	212	425	1,061	2,123	4,245
	100%	47	94	236	472	1,179	2,359	4,717

Table A. 22: Operations and maintenance phase cumulative norther gannet mortality following displacement from offshore wind farms in the post- breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)							
		1%	2%	5%	10%	25%	50%	100%
	10%	3	5	14	27	68	136	272
	20%	5	11	27	54	136	272	544
	30%	8	16	41	82	204	408	815
	40%	11	22	54	109	272	544	1,087
	50%	14	27	68	136	340	680	1,359
	60%	16	33	82	163	408	815	1,631
	70%	19	38	95	190	476	951	1,903

	Mortality level (% of displaced birds at risk of mortality)						
80%	22	43	109	217	544	1,087	2,174
90%	24	49	122	245	612	1,223	2,446
100%	27	54	136	272	680	1,359	2,718

Table A. 23: Operations and maintenance phase cumulative northern gannet mortality following displacement from offshore wind farms annually.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	**2%**	**5%**	**10%**	**25%**	**50%**	**100%**
10%	8	16	40	79	158	238	317
20%	16	32	79	158	317	475	633
30%	24	48	119	238	475	713	950
40%	32	63	158	317	633	950	1,267
50%	40	79	198	396	792	1,188	1,584
60%	48	95	238	475	950	1,425	1,900
70%	55	111	277	554	1,109	1,663	2,217
80%	63	127	317	633	1,267	1,900	2,534
90%	71	143	356	713	1,425	2,138	2,850
100%	79	158	396	792	1,584	2,375	3,167

A.1.5.1.3 During the spring migration (pre-breeding) season, the displacement during the operational phase, when using the displacement rate of 70% (range of 60 to 80%) and a mortality rate of 1% (range of 1 to 10%), results in an additional loss of three (three to 39) individuals (Table A. 20). The regional seas UK Western Waters BDMPS population of northern gannet in the spring migration period is estimated to be 661,888 individuals. Assuming an average baseline mortality rate of 0.193, background mortality during spring migration is 127,744 individuals. The addition of three (three to 39) individual mortalities due to cumulative displacement from the presence of infrastructure would not increase the baseline mortality (0.003% (0.002 to 0.030%)).

A.1.5.1.4 During the breeding season, displacement during the operational phase results in the loss of 33 (28 to 377) individuals from the breeding population (Table A. 21). The regional seas UK Western Waters BDMPS population of northern gannet within the breeding season is estimated to be 522,888 individuals. Assuming an average baseline mortality rate of 0.193, background mortality in the breeding season is 100,917 individuals. The addition of 33 (28 to 377) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the baseline mortality by 0.033% (0.028 to 0.374%).

A.1.5.1.5 During the autumn migration season (post-breeding), displacement during the operational phase results in a loss of 19 (16 to 217) individuals from the migratory population (Table A. 22). The regional seas UK Western Waters BDMPS population of northern gannet during the autumn migration period is estimated to be 545,954 individuals. Assuming an average baseline mortality rate of 0.193, background mortality during autumn migration is 105,369 individuals. The addition of 19 (16 to 217) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the baseline mortality by 0.018% (0.015 to 0.206%).

The annual estimated mortality resulting from displacement during the operational phase is 55 (48 to 633) individuals (

A.1.5.1.6 Table A. 23). Using the largest UK Western Waters BDMPS population of 661,888 individuals, with an average baseline mortality rate of 0.193, the background predicted mortality would be 127,744. The addition of 55 (48 to 633) mortalities would increase the baseline mortality rate by 0.043% (0.037 to 0.496%).

A.1.6 Razorbill

A.1.6.1.1 Razorbill abundance estimates from the historical projects that have been gap-filled are shown in Table A. 24. Within Table A. 24 the blue cells indicate that the gap-filled abundance has been derived from the MERP data and a yellow cell indicates that the number was presented within Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). Therefore, when calculating the updated cumulative total yellow cells do not need to be included.

A.1.6.1.2 Within the matrix tables, the blue cells indicate the range of displacement and mortality ranges requested by the SNCBs. The orange cell is the Applicant’s identified mortality and displacement rate. The thick red line indicates the 1% threshold of increase in baseline mortality with cells to the right of the red line indicating a >1% increase in baseline mortality.

Table A. 24: Razorbill cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase. Blue cells indicate new relative abundances presented as part of the gap-filling.

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance	Non-breeding Abundance
Total abundance presented in table 5.86 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)	15,306	4,153	1,258	3,700	6,195
Burbo Bank Offshore Wind Farm	28	10	3	6	9
Gwynt y Môr Offshore Wind Farm	105	39	12	22	32
Ormonde Wind Farm	198	10	174	6	8
Robin Rigg Offshore Wind Farm	103	15	63	11	14

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance	Non-breeding Abundance
Rhyl Flats Offshore Wind Farm	33	12	4	7	10
Walney 1 & 2 Offshore Wind Farms	111	40	12	25	34
Cumulative total (all projects)	**15,647**	**4,279**	**1,289**	**3,777**	**6,302**

A.1.6.1.3 The following displacement matrices provide the estimated cumulative mortality of razorbill predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table A. 25 to Table A. 29). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore Ornithology Displacement Technical Report of the Environmental Statement (F6.5.2 F03).

Table A. 25: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the pre-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	4	9	21	43	107	214	428
20%	9	17	43	86	214	428	856
30%	13	26	64	128	321	642	1,284
40%	17	34	86	171	428	856	1,712
50%	21	43	107	214	535	1,070	2,140
60%	26	51	128	257	642	1,284	2,567
70%	30	60	150	300	749	1,498	2,995
80%	34	68	171	342	856	1,712	3,423
90%	39	77	193	385	963	1,926	3,851
100%	43	86	214	428	1,070	2,140	4,279

Table A. 26: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	1	3	6	13	32	64	129
20%	3	5	13	26	64	129	258
30%	4	8	19	39	97	193	387
40%	5	10	26	52	129	258	516
50%	6	13	32	64	161	322	645
60%	8	15	39	77	193	387	773
70%	9	18	45	90	226	451	902
80%	10	21	52	103	258	516	1,031
90%	12	23	58	116	290	580	1,160
100%	13	26	64	129	322	645	1,289

Table A. 27: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the post-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	4	8	19	38	94	189	378
20%	8	15	38	76	189	378	755
30%	11	23	57	113	283	567	1,133
40%	15	30	76	151	378	755	1,511
50%	19	38	94	189	472	944	1,889
60%	23	45	113	227	567	1,133	2,266
70%	26	53	132	264	661	1,322	2,644
80%	30	60	151	302	755	1,511	3,022
90%	34	68	170	340	850	1,700	3,399
100%	38	76	189	378	944	1,889	3,777

Table A. 28: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the non-breeding season.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	6	13	32	63	158	315	630
20%	13	25	63	126	315	630	1,260
30%	19	38	95	189	473	945	1,891
40%	25	50	126	252	630	1,260	2,521
50%	32	63	158	315	788	1,576	3,151
60%	38	76	189	378	945	1,891	3,781
70%	44	88	221	441	1,103	2,206	4,411
80%	50	101	252	504	1,260	2,521	5,042
90%	57	113	284	567	1,418	2,836	5,672
100%	63	126	315	630	1,576	3,151	6,302

Table A. 29: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms annually.

Displacement level (% at risk of displacement)	Mortality level (% of displaced birds at risk of mortality)						
	1%	2%	5%	10%	25%	50%	100%
10%	16	31	78	156	391	782	1,565
20%	31	63	156	313	782	1,565	3,129
30%	47	94	235	469	1,174	2,347	4,694
40%	63	125	313	626	1,565	3,129	6,259
50%	78	156	391	782	1,956	3,912	7,824
60%	94	188	469	939	2,347	4,694	9,388
70%	110	219	548	1,095	2,738	5,476	10,953
80%	125	250	626	1,252	3,129	6,259	12,518
90%	141	282	704	1,408	3,521	7,041	14,082
100%	156	313	782	1,565	3,912	7,824	15,647

A.1.6.1.4 During the pre-breeding season, the displacement during the operational phase when using a displacement of 50% (range of 30 to 70%) and a mortality of 1% (range of 1 to 10%), results in an additional loss of 21 (13 to 300) individuals from the pre-breeding population (Table A. 25). The regional seas UK Western Waters BDMPS population of razorbill within the pre-breeding season is estimated to be 606,914 individuals. Assuming an average baseline mortality rate of 0.172, background mortality in the pre-breeding season is 104,389 individuals. The addition of 21 (13 to 300) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the baseline mortality by 0.020% (0.012 to 0.287%)

A.1.6.1.5 During the breeding season, the displacement during the operational phase when using a displacement of 50% (range of 30 to 70%) and a mortality of 1% (range of 1 to 10%), results in an additional loss of six (four to 90) individuals from the breeding population (Table A. 26). The regional seas UK Western Waters BDMPS population of razorbill within the breeding season is estimated to be 198,969 individuals. Assuming an average baseline mortality rate of 0.172, background mortality in the breeding season is 34,223 individuals. The addition of six (four to 90) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the baseline mortality by 0.019% (0.011 to 0.264%).

A.1.6.1.6 During the post-breeding season, the displacement during the operational phase results in an additional loss of 19 (11 to 264) individuals from the non-breeding population (Table A. 27). The regional seas UK Western Waters BDMPS population of razorbill within the post-breeding season is estimated to be 606,914 individuals. Assuming an average baseline mortality rate of 0.172, background mortality in the post-breeding season is 104,389 individuals. The addition of 19 (11 to 264) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the baseline mortality by 0.018% (0.011 to 0.253%).

A.1.6.1.7 During the non-breeding season, the displacement during the operational phase results in an additional loss of 32 (19 to 441) individuals from the non-breeding population (Table A. 28). The regional seas UK Western Waters BDMPS population of razorbill within the non-breeding season is estimated to be 341,422 individuals. Assuming an average baseline mortality rate of 0.172, background mortality in the non-breeding season is 58,725 individuals. The addition of 32 (19 to 441) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the baseline mortality by 0.054% (0.032 to 0.751%).

A.1.6.1.8 The annual estimated mortality resulting from displacement during the operational phase is 78 (47 to 1,095) individuals (Table A. 29). Using the largest BDMPS UK Western Waters population of 606,914 individuals and the average baseline mortality rate of 0.172, the annual background predicted mortality would be 104,389. The additional 78 (47 to 1,095) mortalities would increase the baseline mortality rate by 0.075% (0.045% to 1.049%).

A.2 Collision risk

A.2.1 Black-legged kittiwake

Table A. 30: Monthly densities (birds per km^2) of black-legged kittiwake within selected historical offshore wind farm projects (all behaviours).

Project	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Burbo Bank Offshore Wind Farm	0.43	0.45	0.30	0.18	0.17	0.15	0.13	0.12	0.20	0.33	0.37	0.40
Gwynt y Môr Offshore Wind Farm	0.42	0.44	0.31	0.21	0.19	0.17	0.15	0.13	0.20	0.33	0.36	0.40
Robin Rigg East Offshore Wind Farm	0.45	0.46	0.32	0.21	0.19	0.18	0.16	0.16	0.24	0.38	0.41	0.43
Robin Rigg West Offshore Wind Farm	0.45	0.46	0.32	0.21	0.20	0.18	0.17	0.16	0.24	0.38	0.40	0.43
Rhyl Flats Offshore Wind Farm	0.42	0.44	0.32	0.22	0.20	0.17	0.15	0.14	0.21	0.32	0.36	0.39
Walney 1 Offshore Wind Farm	0.46	0.47	0.31	0.19	0.18	0.16	0.14	0.13	0.22	0.37	0.40	0.43
Walney 2 Offshore Wind Farm	0.47	0.49	0.33	0.20	0.19	0.17	0.15	0.14	0.23	0.38	0.41	0.45
West of Duddon Sands Offshore Wind Farm	0.46	0.47	0.31	0.19	0.18	0.16	0.14	0.13	0.22	0.36	0.40	0.43

Table A. 31: Monthly predicted collision impacts of flying black-legged kittiwake within selected historical offshore wind farm projects, based on consented wind farm parameters using the species-group avoidance rate (99.28).

Project	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual Total
Burbo Bank Offshore Wind Farm	0.22	0.22	0.18	0.11	0.12	0.10	0.09	0.08	0.12	0.18	0.19	0.20	1.78
Gwynt y Môr Offshore Wind Farm	3.37	3.42	2.89	2.05	2.04	1.84	1.65	1.35	1.87	2.93	2.86	3.13	29.38

Table A. 32: Monthly predicted collision impacts of flying black-legged kittiwake within selected historical offshore wind farm projects, based on as-built wind farm parameters using the species-group avoidance rate (99.28).

Project	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual Total
Burbo Bank Offshore Wind Farm	0.27	0.27	0.22	0.14	0.14	0.13	0.11	0.10	0.14	0.23	0.23	0.24	2.22
Gwynt y Môr Offshore Wind Farm	0.42	0.42	0.36	0.25	0.25	0.22	0.20	0.17	0.23	0.36	0.35	0.39	3.62
Robin Rigg Offshore Wind Farm	0.37	0.37	0.31	0.22	0.22	0.21	0.20	0.17	0.23	0.35	0.34	0.35	3.34
Rhyl Flats Offshore Wind Farm	0.37	0.38	0.33	0.23	0.23	0.21	0.18	0.16	0.22	0.31	0.31	0.34	3.28
Walney 1 Offshore Wind Farm	0.58	0.58	0.46	0.30	0.31	0.28	0.24	0.22	0.32	0.52	0.50	0.53	4.85
Walney 2 Offshore Wind Farm	0.27	0.29	0.53	0.75	0.72	0.56	0.46	0.24	0.14	0.16	0.19	0.22	4.51
West of Duddon Sands Offshore Wind Farm	1.30	1.29	1.02	0.66	0.68	0.61	0.54	0.48	0.73	1.13	1.12	1.18	10.72

A.2.1.1.1 Black-legged kittiwake collision estimates from the historical projects that have been gap-filled are shown in Table A. 33. The blue cells indicate that the gap-filled collision estimates have been derived from the MERP data.

Table A. 33: Expected annual and seasonal collision mortality estimates for black-legged kittiwake across relevant historical offshore wind farm projects using the species-group avoidance rate (99.28).

Project	Annual	Pre-breeding season	Breeding Season	Post-breeding season
Total predicted collisions presented in table 5.117 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)	559.24	159.26	158.82	205.13
Burbo Bank Offshore Wind Farm – consented (as-built)	1.78 (2.22)	0.44 (0.54)	0.68 (0.84)	0.69 (0.84)
Gwynt y Môr Offshore Wind Farm – consented (as-built)	29.38 (3.62)	6.79 (0.84)	11.82 (1.45)	10.79 (1.33)
Robin Rigg Offshore Wind Farm – as-built	3.34	0.74	1.33	1.27
Rhyl Flats Offshore Wind Farm – as-built	3.28	0.75	1.34	1.18
Walney 1 – as-built	4.85	1.16	1.81	1.87
Walney 2 – as-built	4.51	0.56	3.26	0.71
West of Duddon Sands Offshore Wind Farm – as-built	10.72	2.59	3.99	4.16
Cumulative total of all projects (as-built parameters of the historical projects)	**591.80**	**166.44**	**172.84**	**216.49**
Cumulative total of all projects (as-built and consented	**617.17**	**172.29**	**183.05**	**225.80**

Project	Annual	Pre-breeding season	Breeding Season	Post-breeding season
parameters of the historical projects)				

A.2.2 Great black-backed gull

Table A. 34: Densities (birds per km^2) of flying great black-backed gull within selected historical offshore wind farm projects.

Project	BDMPS – Non-breeding (September to March)		BDMPS – Breeding (April to August)	
	Boat	Aerial	Boat	Aerial
Burbo Bank Offshore Wind Farm	0.0426	0.0003	0.0453	0.0001
Burbo Bank Extension Offshore Wind Farm	0.0291	0.0003	0.0341	<0.0001
Gwynt y Môr Offshore Wind Farm	0.0160	<0.0001	0.0163	<0.0001
Robin Rigg Offshore Wind Farm	0.0528	<0.0001	0.0350	0.0001
Rhyl Flats Offshore Wind Farm	0.0329	<0.0001	0.0216	0.0001
Walney 1 Offshore Wind Farm	0.0339	0.0001	0.0408	<0.0001
Walney 2 Offshore Wind Farm	0.0382	0.0001	0.0303	<0.0001
West of Duddon Sands Offshore Wind Farm	0.0235	0.0001	0.0428	<0.0001

Table A. 35: Monthly predicted collision impacts of flying great black-backed gull within selected historical offshore wind farm projects, based on consented wind farm parameters, from boat-based bird densities using the species-group avoidance rate of 99.39.

Project	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual Total
Burbo Bank Offshore Wind Farm	0.16	0.15	0.19	0.21	0.23	0.23	0.23	0.22	0.19	0.18	0.16	0.16	2.29
Burbo Bank Extension Offshore Wind Farm	0.44	0.43	0.52	0.63	0.70	0.70	0.71	0.68	0.52	0.49	0.44	0.43	6.70
Gwynt y Môr Offshore Wind Farm	0.73	0.71	0.85	0.91	1.00	1.00	1.02	0.96	0.85	0.81	0.72	0.71	10.26

Table A. 36: Monthly predicted collision impacts of flying great black-backed gull within selected historical offshore wind farm projects, based on as-built wind farm parameters, from boat-based bird densities using the species-group avoidance rate of 99.39.

Project	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual Total
Burbo Bank Offshore Wind Farm	0.17	0.17	0.20	0.22	0.24	0.25	0.25	0.24	0.20	0.19	0.17	0.17	2.46
Burbo Bank Extension Offshore Wind Farm	0.25	0.25	0.30	0.36	0.40	0.40	0.41	0.39	0.30	0.28	0.25	0.25	3.82
Gwynt y Môr Offshore Wind Farm	0.18	0.18	0.21	0.23	0.25	0.25	0.26	0.24	0.21	0.20	0.18	0.18	2.57
Robin Rigg Offshore Wind Farm	0.35	0.34	0.41	0.29	0.32	0.32	0.32	0.31	0.41	0.39	0.35	0.34	4.16
Rhyl Flats Offshore Wind Farm	0.16	0.16	0.19	0.13	0.14	0.14	0.15	0.14	0.19	0.18	0.16	0.16	1.91
Walney 1 Offshore Wind Farm	0.28	0.27	0.32	0.41	0.45	0.45	0.46	0.43	0.32	0.31	0.27	0.27	4.24
Walney 2 Offshore Wind Farm	0.33	0.32	0.38	0.32	0.35	0.35	0.36	0.34	0.39	0.37	0.33	0.32	4.15
West of Duddon Sands Offshore Wind Farm	0.43	0.42	0.50	0.96	1.05	1.06	1.08	1.02	0.50	0.48	0.43	0.42	8.32

Table A. 37: Expected annual and seasonal collision mortality estimates for great black-backed gull across relevant historical offshore wind farm projects, including gap-filled projects using the species-group avoidance rate of 99.39.

Project	Annual	Breeding Season	Non-breeding season
Total predicted collisions presented in table 5.119 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)	129.36	27.44	72.72
Burbo Bank Offshore Wind Farm – consented (as-built)	2.29 (2.46)	1.31 (1.40)	1.00 (1.07)
Burbo Bank Extension – consented (as-built)	6.70 (3.82)	3.94 (2.26)	2.75 (1.58)
Gwynt y Môr Offshore Wind Farm – consented (as-built)	10.26 (2.57)	5.74 (1.44)	4.53 (1.13)
Robin Rigg Offshore Wind Farm – as-built	4.16	1.97	2.18
Rhyl Flats Offshore Wind Farm – as-built	1.91	0.89	1.01
Walney 1 Offshore Wind Farm – as-built	4.24	2.52	1.72
Walney 2 Offshore Wind Farm – as-built	4.15	2.10	2.06
West of Duddon Sands Offshore Wind Farm – as-built	8.32	5.67	2.68
Cumulative total of all projects (as-built parameters of the historical projects)	**160.98**	**45.66**	**86.17**

Project	Annual	Breeding Season	Non-breeding season
Cumulative total of all projects (as-built and consented parameters of the historical projects)	**171.41**	**51.58**	**90.65**

A.2.3 Herring gull

Table A. 38: Monthly densities (birds per km^2) of Herring gull within selected historical offshore wind farm projects (all behaviours).

Project	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Burbo Bank Offshore Wind Farm	0.24	0.26	0.26	0.24	0.20	0.15	0.12	0.10	0.11	0.13	0.16	0.20
Gwynt y Môr Offshore Wind Farm	0.22	0.24	0.24	0.22	0.18	0.14	0.11	0.10	0.10	0.12	0.15	0.19
Robin Rigg Offshore Wind Farm	0.29	0.32	0.44	0.53	0.45	0.35	0.27	0.16	0.12	0.15	0.19	0.24
Rhyl Flats Offshore Wind Farm	0.24	0.26	0.26	0.23	0.19	0.15	0.12	0.10	0.11	0.13	0.16	0.20
Walney 1 Offshore Wind Farm	0.23	0.25	0.55	0.87	0.80	0.70	0.60	0.25	0.10	0.12	0.16	0.19
Walney 2 Offshore Wind Farm	0.20	0.22	0.34	0.46	0.40	0.31	0.25	0.14	0.09	0.11	0.14	0.17
West of Duddon Sands Offshore Wind Farm	0.23	0.25	0.54	0.86	0.79	0.68	0.58	0.25	0.10	0.12	0.16	0.20

Table A. 39: Monthly predicted collision impacts of flying herring gull within selected historical offshore wind farm projects, based on consented wind farm parameters using the species-group avoidance rate of 99.39.

Project	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual Total
Burbo Bank Offshore Wind Farm	0.33	0.34	0.41	0.39	0.36	0.28	0.23	0.18	0.18	0.20	0.22	0.27	3.37
Gwynt y Môr Offshore Wind Farm	3.73	3.94	4.73	4.54	4.10	3.19	2.55	2.20	1.98	2.26	2.52	3.14	38.90

Table A. 40: Monthly predicted collision impacts of flying herring gull within selected historical offshore wind farm projects, based on as-built wind farm parameters using the species-group avoidance rate of 99.39.

Project	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual Total
Burbo Bank Offshore Wind Farm	0.35	0.37	0.45	0.43	0.39	0.30	0.25	0.20	0.19	0.22	0.24	0.29	3.68
Gwynt y Môr Offshore Wind Farm	0.91	0.97	1.14	1.08	1.01	0.78	0.61	0.51	0.49	0.55	0.63	0.76	9.43
Robin Rigg Offshore Wind Farm	0.70	0.76	1.25	1.59	1.49	1.16	0.92	0.51	0.34	0.40	0.45	0.57	10.14
Rhyl Flats Offshore Wind Farm	0.53	0.57	0.95	1.19	1.11	0.87	0.68	0.38	0.26	0.31	0.34	0.43	7.64
Walney 1 Offshore Wind Farm	0.69	0.73	1.94	3.21	3.26	2.86	2.49	0.99	0.35	0.40	0.48	0.56	17.97

Project	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual Total
Walney 2 Offshore Wind Farm	1.50	1.52	1.23	0.78	0.82	0.74	0.66	0.58	0.86	1.35	1.29	1.40	12.70
West of Duddon Sands Offshore Wind Farm	1.55	1.64	4.25	7.10	7.20	6.22	5.40	2.20	0.79	0.90	1.07	1.32	39.62

Table A. 41: Expected annual and seasonal collision mortality estimates for herring gull across relevant historical offshore wind farm projects, including gap-filled projects using the species-group avoidance rate of 99.39.

Project	Annual	Breeding Season	Non-breeding season
Total predicted collisions presented in table 5.122 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)	148.07	55.05	45.86
Burbo Bank Offshore Wind Farm – consented (as-built)	3.37 (3.68)	1.85 (2.02)	1.53 (1.66)
Gwynt y Môr Offshore Wind Farm – consented (as-built)	38.90 (9.45)	21.32 (5.14)	17.57 (4.31)
Robin Rigg Offshore Wind Farm – as-built	10.14	6.92	3.23
Rhyl Flats Offshore Wind Farm – as-built	7.64	5.18	2.44
Walney 1 Offshore Wind Farm – as-built	17.97	14.75	3.22
Walney 2 Offshore Wind Farm – as-built	12.70	4.81	7.91
West of Duddon Sands Offshore Wind Farm – as-built	39.62	32.37	7.26
Cumulative total of all projects (as-built parameters of the historical projects)	**249.29**	**126.24**	**75.88**
Cumulative total of all projects (as-built and consented parameters of the historical projects)	**278.43**	**142.25**	**89.01**

A.2.4 Lesser black-backed gull

Table A. 42: Monthly densities (birds per km²) of lesser black-backed gull within selected historical offshore wind farm projects (all behaviours).

Project	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Robin Rigg Offshore Wind Farm	0.03	0.03	0.07	0.18	0.22	0.28	0.35	0.17	0.07	0.06	0.04	0.04

Table A. 43: Monthly predicted collision impacts of flying lesser black-backed gull, based on as-built parameters using the species-group avoidance rate of 99.39.

Project	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual total
Robin Rigg Offshore Wind Farm	0.08	0.08	0.22	0.61	0.82	1.05	1.33	0.61	0.23	0.18	0.11	0.11	5.42

A.2.4.1.1 Lesser black-backed gull collision estimates from the historical projects that have been gap-filled are shown in Table A. 44. The blue cells indicate that the gap-filled collision estimates have been derived from the MERP data, and the orange cells indicate that the gap-filled collision estimates have been taken from Dong Energy (2014). Within the CEA within Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03) Gwynt y Môr Offshore Wind Farm and Rhyl Flats Offshore Wind Farm had an estimate of impact for lesser black-backed gull. The impact from these two projects has been updated in line with Dong Energy (2014), from 6.00 birds to 8.02 birds.

Table A. 44: Expected annual and seasonal collision mortality estimates for lesser black-backed gull across relevant historical offshore wind farm projects, including gap-filled projects using the species-group avoidance rate of 99.39.

Project	Annual	Pre-breeding season	Breeding Season	Post-breeding season	Non-breeding season
Total predicted collisions presented in table 5.125 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)	275.76	4.00	19.26	10.74	17.19
Burbo Bank Offshore Wind Farm	2.10	Unavailable	Unavailable	Unavailable	Unavailable
Gwynt y Môr Offshore Wind Farm	7.32 (previously presented as 5.00 in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)	Unavailable	Unavailable	Unavailable	Unavailable
Robin Rigg Offshore Wind Farm	5.42	0.22	4.41	0.41	0.38
Rhyl Flats Offshore Wind Farm	0.70 (previously presented as 1.00 in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)	Unavailable	Unavailable	Unavailable	Unavailable
Cumulative total of all projects (as-built parameters of the historical projects)	**285.29**	**4.22**	**23.67**	**11.15**	**17.57**

A.2.5 Northern gannet

Table A. 45: Monthly densities (birds per km^2) of northern gannet within selected historical offshore wind farm projects (all behaviours).

Project	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Burbo Bank Offshore Wind Farm	0.05	0.05	0.06	0.07	0.08	0.10	0.12	0.13	0.13	0.10	0.07	0.06
Gwynt y Môr Offshore Wind Farm	0.07	0.06	0.07	0.09	0.11	0.13	0.15	0.16	0.16	0.12	0.09	0.07
Robin Rigg Wind Farm	0.05	0.05	0.06	0.08	0.10	0.12	0.15	0.17	0.17	0.12	0.07	0.06
Rhyl Flats Offshore Wind Farm	0.06	0.06	0.07	0.09	0.10	0.12	0.14	0.16	0.16	0.12	0.08	0.07
Walney 1 Offshore Wind Farm	0.07	0.06	0.07	0.09	0.11	0.13	0.16	0.18	0.18	0.13	0.09	0.07
Walney 2 Offshore Wind Farm	0.07	0.07	0.08	0.10	0.12	0.14	0.17	0.19	0.19	0.14	0.10	0.08
West of Duddon Sands Offshore Wind Farm	0.07	0.06	0.07	0.09	0.11	0.13	0.16	0.17	0.17	0.13	0.09	0.07

Table A. 46: Monthly predicted collision impacts of flying northern gannet within selected historical offshore wind farm projects, based on consented parameters

Project	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual Total
Burbo Bank Offshore Wind Farm	0.02	0.02	0.03	0.03	0.04	0.06	0.07	0.07	0.06	0.04	0.02	0.02	0.46
Gwynt y Môr Offshore Wind Farm	0.36	0.32	0.49	0.70	0.99	1.20	1.40	1.36	1.16	0.77	0.47	0.34	9.57

Table A. 47: Monthly predicted collision impacts of flying northern gannet within selected historical offshore wind farm projects, based on as-built parameters.

Project	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual Total
Burbo Bank Offshore Wind Farm	0.02	0.02	0.03	0.04	0.05	0.07	0.08	0.08	0.07	0.05	0.03	0.02	0.57
Gwynt y Môr Offshore Wind Farm	0.03	0.03	0.05	0.07	0.10	0.12	0.14	0.14	0.12	0.08	0.05	0.04	0.97
Robin Rigg Offshore Wind Farm	0.03	0.03	0.04	0.06	0.09	0.11	0.14	0.14	0.12	0.08	0.04	0.03	0.90
Rhyl Flats Offshore Wind Farm	0.14	0.15	0.20	0.20	0.19	0.15	0.12	0.09	0.09	0.09	0.09	0.11	1.62
Walney 1 Offshore Wind Farm	0.04	0.04	0.06	0.08	0.11	0.14	0.17	0.18	0.15	0.10	0.05	0.04	1.15
Walney 2 Offshore Wind Farm	0.04	0.05	0.07	0.10	0.13	0.16	0.19	0.20	0.17	0.11	0.06	0.05	1.32
West of Duddon Sands Offshore Wind Farm	0.09	0.08	0.13	0.18	0.26	0.31	0.39	0.37	0.32	0.21	0.12	0.09	2.55

Table A. 48: Expected annual and seasonal collision mortality estimates for northern gannet across relevant historical offshore wind farm projects, including gap-filled projects.

Project	Annual	Pre-breeding season	Breeding Season	Post-breeding season
Total predicted collisions presented in table 5.128 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)	159.87	4.26	75.26	35.07
Burbo Bank Offshore Wind Farm – consented (as-built)	0.46 (0.57)	0.06 (0.06)	0.36 (0.42)	0.06 (0.08)
Gwynt y Môr Offshore Wind Farm – consented (as-built)	9.57 (0.97)	1.02 (0.10)	7.30 (0.74)	1.24 (0.13)
Robin Rigg Offshore Wind Farm – as-built	0.9	0.09	0.7	0.12
Rhyl Flats Offshore Wind Farm – as-built	1.62	0.40	1.04	0.18
Walney 1 Offshore Wind Farm – as-built	1.15	0.12	0.89	0.15
Walney 2 Offshore Wind Farm – as-built	1.32	0.14	1.02	0.17
West of Duddon Sands Offshore Wind Farm – as-built	2.55	0.26	1.96	0.33
Cumulative total of all projects (as-built parameters of the historical projects)	**168.97**	**5.43**	**82.03**	**36.23**
Cumulative total of all projects (as-built and consented parameters of the historical projects)	**177.48**	**6.35**	**88.53**	**37.32**

Appendix B: Common guillemot PVA inputs

B.1 Common guillemot PVA inputs

The log file was created on: 2024-10-28 10:18:51 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

```
##                Package          Version
## popbio         "popbio"         "2.4.4"
## shiny          "shiny"          "1.1.0"
## shinyjs        "shinyjs"        "1.0"
## shinydashboard "shinydashboard" "0.7.1"
## shinyWidgets   "shinyWidgets"   "0.4.5"
## DT             "DT"             "0.5"
## plotly         "plotly"         "4.8.0"
## rmarkdown      "rmarkdown"      "1.10"
## dplyr          "dplyr"          "0.7.6"
## tidyr          "tidyr"          "0.8.1"
```

B.1.1 Basic information

This run had reference name “GU_Cumulative_GapFill”.

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 1234.

Years for burn-in: 5.

Case study selected: None.

B.1.2 Baseline demographic rates

Species chosen to set initial values: Common Guillemot.

Region type to use for breeding success data: Reg.Seas.

Available colony-specific survival rate: Skomer (1985-2011). Sector to use within breeding success region: Irish Sea.

Age at first breeding: 6.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: all.individuals

Are baseline demographic rates specified separately for immatures?: Yes.

B.1.3 Population 1

Initial population values: Initial population 1145528 in 2015

Productivity rate per pair: mean: 0.583 , sd: 0.075

Adult survival rate: mean: 0.939 , sd: 0.025

Immatures survival rates:

Age class 0 to 1 - mean: 0.56 , sd: 0.058 , DD: NA

Age class 1 to 2 - mean: 0.792 , sd: 0.152 , DD: NA

Age class 2 to 3 - mean: 0.917 , sd: 0.098 , DD: NA

Age class 3 to 4 - mean: 0.938 , sd: 0.107 , DD: NA

Age class 4 to 5 - mean: 0.939 , sd: 0.025 , DD: NA

Age class 5 to 6 - mean: 0.939 , sd: 0.025 , DD: NA

B.1.4 Impacts

Number of impact scenarios: 3.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: No

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: No

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2030 to 2065

B.1.5 Impact on demographic rates

B.1.5.1 Scenario A – Name: 30% displacement, 1% mortality - All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.00029157 , se: NA

B.1.5.2 Scenario B - Name: 50% displacement, 1% mortality - All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.00045394 , se: NA

B.1.5.3 Scenario C - Name: 70% displacement, 1% mortality - All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.00061718 , se: NA

B.1.6 Output

First year to include in outputs: 2030

Final year to include in outputs: 2065

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Appendix C: Great black-backed gull PVA inputs – cumulative impacts

C.1 Great black-backed gull PVA inputs

The log file was created on: 2024-10-28 10:09:02 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

Package Version

popbio "popbio" "2.4.4"

shiny "shiny" "1.1.0"

shinyjs "shinyjs" "1.0"

shinydashboard "shinydashboard" "0.7.1"

shinyWidgets "shinyWidgets" "0.4.5"

DT "DT" "0.5"

plotly "plotly" "4.8.0"

rmarkdown "rmarkdown" "1.10"

dplyr "dplyr" "0.7.6"

tidyr "tidyr" "0.8.1"

C.1.1 Basic information

This run had reference name “GBBG_Cumulative_GapFill”.

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 15.

Years for burn-in: 5.

Case study selected: None.

C.1.2 Baseline demographic rates

Species chosen to set initial values: Great Black-Backed Gull.

Region type to use for breeding success data: Global.

Available colony-specific survival rate: National. Sector to use within breeding success region: Irish Sea.

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 3 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: all.individuals

Are baseline demographic rates specified separately for immatures?: Yes.

C.1.3 Population 1

Initial population values: Initial population 17742 in 2000

Productivity rate per pair: mean: 1.01101213410772, sd: 0.472458479741433

Adult survival rate: mean: 0.93 , sd: 0.001

Immatures survival rates:

Age class 0 to 1 - mean: 0.798 , sd: 0.092 , DD: NA

Age class 1 to 2 - mean: 0.93 , sd: 0.001, DD: NA

Age class 2 to 3 - mean: 0.93 , sd: 0.001, DD: NA

Age class 3 to 4 – mean: 0.93 , sd: 0.001, DD: NA

Age class 4 to 5 - mean: 0.93 , sd: 0.001, DD: NA

C.1.4 Impacts

Number of impact scenarios: 2.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: No

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: No

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2030 to 2065

C.1.5 Impact on demographic rates

C.1.5.1 Scenario A - Name: AR 99.39% – All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.0096615, se: NA

C.1.5.2 Scenario B - Name: AR 99.91% - All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.0014255, se: NA

C.1.6 Output

First year to include in outputs: 2030

Final year to include in outputs: 2065

How should outputs be produced, in terms of ages?: whole.population

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

Appendix D: Mona Offshore Wind Project and Morgan Offshore Wind Project: Generation Assets – Offshore Ornithology Cumulative Effects Assessment and In-combination Gap-filling Historical Projects - Methodology

MONA OFFSHORE WIND PROJECT

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Offshore Ornithology Cumulative Effects Assessment and In-combination Gap-filling Historical Projects Note

August 2024

F0.1

Image of an offshore wind farm

www.morganandmona.com/en

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
F0.1	Draft for consultation	RPS and Niras	Mona Offshore Wind Ltd & Morgan Offshore Wind Ltd	Mona Offshore Wind Ltd & Morgan Offshore Wind Ltd	August 2024

Prepared by:

RPS

Prepared for:

Mona Offshore Wind Ltd.
Morgan Offshore Wind Ltd.

Contents

1 OFFSHORE ORNITHOLOGY CUMULATIVE EFFECTS ASSESSMENT AND IN-COMBINATION GAP-FILLING HISTORICAL PROJECTS NOTE

1.1 Background and aims

1.1.1.1 This note has been developed collectively by the Mona Offshore Wind Project (hereafter referred to as 'Mona') and Morgan Offshore Wind Project: Generation Assets (hereafter referred to as 'Morgan Generation'). These two projects will hereafter be referred to collectively as 'the Projects', whilst the Applicant of each project will be referred to collectively as 'the Applicants'.

1.1.1.2 This note follows a technical note (Titled: Cumulative Effects Assessment and In-combination Historical Projects Note – Environmental Statement and Habitat regulations assessments approach) that was prepared by the Applicants in relation to the Projects to outline the approach taken at application(s) for quantifying impacts from historical offshore wind projects for which quantitative analyses were not undertaken. The technical note outlining the approach taken at application was developed in conjunction with the Morecambe Generation Assets Offshore Wind Project. This offshore ornithology cumulative effects assessment and in-combination gap-filling historical projects note has been developed in relation to the Projects only in response to relevant representations from the Statutory Nature Conservation Bodies (SNCBs).

1.1.1.3 As part of the Evidence Plan Process the Projects circulated, prior to the respective DCO applications, the technical note titled *Cumulative Effects Assessment (CEA) and In-combination Historical Projects Note – Environmental Statement and Habitat regulations assessments approach* to the SNCBs (emailed on 26 January 2024). In short, this previous technical note set out that the approach taken in the DCO applications was robust, precautionary, and provided sufficient detail to conclude no significant effects within the Environmental Statements or no adverse effect on site integrity (AEOI) beyond reasonable scientific doubt for the purposes of the Habitats Regulations Assessments (HRAs) undertaken for each of the Projects. The technical note also stated that the assessments undertaken for the Projects were consistent with the information provided in similar recent offshore wind applications.

1.1.1.4 Since submission of the relevant DCOs, Relevant Representations from Natural England (RR-026 for Morgan Generation), Natural Resources Wales (NRW) (RR-011 for Mona and RR-027 for Morgan Generation) and Joint Nature Conservation Committee (JNCC) (RR-033 for Mona), commented that the qualitative assessments included in Volume 2, Chapter 5: Offshore ornithology (APP-057 for Mona and APP-023 for Morgan Generation) do not adequately account for the impacts from historical projects and that quantitative assessments are required.

1.1.1.5 The Applicant notes that a quantitative assessment of historical projects was originally tendered by Natural England as a strategic project but has not been awarded and completed in time for the Mona and Morgan DCO applications and examinations. This was acknowledged in the sixth Expert Working Group (EWG) meeting on 16 October 2023. The Applicant notes NRW's relevant representation (RR-011) states "There are ongoing internal discussions surrounding the development of an approach that may help to address this issue, which will be shared with the Applicant for consideration in due course". The Applicant is continuing to engage with NRW to understand any proposals forthcoming from NRW; however, the Applicant considers that the quantitative assessment approach using the methodology recommended by the

SNCBs in an advice note provided to the Applicants on 16 October 2023 provides the required information in order to resolve this outstanding concern.

1.1.1.6 The Applicants consider that the qualitative assessments presented at application are a valid presentation of the potential risks from historical projects (Volume 2, Chapter 5: Offshore ornithology (APP-057 for Mona and APP-023 for Morgan Generation)) due to the very small number of birds involved. It is further considered that the approach set out in this note is above and beyond the requirements for a robust application and exceeds information provided for other recently consented offshore wind farm projects in the region and Plan Level HRAs; but provides the information requested by SNCBs (i.e. 'indicative estimates' for currently unquantified impacts from historical projects).

1.1.1.7 This note presents a quantitative assessment approach, using the methodology recommended by the SNCBs in an advice note provided to the Applicants on 16 October 2023 to generate indicative numbers for currently unquantified impacts from historical offshore wind farm projects.

1.2 Advice given by SNCBs during Statutory Consultation and the Evidence Plan Process

1.2.1.1 During the Statutory Consultation on the Mona Preliminary Environmental Impact Report (PEIR) and the Morgan Generation PEIR, NRW, JNCC and Natural England did not consider it appropriate to base the cumulative (and hence also in-combination) assessments on a number of 'unknowns' for impacts from some historical offshore wind projects. They outlined that whilst these historical projects may not have undertaken quantitative assessments or assessments using current approaches, "indicative estimates" should be generated for these historical projects.

1.2.1.2 During the pre-application phases for the Projects, Natural England provided advice within an advice note on 16 October 2023 on 'gap filling' for historical offshore wind projects, where fully quantitative assessments have not been provided. NRW and JNCC agreed to the methods presented within Natural England's advice note during the seventh EWG meeting on 8 December 2023. Similarly, both JNCC and NRW, as part of their relevant representations to Mona Offshore Wind Project, refer to the advice received as "SNCB advice"; hereafter, the advice note is referred to as the 'SNCB Advice Note'. NRW, JNCC and Natural England suggested that the approach to assessing the historical projects should continue to be explored collaboratively through any additional offshore ornithology EWGs.

1.2.1.3 The SNCB Advice Note sets out the following:

Natural England do not consider that AEOI can be ruled out beyond reasonable scientific doubt for several species/SPA combinations at Round 4 Irish Sea projects. This is due in part to a lack of appropriate consideration of impacts arising from pre-existing OWFs. This presents a clear consenting risk and would ideally be resolved prior to examination. Natural England consider that some estimate of impact must be attributed to all projects screened in to cumulative and in-combination assessments to reduce or eliminate this risk which arises in some cases simply from a lack of provision of relevant information.

1.2.1.4 The SNCB Advice Note recommended the following approach to estimate displacement and collision impacts from the relevant projects.

Displacement

1. Review the submitted environmental statement. It is accepted that displacement mortality estimates may not be presented. However, if there is abundance data, utilise *this to populate project-specific displacement matrices for relevant species. We also suggest review of the Round 4 plan-level HRA to determine if any suitable estimates are presented therein.*

If no abundance data available…

2. Use a nearby windfarm with a published estimate of mortality arising from displacement as a proxy. Scale this estimate according to the relative area of the two arrays and appropriate buffers.

Collision

1. Review the submitted environmental statement. It is accepted that collision mortality estimates may not be presented. However, if there is abundance data, utilise this to run project-specific CRMs according to current best practice for relevant species. We also suggest review of the Round 4 plan-level HRA to determine if any suitable estimates are presented therein.

If no abundance data available…

2. Use a nearby windfarm with a published estimate of mortality arising from collision as a proxy. Scale this estimate according to the relative number of turbines in the two arrays. The difference in the turbine specifications should be considered to determine if this method is likely to over or underestimate impact.

***If a more rigorous assessment is considered necessary**, the best available bird density estimates and known array footprint + buffers and consented turbine parameters should be used to generate refined project specific assessments of displacement and collision mortality. If baseline characterisation data are not available for a given "gap-filling" project, MERP, strategic VAS of OWF areas, or the recent Welsh Atlas data could be considered (links and references available on request).*

1.2.1.5 The SNCB Advice Note states, "it is acknowledged that the approach detailed below [in the SNCB Advice Note] is flawed". The flawed nature of the SNCBs recommended approach (i.e. using proxies) meant that the Applicants decided to undertake a "more rigorous assessment" to gap-fill historical projects. Using a more rigorous approach provides additional robustness and repeatability to the assessment and is considered the best way to address the gaps.

1.2.1.6 The Applicants' initial assessment of proxies found very high levels of variation presented within the site-specific data of nearby wind farms. In addition, the results of recent surveys (e.g. for Awel y Môr) are highly likely to have been impacted by the presence of two historical projects nearby (in this instance Gwynt y Môr and Rhyl Flats). Having already constructed offshore wind farms within a survey area is highly likely to impact the distribution and abundance of seabirds; therefore, it is not considered appropriate to use such schemes as a proxy.

1.2.1.7 In addition, seabird species show high levels of interannual variation in distribution and movement patterns. To account for this high level of interannual variation, the current offshore wind farm guidance (Parker *et al.*, 2022[1]) requires two consecutive years of data. Several of the older offshore wind farms which could be used as a proxy due to having site-specific data, only undertook surveys over a single year or single bio-

[1] Parker, J., Banks, A., Fawcett, A., Axelsson, M., Rowell, H., Allen, S., Ludgate, C., Humphrey, O., Baker, A. & Copley, V. (2022). Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase I: Expectations for pre-application baseline data for designated nature conservation and landscape receptors to support offshore wind applications. Natural England. Version 1.1. 79 pp.

season (e.g. breeding), and therefore, use of this data would not accord with current best practice guidance.

1.2.1.8 After considering the use of proxies, the ornithological consultants for the Projects concluded that there is no pragmatic or consistent way to use proxy wind farms, and therefore, this approach has not been pursued further.

1.2.1.9 It was considered more appropriate to use the data outputs of the Marine Ecosystems Research Programme (MERP) (Waggitt *et al*., 2020[2]) (hereafter referred to as MERP data), as recommended by the SNCBs. The MERP data produces average density estimates at a 10x10km grid square resolution of the entire north east Atlantic using data from aerial and boat-based surveys from 1980 to 2018. This large temporal and spatial coverage represents the best available data within this area. The ability to use a published source of data also removes potential differences in reproduction and analysis of the data.

1.3 Applicants' proposed approach to cumulative/in-combination assessments for gap-filling historical offshore wind farm projects

1.3.1 Species to be considered for gap-filling historical offshore wind farm projects.

1.3.1.1 The Applicants' approach is to gap-fill projects for species for which the lack of quantification in the CEAs of the Environmental Statements and the in-combination assessments of the HRAs could result in an under-estimation of the cumulative effects (i.e. displacement and collision).

1.3.1.2 The Applicants are proposing to gap-fill historical projects for species assessed in the Environmental Statements for the Projects (Table 1).

[2] Waggitt, J. J., Evans, P. G., Andrade, J., Banks, A. N., Boisseau, O., Bolton, M., ... & Hiddink, J. G. (2020). Distribution maps of cetacean and seabird populations in the North-East Atlantic. Journal of Applied Ecology, 57(2), 253-269.

Table 1: List of species and justification for whether they have been considered in the gap-filling exercise for each Project.

Species	Mona	Morgan Generation
Common scoter (for disturbance and displacement)	**No –** sufficient information is available from existing projects to enable robust assessment to be undertaken	**No** – species not considered in assessments due to no connectivity and no birds recorded during baseline surveys
Red-throated diver (for disturbance and displacement)	**No –** sufficient information is available from existing projects to enable robust assessment to be undertaken	**No** – species not considered in assessments due to no connectivity and no birds recorded during baseline surveys
Atlantic puffin (for disturbance and displacement)	**No** – species only present in low numbers during site-specific surveys and therefore the likelihood of a significant impact occurring was considered to be negligible	**No** – species only present in low numbers during site-specific surveys and consequently the likelihood of a significant impact occurring was considered to be negligible
Black-legged kittiwake (for disturbance and displacement, and collision risk)	**Yes** – Mona contributes to existing cumulative impact in a measurable manner	**Yes** – species considered for one or more SPAs within the Integrity test: Step 2 of the ISAA. Morgan Generation Assets also contribute to existing cumulative impact in a measurable manner
Common guillemot (for disturbance and displacement)	**Yes** – Mona contributes to existing cumulative impact in a measurable manner	**Yes** – species considered for one or more SPAs within the Integrity test: Step 2 of the ISAA. Morgan Generation Assets also contribute to existing cumulative impact in a measurable manner
Great black-backed gull (for collision risk)	**Yes** – Mona contributes to existing cumulative impact in a measurable manner	**Yes** – species considered for one or more SPAs within the Integrity test: Step 2 if the ISAA. Morgan Generation Assets also contribute to existing cumulative impact in a measurable manner
Herring gull (for collision risk)	**Yes** – Mona contributes to existing cumulative impact in a measurable manner	**Yes** – species considered for one or more SPAs within the Integrity test: Step 2 of the ISAA. Morgan Generation Assets also contribute to existing cumulative impact in a measurable manner
Lesser black-backed gull (for collision risk)	**Yes** – Mona contributes to existing cumulative impact in a measurable manner	**Yes** – Morgan Generation Assets contribute to existing cumulative impact in a measurable manner
Manx shearwater (for disturbance and displacement)	**Yes** – Mona contributes to existing cumulative impact in a measurable manner	**Yes** – Morgan Generation Assets contribute to existing cumulative impact in a measurable manner
Northern fulmar (for collision risk)	**No** – Mona not considered to materially contribute to existing cumulative impact	**No** – Morgan Generation Assets not considered to materially contribute to existing cumulative impact
Northern gannet (for disturbance and displacement, and collision risk)	**Yes** – Mona contributes to existing cumulative impact in a measurable manner	**Yes** – Morgan Generation Assets contribute to existing cumulative impact in a measurable manner
Razorbill (for disturbance and displacement)	**Yes** – Mona contributes to existing cumulative impact in a measurable manner	**Yes** – Morgan Generation Assets contribute to existing cumulative impact in a measurable manner

1.3.2 Cumulative displacement

1.3.2.1 It is the Applicants' position that in order to provide the quantitative gap filling requested by SNCBs, a rigorous assessment with the best available bird density estimates should be used to generate "indicative estimates" of displacement.

1.3.2.2 This aligns with the advice provided by the SNCBs on 16 October 2023 on 'gap filling' for historical offshore wind projects.

1.3.2.3 If baseline characterisation data from project-specific documentation are not available for a given historical project or are not considered robust enough to allow for the calculation of impacts, baseline data on seabird distribution from the MERP (Waggitt *et al*., 2020) as specified by the SNCB Advice Note, would be used.

1.3.2.4 The Applicants consider the MERP data to be the best evidence available to characterise baseline abundance given its spatial coverage (the northeast Atlantic) and extensive temporal coverage (1980 and 2018). Using a dataset which covers almost 40 years will allow for interannual variation to be less prominent and provided an indication of average density within the area of interest. It should be noted that the publicly accessible MERP data represents relative and not absolute density estimates, and therefore, any predicted impacts presented are to be taken as relative and not absolute impacts. However, this is considered appropriate to provide the 'indicative' numbers as requested by the SNCBs.

1.3.2.5 Where project-specific documentation (e.g. the original Environmental Statement) indicates the absence or very low abundance of a species considered in 'gap-filing' exercise, there is no requirement to re-characterise the baseline using the MERP data as 'gap-filling' would not be undertaken in these instances. Furthermore, the Applicants will not seek to provide an assessment for any species that were not originally modelled in the project Environmental Statement (e.g. Manx shearwater from Rampion 2 Wind Farm).

1.3.2.6 As parameters used in the displacement matrices modelling (e.g. displacement and mortalities rates) may differ between applications, each of the Projects will undertake its own modelling based on the agreed abundance data.

1.3.3 Cumulative collision

1.3.3.1 Similarly to displacement, the Applicants' position is that if a quantitative gap filling is required, a rigorous assessment using the best available bird density estimates should be used to generate "indicative estimates" of collision.

1.3.3.2 Project-specific collision risk models for historical offshore wind farm projects would be re-run where data is not available from those projects (as advised by the SNCBs in section 1.2). This would allow for an estimate to be generated which can be used to compare and contextualise the approach taken within the CEA of the Environmental Statement submitted for the Projects.

1.3.3.3 Where abundance data are not available from project-specific documentation, baseline data on seabird distribution from the MERP (Waggitt *et al*., 2020) will be used. It is noted that there is no predicted density estimate for great black-backed gull within the MERP data. Therefore, a different data source is proposed to quantify the density of this species within the Irish Sea. As agreed between ornithological consultants for Mona and Morgan Generation, the Seabird Mapping and Sensitivity Tool (SeaMaST) has been identified as the most appropriate due to its spatial and temporal coverage (Bradbury *et al*., 2014)[3].

1.3.3.4 As only the ‘all behaviour data’ are publicly available from MERP, correction factors will be applied to derive densities of birds in flight. Species correction factors calculated from the proportion of birds flying vs. other behaviours present within the Mona, Morgan Generation and Morecambe Generation survey areas (based on an annual average for the three projects) will be used. These three projects were chosen as the three more recent digital aerial survey campaigns within the region, which cover a large proportion of the Irish Sea. This approach uses Digital Aerial Survey data which presents the proportion of flying vs. other behaviour more accurately than boat-based surveys.

1.3.3.5 Similar to the displacement approach, where project-specific documentation (e.g. the original Environmental Statement) indicates the absence or very low abundance of a species considered in this ‘gap-filing’ exercise, the Applicants will not seek to re-characterise the baseline using the MERP data and undertake an assessment of collision risk. Similarly, if the Environmental Statement (or other document) considered that collision risk modelling was not required (e.g. lesser black-backed gull from Awel y Môr), no new assessment will be undertaken.

1.3.3.6 As parameters used in the collision risk models (e.g. avoidance rates or flight speeds) may differ between applications, each of the Projects will undertake its own modelling based on the jointly agreed abundance data.

1.3.3.7 Collision risk models using abundance estimates (from project-specific documentation and MERP) will be run deterministically using the sCRM developed by Marine Scotland (McGregor *et al*., 2018)[4]. The user guide for the sCRM Shiny App provided by Marine Scotland (Donovan, 2017)[5] will be followed for the modelling of collision impacts predicted for each historical project.

1.3.4 Wind farm/turbine parameters and consented scenario

1.3.4.1 The SNCB Advice Note stated that the consented turbine parameters should be used to generate refined project-specific assessments of displacement and collision mortality. The Applicants have used consented parameters when these have been available, but some wind farm documents only provide as-built scenarios (e.g. Robin Rigg). Where there is no information on the consented wind farm turbine parameters the as-built parameters will be used.

1.3.4.2 The wind turbine parameters would be sourced using the MacArthur Green database (Crown Estate, 2019)[6]. This database provides a summary of offshore ornithological collision risk modelling data for all UK offshore wind farms.

1.3.4.3 The SNCB Advice Note also stated that “it would be appropriate to consider timelines and determine if any of these sites can be screened out”. A full breakdown of the wind farms considered and the parameters used will be presented alongside the results of

[3] 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(9), e106366.

[4] McGregor, R.M., King, S., Donovan, C.R., Caneco, B., and Webb, A. (2018) A Stochastic Collision Risk Model for Seabirds in Flight. Marine Scotland Report. Available at: https://tethys.pnnl.gov/sites/default/files/publications/McGregor-2018-Stochastic.pdf. Accessed August 2023.

[5] Donovan, C. (2018) Stochastic Band CRM – GUI User Manual, Draft V1.0, 31/03/2017.

[6] Crown Estate (2019). 2017-2019, Royal Haskoning, Cumulative Ornithological Collision Risk Database. Available at https://www.marinedataexchange.co.uk/details/TCE-2373/2017-2019-royal-haskoning-cumulative-ornithological-collision-risk-database

this exercise in a separate document, which will be shared with the relevant SNCBs in due course.

1.3.4.4 The updated values for as-built scenarios (where possible) will be presented alongside the consented values for comparative purposes only. This will highlight the scenario with the greatest risk and allow stakeholders to validate the conclusion of the quantitative and qualitative CEA presented in the Project Environmental Statements.

1.3.5 Presentation of results

1.3.5.1 The impacts of displacement and collision calculated using abundance estimates (from project-specific documentation and MERP) will be presented.

1.3.5.2 The implications of including impacts from the gap-filled historical projects will be presented for the selected species shown in Table 1.

1.3.5.3 This will allow stakeholders to validate the conclusions of the quantitative and qualitative CEAs presented in the Project Environmental Statements and the in-combination assessment for both Projects.

1.3.5.4 If the numbers demonstrate that the ‘gap filled’ CEA could materially alter the conclusions of the assessment, the impact will be investigated further using the approaches applied in the Environmental Statement chapters for each project.

Appendix E: Meeting minutes for offshore ornithology meeting with the JNCC, NRW and Natural Resources Wales on 29 August 2024

MINUTES OF MEETING

Security Classification: Project External

Partners in UK offshore wind

MOM Number	**:**	20240829_Morgan and Mona Offshore Ornithology	**REV. No.**	**:**	F01
MOM Subject	**:**	Morgan and Mona Offshore Wind Projects & SNCB meeting: Offshore Ornithology CEA - Gap-filling of historical offshore wind projects			

MINUTES OF MEETING

MEETING DATE	**:**	29/08/2024
MEETING LOCATION	**:**	MS Teams
RECORDED BY	**:**	Thomas Griffin-Beale (RPS)
ISSUED BY	**:**	S. Tuddenham (RPS)

PERSONS PRESENT:

- Sarah Randall – bp (SR)
- Paul Carter – bp (PC)
- Hannah Adams – bp (HA)
- Philip Bloor – bp (PB)
- Kevin Linnane – RPS (KL)
- Samantha Tuddenham – RPS (ST)
- Thomas Griffin-Beale – RPS (TGB)
- Lucas Mander – RPS (LM)
- Nick Goldsmith – RPS (NG)
- Matt Hazleton – NIRAS (MH)
- Anne Moullier – NIRAS (AM)
- Richard Shelmerdine – JNCC (RS)
- Mike Meadows – JNCC (MM)
- Rebecca Hall – JNCC (RH)
- Emma Lowe – NRW (EL)
- Paige Minahan NRW - (PM)
- Adam Cooper – NRW (AC)
- Helen Rowell – NRW (HR)
- Emma Cole – NRW (EC)
- Kathleen Bealby – Natural England (KB)
- Richard Berridge – Natural England (RB)

ITEM NO:	DISCUSSION ITEM:	Responsible party	Date
1.	**Project Updates** KL welcomed all to the meeting and led introductions. HA provided an update on the Mona Offshore Wind Project. HA – The Mona Offshore Wind Project Examination is ongoing. Deadline 2 was on 27th August. The Examining Authority (ExA) issued a Rule 17 letter specifically referring to offshore ornithology, a response to which was provided at Deadline 2 and will be live on the Planning Inspectorate website soon. Also included at Deadline 2		**Mona Offshore Wind Project**

	were revised offshore ornithology application documents to address identified errata and revised Cumulative Effects Assessment (CEA) numbers to align with the Morgan Offshore Wind Project: Generation Assets (hereafter referred to as the Morgan Generation Assets) and Morecambe Generation Assets, responses to Written Representations were also submitted. Deadline 3 is on 30th September and the Applicant is anticipating submitting the results of the gap-filling analysis then. KL- This draft technical note sent to the Statutory Nature Conservation Bodies (SNCBs) ahead of the meeting will be updated to reflect the updated application material submitted at Deadline 2 and SNCB feedback where appropriate (including the Written Representations). The results presented in the final technical note will not materially differ from those presented in the draft technical note. MM - We may disagree that the edits made to the application material would not make a difference to the results of the gap-filling analysis. KL- Noted, it may make some difference to the overall numbers but it won't change the numbers produced for the historical projects or the overall conclusions of the assessments. SR provided an update on the Morgan Generation Assets. SR – The Procedural Deadline for the Morgan Generation Assets was on 27th August, the Rule 6 Letter setting out the Morgan Generation Assets timescales was issued on 5th August. The first hearings are being held on 10th September and Deadline 1 is on 3rd October. Statement of Common Ground (SoCG) meetings are ongoing in preparation for submission at Deadline 1.		**Deadline 2: 27th August** **Mona Offshore Wind Project Deadline 3: 30th September** **Morgan Generation Assets Deadline 1: 3rd October**
2.	**Context for gap-fill methodology** KL set out the context for the gap-filling methodology and the advice received up to this point from SNCBs. KL – The SNCB responses to the Mona Offshore Wind Project s42 consultation flagged concerns in relation to the consideration of historic offshore wind projects. In October 2023, advice from Natural England which was endorsed by Natural Resources Wales (NRW) and the Joint Nature Conservation Committee (JNCC) was issued to the Mona Offshore Wind Project and Morgan Generation Assets (hereafter referred to as the 'SNCB Advice Note') regarding suggested methodologies for 'gap filling' historical offshore wind projects. For the Mona Offshore Wind Project and Morgan Generation Assets applications, the Applicants provided a qualitative assessment of certain historical offshore wind projects' impacts on offshore ornithology. In Relevant Representations (Mona Offshore Wind Project and Morgan Generation Assets) and Written Representations (Mona Offshore Wind Project only), it was flagged that a qualitative assessment for these historical offshore wind projects may be insufficient. The aim of the gap-fill work was to generate indicative numbers for currently unquantified impacts from historical projects using a methodology recommended in the SNCB Advice Note, to provide an understanding of potential cumulative or		

	in-combination impacts and to enable an informed judgement to be made on the risks associated with these projects. KL- The Applicants and the SNCBs have previously discussed the difficulty of reassessing other projects' impacts. In addition, the Applicants and SNCBs have discussed that this is something that typically hasn't been done for other offshore wind projects and ought to be addressed at a strategic level. However, the Applicants are looking to support the SNCBs and provide the information to allow advice on significant effects and adverse effects on integrity (AEoI) to be provided with respect to the Mona Offshore Wind Project and Morgan Generation Assets. The gap-fill analysis results should be viewed alongside the Environmental Impact Assessments (EIA) and Habitats Regulation Assessments (HRA) submitted with the applications. KL- The Applicants have followed the SNCB Advice Note for the gap-fill analysis. There are a number of ways that these estimates could be generated. The Mona Offshore Wind Project and Morgan Generation Assets ornithology teams (RPS and Niras) have worked together on the approach liaising with the Morecambe Generation Assets project team and ornithologists (Royal HaskoningDHV). The specialists feel that the approach adopted is the most defensible and robust approach. LM – The Applicant has considered all three potential approaches from the SNCB Advice Note. With regards to the first, where possible, site-specific abundance data for historical projects from submitted Environmental Statements were used in the application documents. Post-application the Applicant has identified more information from historical projects before undertaking the third approach. The Applicant has progressed with the third approach for quantifying the impacts of historical projects, using data on seabird distributions from the Marine Ecosystems Research Programme (MERP). This is regarded in the SNCB Advice Note as a 'more rigorous assessment' to gap-fill historical projects.		
3.	**<u>Gap filling methodology for Mona Offshore Wind Project and Morgan Generation Assets (presented by LM)</u>** Displacement – To gap-fill historical projects, the Applicant used data on seabird distribution from the MERP (Waggitt *et al*., 2020) as specified by the SNCB Advice Note from October 2023. For four of the eight historical projects, MERP data was used. For the rest, a combination of MERP data and site-specific data identified post-application was used. The data used was presented in table 1.2 of the results note issued ahead of this meeting. Collision Risk Modelling (CRM) – If collision risk data from project-specific documentation were not available for a given historical project, the Applicant obtained data on seabird densities from MERP. Seabird Mapping and Sensitivity Tool (SeaMaST) data was used to quantify the density of great black-backed gull. Collision risk modelling was undertaken using the stochastic CRM (sCRM) developed by Marine Scotland (McGregor et al., 2018). Collision risk models were run deterministically in the sCRM using Band Option 2 of the sCRM. Displacement and mortality- The parameters used were identical to the parameters used in the respective Mona Offshore Wind Project		

	and Morgan Generation Assets development consent order (DCO) applications. Both the species-group and species-specific avoidance rates have been used, both of which come from Ozsanlev-Harris *et al.* (2023). The full range of displacement and mortality rates has been presented but the Applicant's preferred displacement and mortality rates were taken forward to compare the CEA at application and the CEA gap-fill. RH – After the Atlantic Puffin mortality numbers were corrected in the revised Mona Offshore Wind Project Application documents updated at Deadline 2, were they included in the gap-fill work? LM – Not as it stands (see post-meeting note on page 4). HR – What were the reasons for running the model deterministically rather than stochastically? NG – Waggitt/Bradley data presented as mean abundance and with standard deviations but the way that the parameters were used for the wind turbines meant that the Applicant couldn't use both. HR – Suggest this detail is included in the technical note as it is currently not in the draft version. NG – This will be clearly explained within the results note submitted at Deadline 3. **Post-meeting note:** The corrected annual impact on Atlantic puffin from displacement was 0 (0 to 3) birds (30% displacement to 1% mortality to 70% displacement to 10% mortality) - as amended in updated Volume 2, Chapter 5: Offshore ornithology (REP2-016). Considering the maximum impact on Atlantic puffin is 3 birds annually, and that the abundance of birds from project-specific applications in the Irish Sea is low, it was not deemed necessary to gap-fill projects for Atlantic Puffin.	**The Applicants to clearly explain why the model was run deterministically rather than stochastically in the results notes submitted at Deadline 3 for the Mona Offshore Wind Project and Deadline 1 for the Morgan Generation Assets.**	30/09/2024 (Mona) 03/10/2024 (Morgan Generation Assets)
4.	<u>**Mona Offshore Wind Project Results (presented by LM)**</u> For displacement of kittiwake, the difference in baseline mortality between the CEA presented within the DCO application and the CEA gap-fill results is very small (<0.017%). This is the same across all species, meaning that the addition of the quantitative data for historical projects added little in terms mortality. For collision, the difference in the increase in baseline mortalities are again small (e.g. 0.045% for the consented and as-built parameters for back-legged kittiwake). Based on the small differences in baseline mortalities, the additional historical projects will have no effect on the conclusions of the CEA presented at application and would not affect the overall conclusions of no AEoI on any Special Protection Areas (SPAs) designated for black-legged kittiwake. Due to the change in mortality between the CEA presented in the Mona Offshore Wind Project application documents and the gap-filled CEA, there is the need to undertake further assessment (PVA) of the impact to see if the magnitude of impact presented within Volume 2, Chapter 5: Offshore ornithology is still valid. For greater black-backed gull, the gap-fill CEA for collision results in an increase of baseline mortality of 3.450 % (using the species-group avoidance		

	rate recommend by SNCBs) and therefore there is a need to conduct an updated Population Viability Analysis (PVA) for this species. Further assessment (PVA) on great black-backed gull is presented in the draft technical note issued before this meeting and in slide 24. The Applicants consider that connectivity between the Mona Offshore Wind Project and the Isles of Scilly SPA is highly unlikely, and that a PVA is therefore unnecessary for the Mona Offshore Wind Project, but a PVA has still been conducted to demonstrate the potential impact on the population. For herring gull, the difference in the increase in baseline mortality are small (0.333%). Based on the small differences in baseline mortalities, the additional historical projects will have no effect on the conclusions of the CEA presented at application and would not affect the overall conclusions of no AEOI on any SPAs designated for herring gull. For lesser black-backed gull, the difference in the increase in baseline mortality are small (0.025%). Based on the small differences in baseline mortalities, the additional historical projects will have no effect on the conclusions of the CEA presented at application and would not affect the overall conclusions of no AEOI on any SPAs designated for lesser black-backed gull. For northern gannet, the difference in the increase in baseline mortality are small (0.015%). Based on the small differences in baseline mortalities, the additional historical projects will have no effect on the conclusions of the CEA presented at application and would not affect the overall conclusions of no AEOI on any SPAs designated for northern gannet. For kittiwake and northern gannet combined displacement and collision risk, the increases in baseline mortality are small (0.011% and 0.003% respectively). Based on the small differences in baseline mortalities, the additional historical projects will have no effect on the conclusions of the CEA presented at application and would not affect the overall conclusions of no AEOI on any SPAs designated for northern gannet and kittiwake. <u>PVA for great black-backed gull (presented by NG)</u> The cumulative impact on great black-backed gull continues to surpass the 1% threshold for further assessment. When considering the cumulative increase in baseline mortality, it is predicted to be 3.450% (when using the species-group avoidance rate of 99.39) and 0.517% (when using the species-specific avoidance rate of 99.91). The counterfactual growth rate is 0.996; this is smaller than the baseline (unimpacted) scenario. All three modelled scenarios result in population growth. RB – The largest Biologically Defined Minimum Population Scales (BDMPS) population being used in the PVA is still the 44,753. In March 2024 advice was provided with a different population (largest was 17,742). Confused as to why the 44,000 population is still being used, as the 17,742 would give different results. The reference population used for the Morgan Generation Assets is the correct 17,742. HR worked on this and can provided further information. HR – The initial 44,000 advised in 2023 was joint SNCB (NE/NRW/JNCC) advice, where all UK non-SPA western colonies from Furness (2015) had been included in the total UK south-west and		

	Channel BDMPS (that relevant for Mona/Morgan) breeding season reference population calculation. This was subsequently revisited by NE and NRW and a review of the locations of great black-backed gull non-SPA western colonies showed that a significant proportion of these were located in Scotland. A review of the colonies and their counts from Seabird 2000 was undertaken and based on the locations of the colonies with regard to the relevant BDMPSs, the total non-SPA western colonies total from Furness (2015) was split out accordingly to the UK south-west and Channel BDMPS and the UK west of Scotland waters BDMPS. This resulted in a recalculated south-west and Channel BDMPS breeding season reference population of 13,424, meaning that the largest BDMPS to use for EIA annual impact assessment was the non-breeding season figure of 17,742 from Furness (2015). The 17,742 therefore became the correct reference population and was included in the interim Natural England and NRW advice note sent by Natural England to Round 4 and Extension projects in March 2024 (see post-meeting note on page 7). RB – It might be worth checking through in general to make sure that the numbers provided in this Advice Note are reflected in both the Mona Offshore Wind Project and Morgan Generation Assets assessments – Morgan Generation Assets has used a herring gull number that may also not be correct. NG – The PVA results for the gap-fill exercise could be re-run using this BDMPS number if necessary. RH – In terms of the use of percentage of birds in flights from the Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Generation Assets surveys and applying these to the gap-filled projects, we would query how appropriate it would be to apply those numbers to wind farms closer to the coast, given that birds may behave differently closer to the coast than further offshore? It would be worth checking the percentages of birds in flight from wind farms located closer inshore with available data. NG – These numbers were chosen as those are the most recent surveys and were conducted across the widest swathe of the Irish Sea. It may be possible to incorporate Awel y Mor's aerial survey data as a representative closer to the coast. HR – The percentage of birds in flight is averaged from an annual number to produce an identical % for each month – is this appropriate, given CRM uses monthly density estimates of birds in flight? NG – It would be possible to do a month-by-month breakdown – we can review and see if this produces differences in the results if used. HR – Would definitely like to see the results using a month-by-month number for percentage of birds in flight. MM – There's also the possibility to use the in-flight data from the MERP data. NG – This was looked at but wasn't available in the timeframes. RB – If you run the CRM deterministically it shouldn't matter whether monthly numbers are adjusted front-end or back-end. Main concern with data is that again this data is predominantly offshore, whereas	**The Applicants to check that the numbers provided in the SNCB Advice Note in March 2024 are reflected in both the Mona Offshore Wind Project and Morgan Generation gap-fill.** **The Applicants to run a month-by-month breakdown of the percentage of birds in fight to check if results differ** **The Applicants to check whether there are any significant differences between the percentage of birds in flight numbers from the Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Generation Assets surveys and those available from historical projects.**	30/09/2024 (Mona) 03/10/2024 (Morgan Generation Assets) 30/09/2024 (Mona) 03/10/2024 (Morgan Generation Assets)

	the historical projects are closer to shore, and there are behavioural differences closer to shore. If you can justify that this approach is appropriate and that there's no difference whichever percentage of birds in flight is used then that would be good and Natural England would be content with what has been produced, but currently this is an area of uncertainty. Might be useful to look at if any of the historical projects have Digital Areal Survey data available. KL – We can look into this to see if there are any significant differences between the percentage of birds in flight numbers from the Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Generation Assets surveys and those available from historical projects. RB – Appreciated and agree that the idea here was always to produce indicative numbers and that this is, overall, a procedure designed to produce estimates. **Post-meeting note:** The Mona Offshore Wind Project did not directly receive the Natural England and NRW advice note from Natural England but instead was made aware of it through Morgan Offshore Wind Ltd.		
5.	**<u>Morgan Generation Assets Results (presented by MH)</u>** <u>Displacement</u> Similarly to the Mona Offshore Wind Project, for all species for displacement including historical projects does not materially alter the predicted magnitude of impact. In addition, these conclusions are also applicable to the ISAA, so no AEOI for all SPAs. <u>Collision risk</u> For kittiwake, the percentage increase in baseline mortality is small, and the conclusions presented at application do not change (no AEOI). For great black-backed gull, the percentage of baseline mortality does increase when incorporating historical projects but doesn't cross any thresholds to trigger the requirement for further assessment. For herring gull and lesser black-backed gull, the percentage increase in baseline mortality is small (although larger than kittiwake), and the conclusions presented at application do not change (no AEOI). For lesser black-backed gull, a lot of historical projects had already run assessments so a very small percentage increase is observed. For gannet, the increase in baseline mortality is small, and the conclusions presented at application do not change (no AEOI). For kittiwake and northern gannet combined displacement and collision risk, the increases in baseline mortality are small, and the conclusions presented at application do not change (no AEOI). KL – There is a technical note presenting initial results from the gap-fill exercise being prepared for the Morgan Generation Assets (planned to be submitted at Deadline 1) which will be circulated after this meeting. Do the SNCBs have any more feedback on the approach		

	– is what has been presented in line with what was required (noting clarifications required above)? RB – Agree that broadly the approach provides the information requested by SNCBs, but clarification is required on a few points. The results suggest that some of the historic projects do contribute to the cumulative effect so SNCBs maintain their position that this quantification was necessary. HR – The use of the MERP data is certainly more repeatable and defensible than the proxy approach but as per earlier, note the clarification on the points raised regarding birds in flight and try to source data closer to shore than the Mona Offshore Wind Project and Morgan Generation Assets data. RH – We are happy with the general approach and the use of MERP makes sense. Can any extra information used in these updated assessments/models be provided (e.g. wind farm width) so that the CRM outputs can be replicated? We're happy to provide written feedback on the technical note when provided. MH – Wind farm width not used for these models but happy to send over everything we've used in the Morgan Generation Assets modelling in the gap-fill technical note or include it in an appendix to the note. RB – In the initial advice from SNCBs a collaborative approach was recommended. This was to reduce the workload on individual projects but also to ensure consistency. From our perspective, it is important that the updated assessments all use the same data. It was clear that there was collaboration on the initial (critical/negative) response to SNCB advice, **but** since then, projects appear to have pursued their own gap-filling exercises using different methods. White Cross used the proxy sites method, generating indicative assessments of historic projects while also highlighting the relative levels of uncertainty & generally placing little confidence in the results. We considered the outputs sufficient to agree with the project's conclusions, noting that for some historic projects relatively high levels of impact were calculated for some species. However, Natural England are **not** advising that other projects adopt those impact estimates for CEA. SNCBs are currently unsure what approach Morecambe Generation Assets are taking to gap filling. Is there any collaboration ongoing between Morgan Generation Assets, the Mona Offshore Wind Project and the Morecambe Generation Assets? SR – Yes, the advice regarding alignment is being taken on board by all projects and there is a lot of conversations taking place between the projects while the Morecambe Generation Assets consider their Relevant Representations. HR – Note that Llyr wind farm project application has recently been submitted, and their figures are now in the public domain. KL – Noted the submission of the Llyr wind farm project application. Before we move to Next Steps, it is worth noting that other projects have approached the same problem of the historic project data gaps in different ways. For example, White Cross has taken a "proxy wind farm" approach and we note that SNCBs did not want that exercise	**The Applicants to provide all parameters used in the Mona Offshore Wind Project and the Morgan Generation Assets modelling in the gap-fill analysis.**	30/09/2024 (Mona) 03/10/2024 (Morgan Generation Assets)

	repeated for the Mona Offshore Wind Project and the Morgan Generation Assets. The Morecambe Generation Assets' DCO application took the approach of looking at how much the historic projects would need to add to the cumulative effects to exceed certain thresholds (and therefore represent a risk to protected bird species) and concluded they are unlikely to add to the risk of significant effects/AEoI. Ultimately, there is no significant difference in their conclusions with the inclusion of quantified impacts from historic projects. Given that the Mona Offshore Wind Project and the Morgan Generation Assets have undertaken different analyses, this suggests that no matter how this issue of data gaps from historic projects is viewed, these projects do not represent an increased risk for the Mona Offshore Wind Project and the Morgan Generation Assets. Do the SNCBs agree with this broad view (noting clarifications the Applicants need to provide) and that this issue will not likely lead to AEoI or significant effects on bird populations? KL noted these are well sited projects and the risks to birds from these is low. RB – Agree that the risk of adverse effects from these projects is low and they are well sited, and that the White Cross proxy advice was not advised for the Mona Offshore Wind Project and the Morgan Generation Assets. The numbers presented indicate that SNCBs were right to ask for quantification of the impacts, as for some projects the impacts predicted were "negligible" and this exercise showed there is some impact. Whilst it is acknowledged that the risk of adverse effects is low, SNCBs need to clarify these points to ensure confidence in the conclusions. MM – Agree with RB. Clarification is needed to rule out adverse effects, but agree risk is low. HR – Agree with above. In general, NRW feel the risk of adverse effects is low but need clarity on a few points to ensure it can be ruled out beyond reasonable scientific doubt.		
6.	**<u>Next Steps (presented by ST)</u>** <u>The Mona Offshore Wind Project</u> • The results presented in the draft Technical Note reproduce the relevant results presented in the corresponding tables of the Offshore Ornithology chapter submitted in the application. • Revised offshore ornithology application material has been submitted at Deadline 2 • Given that the draft technical note was not issued to SNCBs ahead of Deadline 2, it was considered appropriate to retain the use of the total abundances presented in the application, which have already been seen by the SNCBs, rather than introduce new, unseen material in addition to the information on the gap filled historical projects. Therefore, no amendments were undertaken to account for errata or Written Representations for the purpose of the draft results sent before the meeting.	**Morgan Generation Assets Draft Technical Note to be distributed to SNCBs.** **The Mona Technical Note will be submitted at Mona Offshore Wind Project Deadline 3 and Morgan**	Complete 30/09/2024 (Mona) 03/10/2024 (Morgan

	• The draft Technical Note will be updated and submitted at Deadline 3 to take account of the updated application material submitted at Deadline 2. • The results presented in the final technical note will not materially differ from those presented in the draft technical note. • If you could provide key feedback on the draft Technical Note within 1 week from this meeting it would be much appreciated. This would allow the Applicant to incorporate and address the feedback in the note to be submitted at deadline 3. • The Applicant notes that detailed formal feedback would be received through the examination process. <u>Morgan Generation Assets</u> • The draft Technical Note and methodology paper will be submitted into the Examination at Deadline 1 • If you could provide comments on the Morgan Generation results as presented on the slides circulated within 2 weeks from this meeting it would be much appreciated. • The Applicant notes that detailed formal feedback would be received through the examination process. <u>General</u> • Minutes will be circulated two weeks after the meeting. SNCBs to review and return one week from that date.	**Generation Assets at Deadline 1.** **SNCBs to provide key feedback within 1 week for the Mona Offshore Wind Project.** **SNCBs to provide key feedback within 2 weeks for Morgan Generation Assets.** **Minutes to be circulated within 2 weeks of the meeting. SNCBs to review and return 1 week from that date.**	Generation Assets) Complete Complete Complete

Appendix F: Offshore Ornithology CEA and In-Combination Gap-Filling of Historical Projects-proportion of birds in flight

F.1 Introduction

F.1.1.1.1 In the Offshore Ornithology Cumulative Effects Assessment (CEA) and In-combination Gap-filling of Historical Projects note, the Applicant has utilised densities from the Marine Ecosystems Research Programme (MERP) dataset (Waggitt *et al.,* 2020) that represent birds in flight and birds sitting on the water. These densities have been used in collision risk modelling to provide collision risk estimates that incorporate both birds sitting on the water and birds in flight. As birds sitting on the water are not at risk of collision with turbines, these birds should be removed before further analysis. The Applicant has achieved this by multiplying collision risk estimates by an annual proportion of birds in flight calculated from data collected for the baseline characterisation of the Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Offshore Windfarm: Generation Assets.

F.1.1.1.2 As part of the Statutory Nature Conservation Body (SNCB) ornithology meeting (29 August 2024), the methodology and results of an earlier draft of the Offshore Ornithology CEA and In-combination Gap-filling of Historical Projects note were presented to the SNCBs. The SNCBs, both in the meeting and in a written response following the meeting, requested that the Applicant investigate the variation in the proportions of birds in flight on a monthly and seasonal basis to determine if the use of an annual proportion is appropriate (Appendix E).

F.1.1.1.3 This note provides a comparison of the proportion of birds in flight calculated on annual, seasonal and monthly bases.

F.2 Methodology

F.2.1 Analysis approach

F.2.1.1.1 The average annual proportions of birds in flight applied in the Offshore Ornithology CEA and In-combination Gap-filling of Historical Projects note were calculated using the annual proportions from the Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Offshore Windfarm: Generation Assets. To calculate these proportions, raw data from the Mona Offshore Wind Project and Morgan Generation Assets, and population estimates from the Morecambe Offshore Windfarm: Generation Assets were used with the proportions calculated for each project then averaged to provide the average annual proportions. The seasonal and monthly proportions calculated in this report have used the same datasets from these three projects. No weighting or other calculation steps were applied before calculating any of the average values as discussed in section F.2.2.

F.2.1.1.2 Annual, seasonal and monthly proportions of birds in flight have been calculated for kittiwake *Rissa tridactyla*, herring gull *Larus argentatus*, lesser black-backed gull *Larus fuscus* and gannet *Morus bassanus* with comparisons presented graphically for each species in section F.3.1. Density data for great black-backed gull was calculated using the SEAMAST dataset (Bradbury *et al.,* 2014) which provides individual datasets for birds in flight and on the water. A correction factor was therefore not required for this species.

F.2.1.1.3 Where the comparisons presented in section F.3.1 suggest that there may be some degree of variation in the proportions of birds in flight, further consideration of how the application of these proportions may affect collision risk estimates is provided in section F.3.2. This analysis, where necessary, uses the same collision risk estimates as used in the Offshore Ornithology CEA and In-combination Gap-filling of Historical Projects note.

F.2.2 Representativeness of data

F.2.2.1.1 When calculating the proportion of birds at collision height from site-specific survey data for use in collision risk modelling, a 100 bird threshold has been recommended by Natural England (Natural England, 2013), Johnston and Cook (2016) and Cook *et al.* (2018) as being required in order to calculate a representative value. The same threshold has also been used when calculating the proportion of immature birds at a project (Ørsted, 2018a; Volume 4, Annex 5.5: Offshore ornithology apportioning technical report (APP-057)) and where analysing flight directions of birds (Ørsted, 2018b; Volume 4, Annex 5.1: Offshore ornithology baseline characterisation (APP-053)). It is considered appropriate to apply this threshold to the total number of birds in the analysis undertaken in this report in order to also identify when the proportion of birds in flight may be representative of the behaviour of birds at each project.

F.3 Results

F.3.1 Temporal comparisons

F.3.1.1 Kittiwake

F.3.1.1.1 Figure F.1 presents the average proportion of birds in flight on a monthly basis when combining the birds in flight proportions from the Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Offshore Windfarm: Generation Assets. Figure F.2 provides a similar comparison but with data presented on a seasonal basis. The sample sizes presented in Figure F.1 and Figure F.2 are a combination of the raw data from the Mona Offshore Wind Project and the Morgan Generation Assets. Raw data is not available for the Morecambe Offshore Windfarm: Generation Assets and therefore further interpretation, which is provided in this section, is therefore required in order to understand whether the sample sizes surpass the 100 bird threshold discussed above to ensure the representative value of the data.

F.3.1.1.2 The 100 bird threshold is surpassed in all months and seasons. In some months the proportions show good correspondence with other months and the annual average proportion. However, there are some months that show a degree of variation (e.g. November and December) (Figure F.1). The seasonal dataset (Figure F.2) shows limited variation between seasons, with all seasons having proportions of 55-57%.

F.3.1.1.3 The high level of correspondence between the proportions of birds in flight in the majority of months and between seasons suggests that the use of an annual average is appropriate for kittiwake. Despite the limited variation observed, further consideration of the differences between the use of monthly, seasonal and annual proportions on collision risk estimates is provided in section F.3.2.

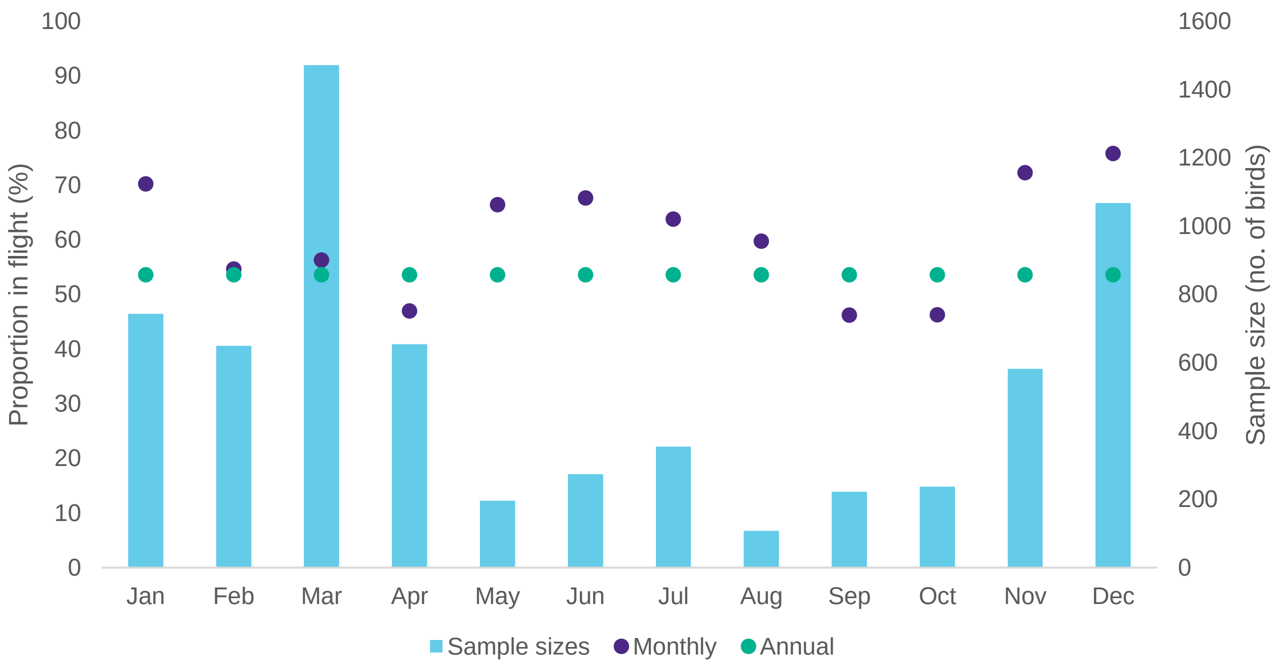

Figure F.1 Comparison between monthly and annual proportions of kittiwake in flight with sample sizes calculated using raw data from the Mona Offshore Wind Project and Morgan Generation Assets.

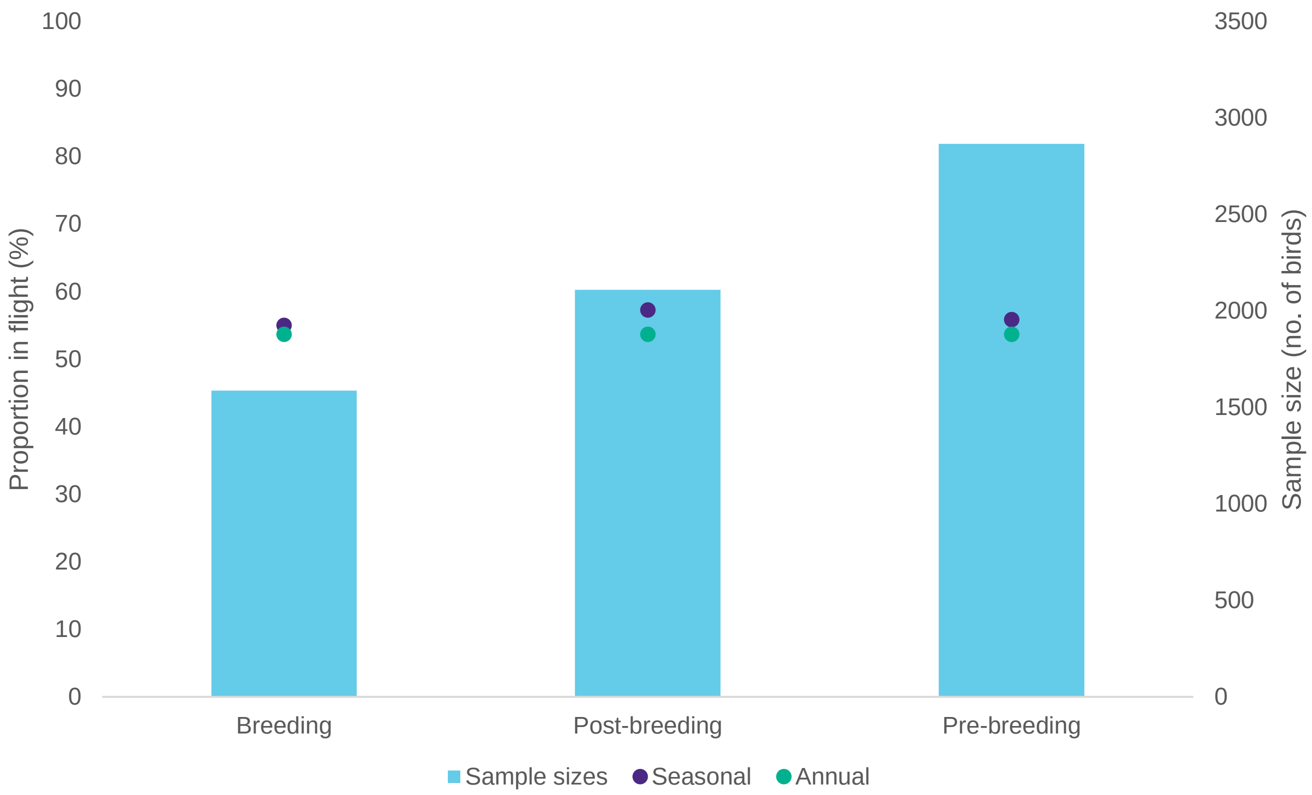

Figure F.2: Comparison between seasonal and annual proportions of kittiwake in flight with sample sizes calculated using raw data from the Mona Offshore Wind Project and Morgan Generation Assets.

F.3.1.2 Herring gull

F.3.1.2.1 Figure F.3 presents the average proportion of birds in flight on a monthly basis when combining the birds in flight proportions from the Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Offshore Windfarm: Generation Assets. Figure F.4 provides a similar comparison but with data presented on a seasonal basis. The sample sizes presented in Figure F.3 and Figure F.4 are a combination of the raw data from the Mona Offshore Wind Project and Morgan Generation Assets. Further interpretation, which is provided this section, is therefore required in order to understand whether the sample sizes surpass the 100 bird threshold discussed above.

F.3.1.2.2 The monthly sample sizes based on raw data from the Mona Offshore Wind Project and the Morgan Generation Assets do not surpass the 100 bird threshold (Figure F.3). This remains true for all but March, even if the Morecambe Offshore Windfarm: Generation Assets population estimates are included. In March, the contribution of the Mona Offshore Wind Project and Morgan Generation Assets is 88 birds. The population estimate from the Morecambe Offshore Windfarm: Generation Assets is 57 birds with the underlying raw data unlikely to contribute the required number of birds to surpass the 100 bird threshold when combined with the raw data from the Mona Offshore Wind Project and Morgan Generation Assets. Whilst there is a large degree of variation in the monthly proportions shown in Figure F.3 it is considered that this is not a reliable indication of the suitability of using an annual average.

F.3.1.2.3 The sample sizes associated with each season, calculated when using the raw data from the Mona Offshore Wind Project and the Morgan Generation Assets, do surpass the 100 bird threshold (Figure F.4). There is limited variation in the proportions of birds in flight between the breeding and non-breeding season suggesting that the use of an annual average is appropriate for herring gull.

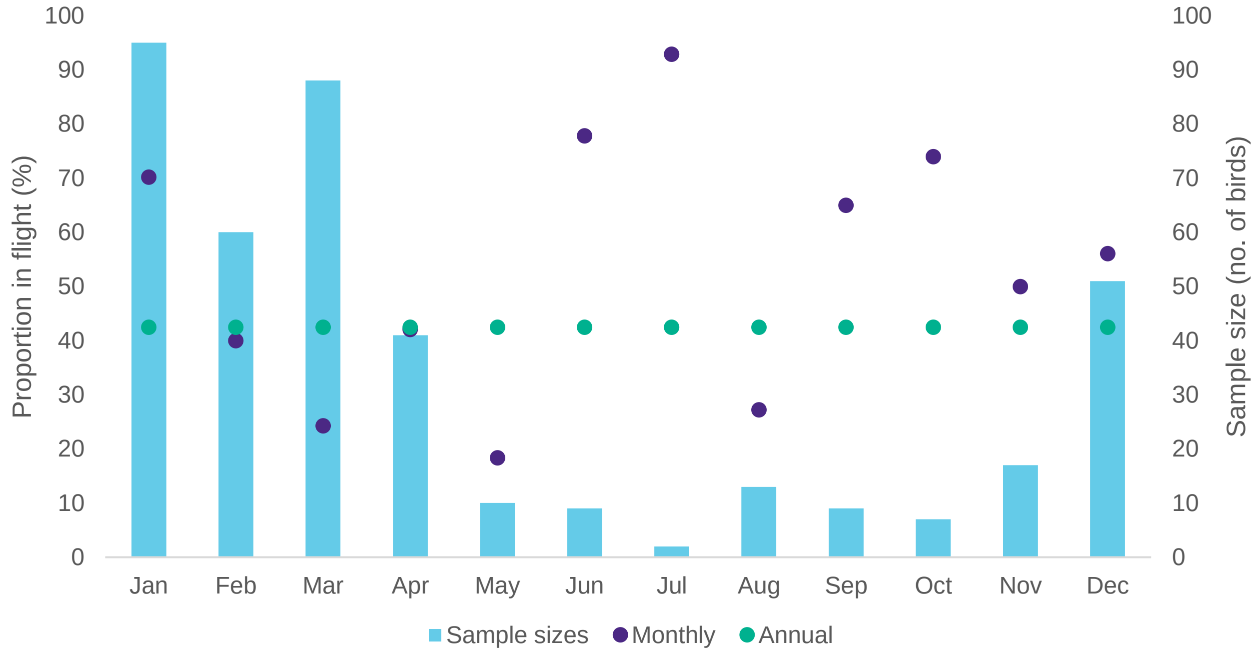

Figure F.3: Comparison between monthly and annual proportions of herring gull in flight with sample sizes calculated using raw data from the Mona Offshore Wind Project and Morgan Generation Assets.

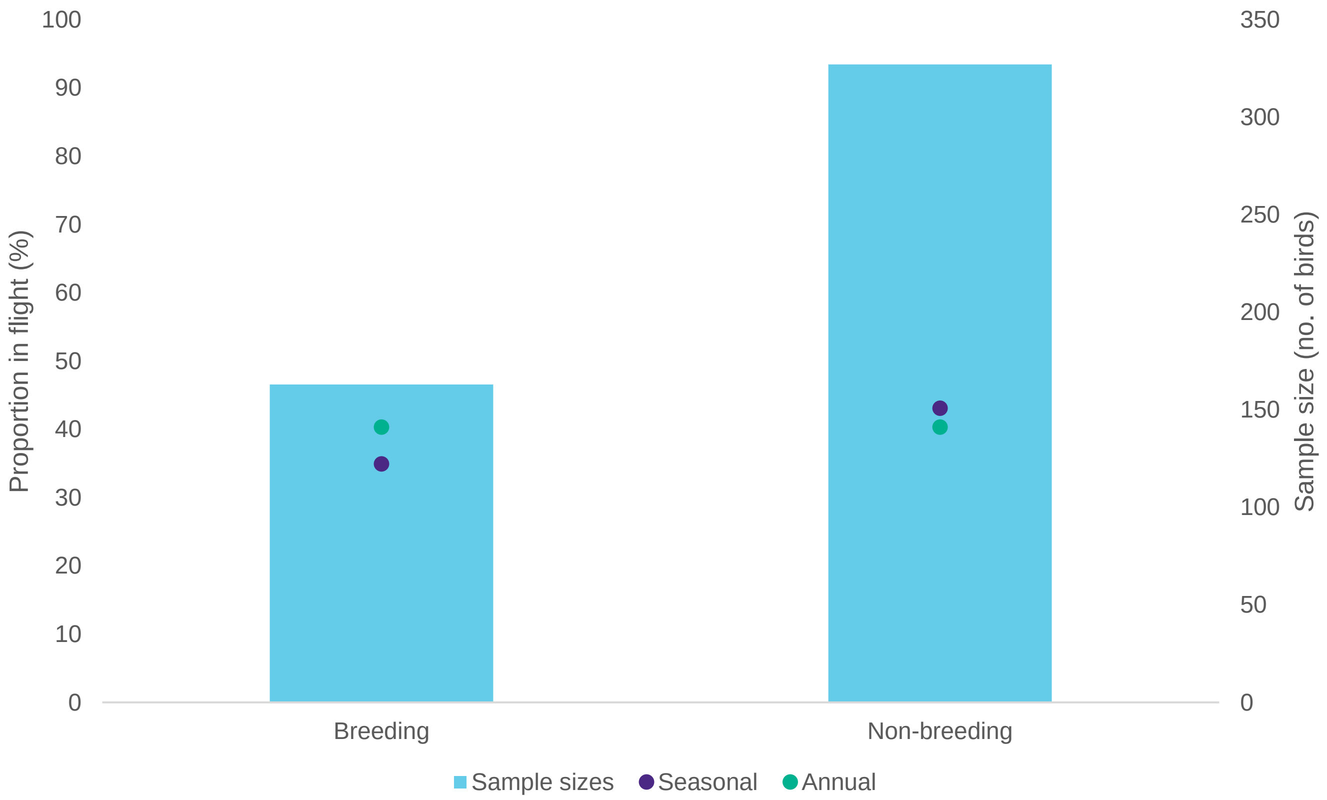

Figure F.4: Comparison between seasonal and annual proportions of herring gull in flight with sample sizes calculated using raw data from the Mona Offshore Wind Project and Morgan Generation Assets.

F.3.1.3 Lesser black-backed gull

F.3.1.3.1 Figure F.5 presents the average proportion of birds in flight on a monthly basis when combining the birds in flight proportions from the Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Offshore Windfarm: Generation Assets. Figure F.6 provides a similar comparison but with data presented on a seasonal basis. The sample sizes presented in Figure F.5 and Figure F.6 are a combination of the raw data from the Mona Offshore Wind Project and Morgan Generation Assets. Further interpretation, which is provided this section, is therefore required in order to understand whether the sample sizes surpass the 100 bird threshold discussed above.

F.3.1.3.2 The monthly sample sizes based on raw data from the Mona Offshore Wind Project and the Morgan Generation Assets do not surpass the 100 bird threshold (Figure F.5). This remains true even if the Morecambe Offshore Windfarm: Generation Assets population estimates are included. Whilst there is a large degree of variation in the monthly proportions shown in Figure F.5, which is skewed by the lack of birds in October and December, it is considered that this is not a reliable indication of the suitability of using an annual average.

F.3.1.3.3 The sample sizes associated with each season, based on raw data from the Mona Offshore Wind Project and the Morgan Generation Assets, do not surpass the 100 bird threshold (Figure F.6). This remains true for the post-breeding, non-breeding and pre-breeding seasons even if the population estimates associated with the Morecambe Offshore Windfarm: Generation Assets are included. In the breeding season, the raw data total from the Mona Offshore Wind Project and the Morgan Generation Assets is 75 birds. The population estimate associated with the Morecambe Offshore Windfarm: Generation Assets is 95 birds. It is therefore possible that, in the breeding season, the 100 bird threshold may be surpassed if the raw data from the Morecambe Offshore Windfarm: Generation Assets were available. In the breeding season there is limited deviation from the annual average however, due to the limited sample size in other seasons, comparisons between these and the breeding season are not considered representative. Therefore, whilst there is a large degree of variation in the monthly proportions shown in Figure F.6 it is considered that this is not a reliable indication of the suitability of using an annual average.

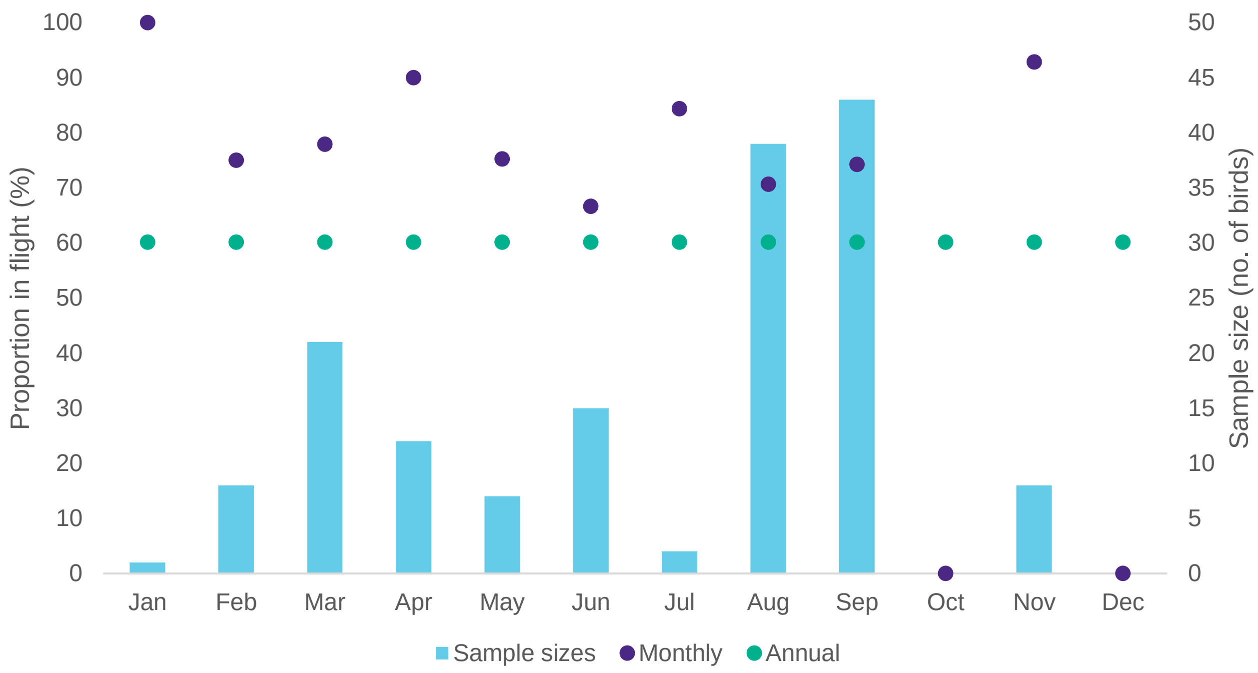

Figure F.5: Comparison between monthly and annual proportions of lesser black-backed gull in flight with sample sizes calculated using raw data from the Mona Offshore Wind Project and Morgan Generation Assets.

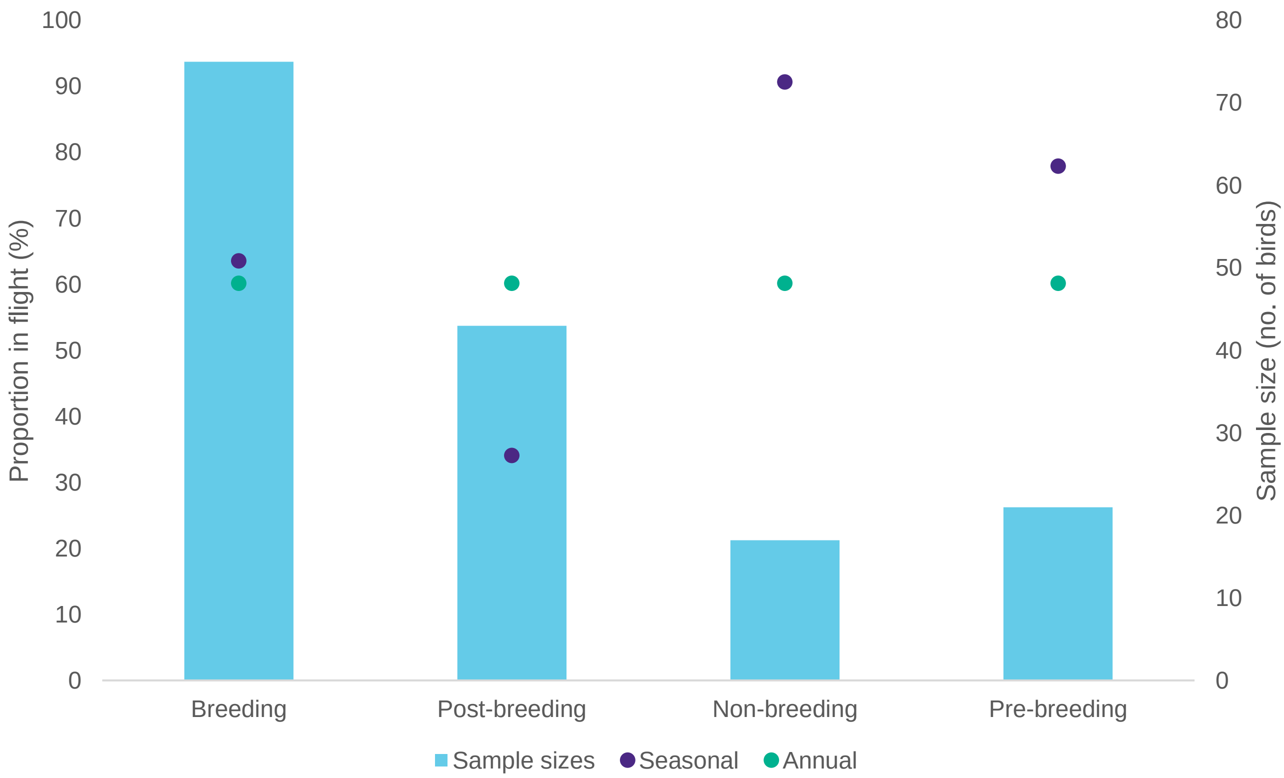

Figure F.6: Comparison between seasonal and annual proportions of lesser black-backed gull in flight with sample sizes calculated using raw data from the Mona Offshore Wind Project and Morgan Generation Assets.

F.3.1.4 Gannet

F.3.1.4.1 Figure F.7 presents the average proportion of birds in flight on a monthly basis when combining the birds in flight proportions from the Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Offshore Windfarm: Generation Assets. Figure F.8 provides a similar comparison but with data presented on a seasonal basis. The sample sizes presented in Figure F.7 and Figure F.8 are a combination of the raw data from the Mona Offshore Wind Project and Morgan Generation Assets. Further interpretation, which is provided this section, is therefore required in order to understand whether the sample sizes surpass the 100 bird threshold discussed above.

F.3.1.4.2 The 100 bird threshold was not surpassed in January, February, June, November and December when using the raw data from the Mona Offshore Wind Project and Morgan Generation Assets. In January, February, November and December, the number of birds remained below 100 even incorporating the Morecambe Offshore Windfarm: Generation Assets population estimates. In June, the 100 bird threshold was surpassed when incorporating the Morecambe Offshore Windfarm: Generation Assets population estimate. However, it increased to only 105 birds, suggesting that it would not be surpassed if using raw data from the Morecambe Offshore Windfarm: Generation Assets. In the months considered to have representative sample sizes, with the exception of April and September there was generally good correspondence both between months and with the annual average.

F.3.1.4.3 The sample sizes in the breeding and post-breeding season, calculated when using the raw data from the Mona Offshore Wind Project and the Morgan Generation Assets, surpass the 100 bird threshold (Figure F.4). No gannet were recorded at the Morecambe Offshore Windfarm: Generation Assets between December and February and therefore the threshold remains unsurpassed even with the inclusion of the Morecambe Offshore Windfarm: Generation Assets. There is a degree of variation in the proportions of gannet in flight between the breeding and post-breeding seasons. The breeding season shows good correspondence with the annual average with this driven by the contribution of the breeding season to the total number of gannet recorded.

F.3.1.4.4 The high level of correspondence between the proportions of birds in flight in the majority of months with representative sample sizes suggests that the use of an annual average is appropriate for gannet. However, the variation observed between seasons suggests otherwise. Further consideration of the potential implications this has for collision risk estimates is provided in section F.3.2.

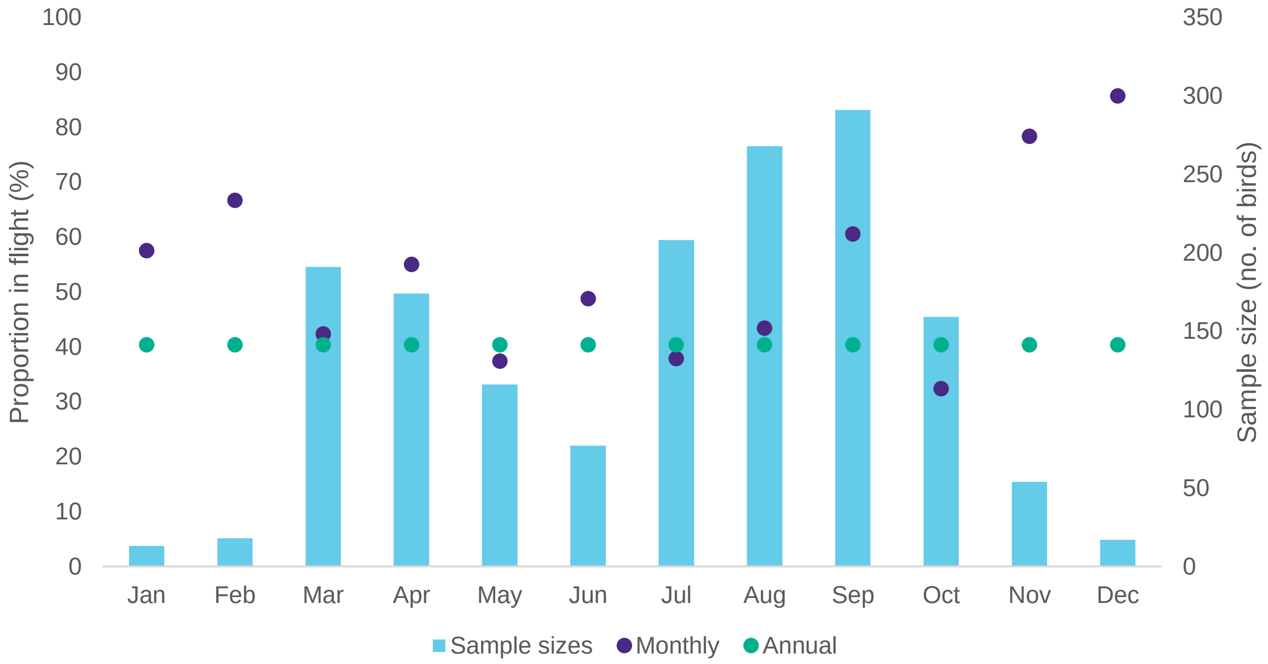

Figure F.7: Comparison between monthly and annual proportions of gannet in flight with sample sizes calculated using raw data from the Mona Offshore Wind Project and Morgan Generation Assets.

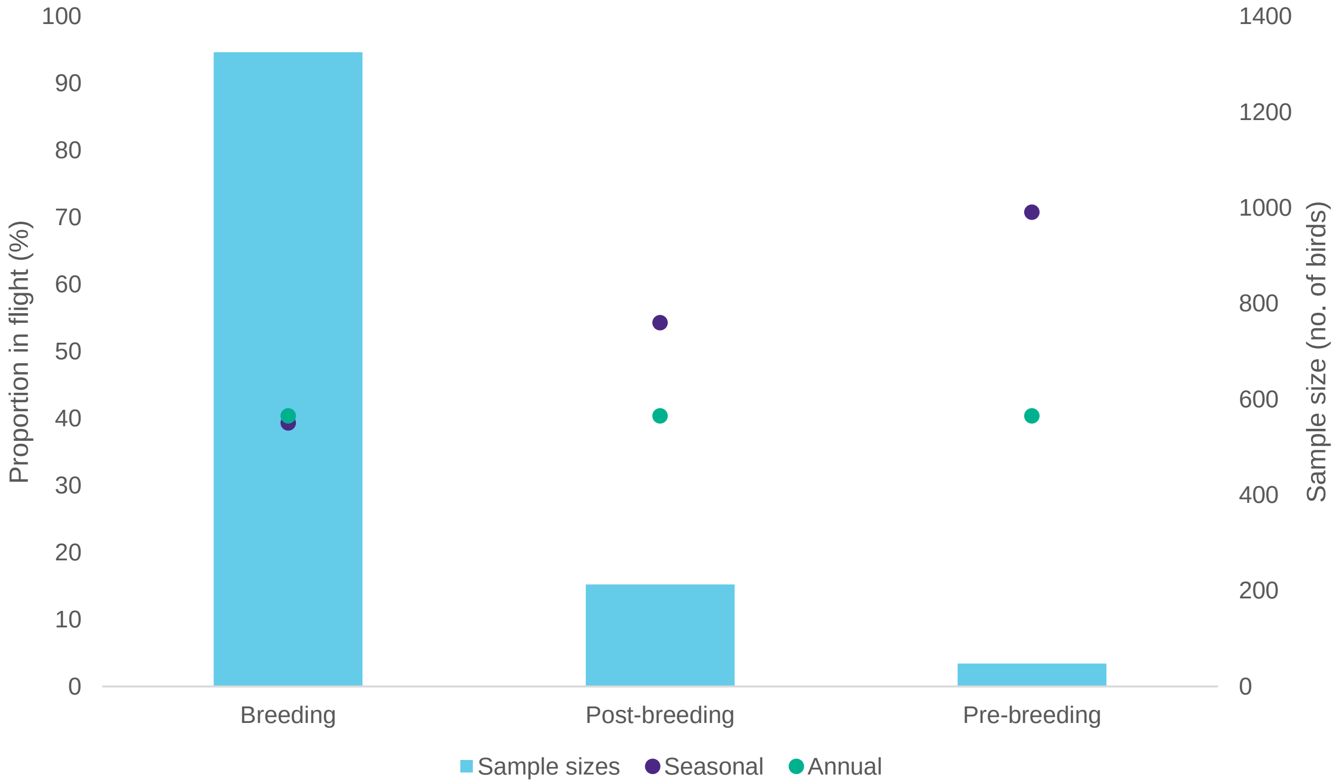

Figure F.8: Comparison between seasonal and annual proportions of gannet in flight with sample sizes calculated using raw data from the Mona Offshore Wind Project and Morgan Generation Assets.

F.3.2 Impact on collision risk estimates

F.3.2.1.1 The monthly proportions for kittiwake and gannet showed a degree of variation between months and when compared to the annual average.

F.3.2.1.2 The monthly and seasonal proportions for herring gull and lesser black-backed gull were not considered to be representative of bird flight behaviour. Therefore, the use of an annual proportion is the only viable option, and collision risk estimates for herring gull and lesser black-backed gull have not been re-calculated in this section.

F.3.2.2 Kittiwake

F.3.2.2.1 Collision risk estimates for kittiwake for the additional projects considered in the Offshore Ornithology CEA and In-combination Gap-filling of Historical Projects note have been recalculated using the monthly and seasonal proportions. The re-calculated collision risk estimates are presented alongside those calculated using a single annual proportion in Table F.1.

Table F.1: Annual collision risk estimates for kittiwake calculated using annual, seasonal and monthly proportions of birds in flight.

Project	Annual collision risk estimates calculated using different proportions		
	Annual	Seasonal	Monthly
Burbo Bank Offshore Wind Farm	1.98	2.07	1.96
Gwynt y Môr Offshore Wind Farm	32.58	34.07	32.15
Robin Rigg Offshore Wind Farm	3.70	3.87	3.68
Walney 1 Offshore Wind Farm	5.38	5.63	5.35
Walney 2 Offshore Wind Farm	5.00	5.18	4.61
Walney 1&2 Offshore Wind Farm	10.38	10.81	9.95
West of Duddon Sands Offshore Wind Farm	11.88	12.44	11.79

F.3.2.2.2 Annual collision risk estimates calculated using the seasonal proportions are marginally higher when compared to those calculated using the annual proportion. When using the monthly proportions, annual collision risk estimates are marginally lower than those calculated when using the annual proportion. Although there are minor differences in the collision risk estimates calculated using different proportional data, the scale of the changes is not considered to be of a magnitude that would materially alter the conclusions reached in the Offshore Ornithology CEA and In-combination Gap-filling of Historical Projects note.

F.3.2.2.3 The monthly collision risk estimates tend to follow the same trend across all of the additional historical projects, with any differences generally occurring in winter months. An example of the trend is presented using the monthly collision risk estimates calculated using the annual, seasonal and monthly proportions for Burbo Bank Offshore Wind Farm in Figure F.9. Whilst the monthly collision risk estimates vary across the year, the majority of months have collision risk estimates lower than the corresponding collision risk estimates calculated when applying the seasonal and annual proportions.

Figure F.9: Monthly collision estimates for kittiwake calculated using monthly, seasonal and annual proportions for birds in flight (based on Burbo Bank Offshore Wind Farm data as an example).

F.3.2.3 Gannet

F.3.2.3.1 Collision risk estimates for gannet for the additional projects considered in the Offshore Ornithology CEA and In-combination Gap-filling of Historical Projects note have been recalculated using the monthly and seasonal proportions. The re-calculated collision risk estimates are presented alongside those calculated using a single annual proportion in Table F.2.

F.3.2.3.2 Annual collision risk estimates calculated using the seasonal and monthly proportions are higher when compared to those calculated using the annual proportion. This difference is likely due to some months and seasons having a sample size considered to be too low to allow for the calculation of a representative proportion of birds in flight. Although there are differences in the collision risk estimates calculated using different proportional data, the changes are not considered to be of a magnitude that would materially alter the conclusions reached in the Offshore Ornithology CEA and In-combination Gap-filling of Historical Projects note.

Table F.2: Annual collision risk estimates for gannet calculated using annual, seasonal and monthly proportions of birds in flight.

Project	Annual collision risk estimates calculated using different proportions		
	Annual	Seasonal	Monthly
Burbo Bank Offshore Wind Farm	0.46	0.51	0.56
Gwynt y Môr Offshore Wind Farm	9.54	10.55	11.63
Robin Rigg Offshore Wind Farm	0.88	0.96	1.06
Walney 1 Offshore Wind Farm	1.13	1.24	1.37
Walney 2 Offshore Wind Farm	1.30	1.43	1.58
Walney 1&2 Offshore Wind Farm	2.43	2.68	2.95
West of Duddon Sands Offshore Wind Farm	2.51	2.77	3.04

F.3.2.3.3 The trend in monthly collision risk estimates tends to follow the same trend across all of the additional historical projects. An example of the trend is presented using the monthly collision risk estimates calculated using the annual, seasonal and monthly proportions for Burbo Bank Offshore Wind Farm in Figure F.10. As would be expected there is a degree of variation, but all three datasets follow the same trend with the only real outlier being the monthly collision risk estimate calculated in September.

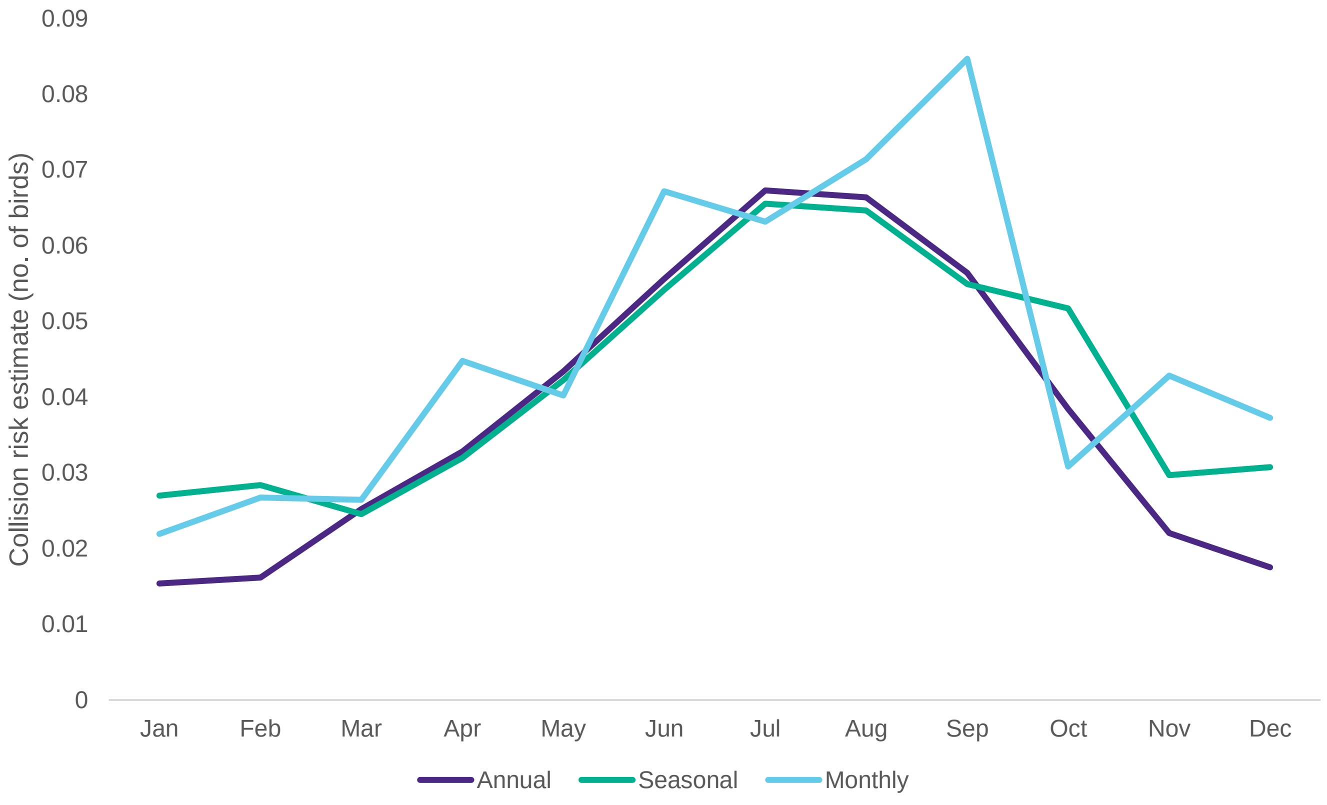

Figure F.10: Monthly collision estimates for gannet calculated using monthly, seasonal and annual proportions for birds in flight (based on Burbo Bank Offshore Wind Farm data as an example).

F.4 Conclusion

F.4.1.1.1 Comparisons of annual, seasonal and monthly proportions of birds in flight for kittiwake showed good correspondence in some months and between seasons. Any variation that was present was considered to have a limited impact on resulting collision risk estimates.

F.4.1.1.2 A similar conclusion in relation to variation between datasets was reached for gannet, although in some months and seasons the number of birds recorded across the Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Offshore Windfarm: Generation Assets was considered too low to enable the calculation of representative proportions. Any variation that was present was also considered to have a limited impact on resulting collision risk estimates.

F.4.1.1.3 The sample sizes for lesser black-backed gull were considered too low to allow the calculation of representative proportions on monthly and seasonal bases. The use of an annual proportion was therefore considered to be the only viable option for this species.

F.4.1.1.4 However, for lesser black-backed gull it should be noted that the use of monthly, seasonal or annual proportions would make no material difference to collision risk estimates. Calculation of collision risk estimates for lesser black-backed gull was only required for one project (Robin Rigg offshore wind farm) in the Offshore Ornithology CEA and In-combination Gap-filling of Historical Projects note. This exercise applied an annual proportion of birds in flight of over 60%. Applying this proportion provided a limited number of collisions and therefore it is considered that, even if it was assumed that 100% of lesser black-backed gulls were in flight across all months, this would not alter the conclusions reached in the Offshore Ornithology CEA and In-combination Gap-filling of Historical Projects note.

F.4.1.1.5 The sample sizes for herring gull were considered too low in all months to allow for the calculation of representative proportions on a monthly basis. Sample sizes were higher on a seasonal basis, with the seasonal proportions showing limited variation and therefore good correspondence with the annual average proportion. The use of an annual proportion is therefore considered valid for herring gull.

F.4.1.1.6 In conclusion, it has been demonstrating that the use of annual proportions of birds in flight calculated from data associated with the Mona Offshore Wind Project, Morgan Generation Assets and Morecambe Offshore Windfarm: Generation Assets is appropriate for all four species in the Offshore Ornithology CEA and In-combination Gap-filling of Historical Projects note.

F.5 References

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