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MONA OFFSHORE WIND PROJECT

Offshore Ornithology Assessment of Pen y Gogarth/Great Orme's Head SSSI

F02 (Clean)

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Image of an offshore wind farm

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Prepared by:

RPS

Prepared for:

Mona Offshore Wind Ltd.

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Glossary

Term	Meaning
Applicant	Mona Offshore Wind Limited.
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
BDMPS	Biologically Defined Minimum Population Scales
CEA	Cumulative effects assessment
DCO	Development Consent Order
EPP	Evidence Plan Process
EWG	Expert Working Group
LCI	Lower confidence interval
NRW	Natural Resources Wales
PVA	Population Viability Analysis
SNCB	Statutory Nature Conservation Body
SPAs	Special Protection Areas
SSSI	Site of Special Scientific Interest
UCI	Upper confidence interval
UK	United Kingdom

Units

Unit	Description
%	Percentage
km^2	Square kilometres
km	Kilometres
m	Metres

1 OFFSHORE ORNITHOLOGY ASSESSMENT OF PEN Y GOGARTH/GREAT ORME'S HEAD SITE OF SPECIAL SCIENTIFIC INTEREST

1.1 Introduction

1.1.1.1 This document provides an updated assessment of the Pen y Gogarth/Great Orme's Head Site of Special Scientific Interest (SSSI) following comments received from Natural Resources Wales (Advisory) (NRW (A)) in the examination of the Development Consent Order (DCO) application for the Mona Offshore Wind Project.

1.1.1.2 NRW (A) provided advice on the need to undertake an assessment of the ornithological features of Pen y Gogarth/Great Orme's Head Site of SSSI during the Evidence Plan Process (EPP) (detailed in Technical Engagement Plan Appendices – Part 1 (A to E) (APP-042)), as part of their Relevant Representations (RR-011), Written Representations (REP1-056) at Deadline 1, Deadline 2 submission (REP2-099) and most recently within their Deadline 3 submission (REP3-089). The Applicant responded to NRW's submissions and is documented in the following:

- Applicant's Response to Relevant Representations (PDA-008) in response to NRW's Relevant Representations (RR-011),
- Appendix to Response to WRs: NRW (REP2-080) in response to NRW's Written Representations (REP1-056),
- Response to Natural Resource Wales Deadline 2 Submission (REP3-038) in response to NRW's Deadline 2 Submission (REP2-099); and within the,
- Applicant's All Response to Natural Resources Wales Deadline 3 Submission (S_D4_16) in response to NRW's Deadline 3 Submissions (REP3-089).

1.1.1.3 Table 1-1 provides a summary of NRW (A)'s comments received to date and the Applicant's response where relevant to Pen y Gogarth/Great Orme's Head SSSI.

1.1.1.4 The initial version of this note (Offshore Ornithology Assessment of Pen y Gogarth & Great Orme's Head SSSI (REP1-037)) was submitted at Deadline 1 and took account of advice received via the EPP and NRW's Relevant Representations (RR-011).

1.1.1.5 This version (Offshore Ornithology Assessment of Pen y Gogarth & Great Orme's Head SSSI (S_D1_25 F02)) has been updated at Deadline 4 to reflect further guidance from NRW received at Deadlines 2 and 3. Specifically the main updates are:

- the incorporation of the gap-filled projects (see Offshore Ornithology Cumulative Effects Assessment and In-combination Gap-filling Historical Projects Technical Note (S_D3_12 F02)) as part of the cumulative assessment:
- removal of the displacement assessment for black-legged kittiwake (in line with NRW guidance).
- Other minor changes have also occurred to the visualisation of the PVA outputs,
- A summary of the relevant consultation history in relation to this assessment is presented within Table 1-1.

1.1.1.6 A set out in Table 1-1, in a meeting on 18 October 2024, NRW requested that the Applicant use the juvenile survival parameters in the NRW and Natural England interim advice note when adding a population viability analysis for razorbill. The assessment

in this document presents the razorbill PVAs using the parameters provided in the interim advice note parameters for this species.

Table 1-1: Summary of NRW (A)'s key comments on the assessment for the Pen y Gogarth/Great Orme's Head SSSI following the publication of the first version at Deadline 1 (Offshore Ornithology Assessment of Pen y Gogarth/Great Orme's Head Site of Special Scientific Interest (REP1-037)).

Source	Relevant Comment	Applicant's Response (as provided at the time)
REP2-099.7 within Response to Natural Resource Wales Deadline 2 Submission (F01) (REP3-038)	**2. Comments on Offshore Ornithology Assessment of Pen y Gogarth / Great Orme's Head SSSI [REP1-037]** **2.1 Key Comments** We welcome that the Applicant has now submitted a detailed quantitative assessment of impacts of the Mona project alone on the kittiwake, guillemot and razorbill features of the Pen y Gogarth / Great Orme's Head SSSI. This was advised to be undertaken by NRW (A) in both our Relevant Representation [RR-011], and with further detail on this request provided in our Written Representation [REP1-056]. The Applicant's assessment document was submitted ahead of submission of our Written Representation and hence produced before the further detail in REP1- 056 was available. As a result, there are some aspects of the assessment approach that we have concerns/queries regarding, or that we would not agree with/advise are undertaken: • Non-breeding season age class apportioning (see Section 2.2.1 below). • Calculation of non-breeding season apportionment rates to the Pen y Gogarth / Great Orme's Head SSSI (see Section 2.2.1 below). • Concerns regarding the foraging ranges used for guillemot and razorbill (as raised by JNCC in their Written Representations, REP1-066, with which we agree) and potential implications of this for the breeding season apportionment rate calculations for the Special Site of Scientific Interest (SSSI) (see Section 2.2.2 below). • Kittiwake seasonal definitions and calculations of Environmental Impact Assessment (EIA) scale seasonal collision totals used in calculating seasonal collision impacts to the SSSI (see Section 2.2.3.1 below). • Need to consider and present displacement impacts across the full range of SNCB advised % displacement and % mortality rates for auk displacement assessments and where predicted impacts equate to 1% or more of baseline mortality of the colony to give further consideration through Population Viability Analysis (PVA) (see Sections 2.2.3.2 and 2.2.3.3 below). • Need to undertake a cumulative assessment of impacts as well as assessment of project alone impacts (see Section 2.2.4 below). Further information on each of these issues is set out in our detailed comments below	The Applicant notes NRW (A)'s comments and has responded in detail in the rows below. To confirm, the Applicant will submit a revised Offshore Ornithology Assessment of Pen y Gogarth / Great Orme's Head SSSI note at Deadline 4 to address, where required, the matters raised by NRW (A) (*this document*). The revisions to the assessment are not expected to alter the conclusions of the assessment.

Source	Relevant Comment	Applicant's Response (as provided at the time)
REP2-099.8 within Response to Natural Resource Wales Deadline 2 Submission (F01) (REP3-038)	2.2 Detailed Comments 2.2.1 Non-breeding season apportionment of impacts, including age classes (relevant to all three features of the SSSI) For the assessment of impacts to the Pen y Gogarth / Great Orme's Head SSSI, the Applicant has taken the same approach to apportioning impacts to adults in the non-breeding season as taken for Special Protection Area (SPAs) in their submission documents, i.e. to use a theoretical generalised stable age structure (Furness 2015) to apportion impacts to adults in the non-breeding season from the SSSI. It also appears that in the approach undertaken by the Applicant in REP1-037, the Applicant has taken the same approach as used for SPAs in their submission of taking the EIA scale all age class collision figure/abundance figure for displacement for the non-breeding season(s) and applied an apportionment rate for proportion of adults (based on stable age structure from Furness 2015) and an apportionment rate for proportion of adult birds within the relevant seasonal Biologically Defined Minimum Population Scale (BDMPS). As noted in our Relevant Representations [RR-011] and Written Representations [REP1-056], we did not agree with these approaches regarding SPAs, and again note here that the Applicant's approach essentially double apportions to adults as the BDMPS proportions in the tables in Appendix A of Furness (2015) already takes account of the number of adults likely to be present in the BDMPS, so it is not appropriate to correct (a second time) for the proportions of adults (or adult type in the case of kittiwake) in the BDMPS. Therefore, we recommend that no age class apportionment is undertaken for the non-breeding season(s) and that the apportionment to the SSSI for the non-breeding season(s) is undertaken based on the proportion of the SSSI adult birds (we suggest this is based on use of the adult proportion of birds for the UK western non SPA colonies in the Furness 2015 Appendix A tables rather than Rathlin Island SPA; as was done at Awel y Môr) across the BDMPS total of birds of all ages for each relevant nonbreeding BDMPS season.	The Applicant has provided a detailed response on non-breeding season apportionment of impacts in response to NRW (A)'s written representation comments REP1-056.77 to REP1-056.80 in the Applicant's Appendix to Response to WRs: NRW (REP2-080). Adult impacts were apportioned to the adult Biologically Defined Minimum Population Scales (BDMPS) population as stated in paragraph 1.3.1.4 of Offshore Ornithology Assessment of Pen y Gogarth/ Great Orme's Head SSSI (REP1-037). With regards to the apportionment of age-classes during the breeding and non-breeding season, the Applicant has updated the apportionment of adults in a revised version of Offshore Ornithology Assessment of Pen y Gogarth/ Great Orme's Head SSSI (REP1-037) using age-classes presented in Table 1.5 of Volume 6, Annex 5.5: Offshore ornithology apportioning technical report (REP2-022). This will be submitted at Deadline 4 (this technical note). The Applicant notes that the proportion of adult birds in the BDMPS (from Furness, 2015) originating from "Rathlin Island" and "Western non-SPA" is slightly different for common guillemot during the non-breeding season (proportion of adults in UK western waters for the West coast UK non-SPA populations is 0.95 and 1 for Rathlin Island, Furness (2015)) and razorbill during the winter (proportion of adults in UK western waters for the West coast UK non-SPA populations is 0.4 and 0.3 for Rathlin Island (Furness, 2015)). There is, however, no difference for black-legged kittiwake in autumn and spring migrations (proportion of adults in UK western waters for the West coast UK non-SPA populations is 0.8 and 0.8 for Rathlin Island) and for razorbill during the migrating seasons (proportion of adults in UK western waters for the West coast UK non-SPA populations is 0.02 and 0.02 for Rathlin Island). Given the marginal differences, the application of the "Western non-SPA" proportion would not alter the assessment and the conclusion of the assessment.
REP2-099.9 within Response to Natural Resource Wales Deadline 2 Submission (F01) (REP3-038)	However, we do note that in this case, as the numbers of birds involved are small, our preferred approach to non-breeding season age class apportionment and apportionment method to the SSSI does not result in significant differences in the adult abundances of birds (auks) or adult densities (kittiwake) apportioned to the site in terms of annual totals. However, this may not be the case for other offshore wind development sites where higher numbers/densities of birds are recorded. Therefore, we would not advise that the approach the Applicant has taken to apportioning non-breeding season impacts to SSSI colonies is followed by other projects where assessment of impacts to SSSI breeding seabird colonies is required.	
REP2-099.10 within Response to Natural Resource Wales	2.2.2 Breeding season apportionment (guillemot and razorbill)	Table 1.7 of the HRA Stage 1 Screening Report (REP2-012) submitted at Deadline 2 corrected the foraging ranges for common guillemots and

Source	Relevant Comment	Applicant's Response (as provided at the time)
Deadline 2 Submission (F01) (REP3-038)	With regard to the breeding season apportionment rate calculations for the Pen y Gogarth / Great Orme's Head SSSI colony of 15.6% for guillemot and 21.1% for razorbill, we are content with the use of the NatureScot apportionment tool to calculate these. However, we note the concerns raised by JNCC in their Written Representations [REP1-066] regarding the guillemot and razorbill foraging ranges used by the Applicant and the uncertainties this has on the calculated apportionment rates to colonies (with which we agree – note the advised foraging ranges, to which NRW (A) agreed, were provided by JNCC to the Applicant following EWG5, see Section D.6.2 of Appendix D of the technical engagement plan, E4.1). Therefore, further information is required from the Applicant as to whether this issue would alter the breeding season apportionment rates to this colony for these two features.	razorbills, and the 'exceptions' that misinterpreted the JNCC's advice from their Section 42 response were removed. No sites were required to be included or excluded in Volume 6, Annex 5.5: Offshore ornithology apportioning technical report (REP2-022), and as a result of this change. Therefore, there are no changes to the apportioning values to the Pen y Gogarth/Great Orme's Head SSSI for common guillemot and razorbill and no changes to the conclusions of the assessment.
REP2-099.18 within Response to Natural Resource Wales Deadline 2 Submission (F01) (REP3-038)	We note that it is unclear as to how the Applicant has calculated the baseline mortality figure of 457.87 for guillemot at Pen y Gogarth / Great Orme's Head SSSI presented in Table 1.3 of APP-095 – based on using a colony size of 3,578 adults (as presented in Table 1.3 of APP-095, which we assume is based on the 2023 Seabird Monitoring Programme (SMP) count), we calculate the baseline mortality of the colony to be 218 birds (using adult mortality rate as we have advised in our Relevant Representations, RR-011). This has implications for the % baseline mortality that the predicted apportioned impacts across the range of advised rates equates to and where within this range the predicted impacts exceed 1% of baseline mortality – for example for the Applicant's preferred rate of 50% displacement and 1% mortality: • if the baseline mortality of 458 birds (as presented by the Applicant in APP-095) is used, then the predicted annual mortality to the SSSI equates to less than 1% of baseline mortality. However, • if the baseline mortality of 218 birds (as calculated by NRW (A)) is used, then the predicted mortality for this range equates to greater than 1% of baseline mortality at 1.37%, which requires further consideration.	The Applicant understands this comment refers to Table 1.3 in Volume 6, Annex 5.6: Offshore Ornithology Population Viability Analysis Technical Report (APP-096 and REP2-024) rather than Table 1.3 in Volume 6, Annex 5.5: Offshore Ornithology Apportioning Technical Report (APP-095 and REP2-022). The Applicant notes that this discrepancy is specific to Table 1.3 of Volume 6, Annex 5.6: Offshore ornithology population viability analysis technical report (of APP-096 and REP2-024), where the background mortality presented in Table 1.3 used an incorrect mortality rate rather than an adult specific mortality rate (of 0.061). This erratum has been captured with the Errata Sheet (S_DP_1 F04) submitted at Deadline 3. This discrepancy only occurs within Table 1.3 of Volume 6, Annex 5.6: Offshore Ornithology Population Viability Analysis Technical Report (APP-096 and REP2-024) and the impacts presented within the rest of the document uses the correct 0.061 adult mortality rate. However, the input data to Volume 6, Annex 5.5: Offshore Ornithology Population Viability Analysis Technical Report (APP-095 and REP2-024) was based on the correct mortality rates as shown in Appendix A: Seabird PVA Parameter Log of Volume 6, Annex 5.5: Offshore Ornithology Population Viability Analysis Technical Report (APP-095 and REP2-024). To demonstrate that the correct rates were used, please find below explanation: As presented in Table 1.5 of Volume 6, Annex 5.5: Offshore Ornithology Population Viability Analysis Technical Report (REP2-024), the impact during the breeding season was 3.3 (2.0 to 45.9) birds. The Pen y Gogarth/Great Orme SSSI maximum impact is 45.9 birds (when considering displacement values of 70% and 10% of mortality), with the resultant increase in baseline mortality being 21.05%. If you divide 45.9 by 21.05%, it results in 218 birds. Thus, the correct mortality rates were used for apportioning and the PVA in the application. The discrepancy in Table 1.3 is a typographic error in Table 1.3 in Volume 6, Annex 5.6: Offshore Ornithology Population Viability Analysis Technical Report (APP-096 and REP2-024) only and does not impact the conclusion of the assessment presented in Offshore Ornithology Assessment of Pen y Gogarth & Great Orme's Head (REP1-037).

Source	Relevant Comment	Applicant's Response (as provided at the time)
REP2-099.22 within Response to Natural Resource Wales Deadline 2 Submission (F01) (REP3-038)	However, we are currently unclear as to the source and years of the productivity rate of 0.532 (SD 0.089) used by the Applicant in the PVA. This is because this does not appear to fit with any of the pre-populated rates in the PVA tool for this species and nor does it appear to fit with any of the guillemot productivity rates listed in Horswill & Robinson (2015). Clarification is required on this from the Applicant before agreement to be reached on whether a suitable rate has been used in the PVA model, noting that for the Awel-y-Môr models NRW (A) advised the Applicant to use the national rates in Horswill & Robinson (2015).	As discussed during the fourth offshore ornithology Expert Working Group (Appendix D of Technical Engagement Plan Appendices - Part 1 (A to E) (APP-042)), updated productivity rates were used for the PVA. These were requested from the British Trust for Ornithology and sent to the Applicant on 21 July 2023. As shown in Table 5.15 in Volume 2, Chapter 5: Offshore ornithology (REP2-016), the average productivity rate for common guillemot was calculated as 0.583. However, for common guillemot, an average productivity of 0.532 was used for the Great Ormes PVA and the Little Ormes Head PVA presented in Volume 6, Annex 5.6: Offshore ornithology population viability analysis technical report (REP2-024), which is the average productivity rate for razorbill and not guillemot. The Applicant stresses that the estimates from the PVA model presented at application in Volume 6, Annex 5.6: Offshore ornithology population viability analysis technical report (REP2-024) are more precautionary because the productivity rate of 0.532 used at application (Volume 6, Annex 5.6: Offshore ornithology population viability analysis technical report REP2-024) is below the 0.583 rate which has been agreed with the SNCBs during the fourth offshore ornithology Expert Working Group (Appendix D of Technical Engagement Plan Appendices - Part 1 (A to E) (APP-042)). However, the Applicant acknowledges the discrepancy and included this in the Errata Sheet (S_DP_1 F04) submitted at Deadline 3. An updated PVA for the Pen y Gogarth/Great Orme's Head SSSI and Creigiau Rhiwledyn/Little Orme's Head SSSI will be provided in an update to the Offshore Ornithology Errata Clarification Note submitted at Deadline 4. The PVA for the Pen y Gogarth/Great Orme's Head SSSI will also be updated in a revised version of the Offshore Ornithology Assessment of Pen y Gogarth & Great Orme's Head SSSI (REP1-027) submitted at Deadline 4.[1]
REP2-099.26 within Response to Natural Resource Wales Deadline 2 Submission (F01) (REP3-038)	2.2.4 Cumulative Effects We also suggest that the Applicant considers assessment of impacts to the SSSI of the Mona project cumulatively with other plans and projects. This is particularly as the Awel-y-Môr, Morgan generation assets and Morecambe	The assessment of impacts to the Pen y Gogarth/Great Orme's Head SSSI of the Mona Offshore Wind Project cumulatively with other plans and projects has been considered in this note (see section 1.3).

[1] The Applicants position has been udpated since Response to Natural Resource Wales Deadline 2 Submission (REP3-038) was submitted. An updated PVA for the Pen y Gogarth/Great Orme's Head SSSI and Creigiau Rhiwledyn/Little Orme's Head SSSI has been provided in this note submitted at Deadline 4 not in an updated Offshore ornitholgoy errta clarification note.

Source	Relevant Comment	Applicant's Response (as provided at the time)
	generation assets projects are all located within foraging range of all three features of the Pen y Gogarth / Great Orme's Head SSSI	
REP3-090.2 within All Responses to Natural Resource Wales Deadline 3 Submission (S_D4_16)	REP2-080; para REP1-056.2: We welcome the Applicant's submitted detailed quantitative assessment of impacts of the Mona project alone on the kittiwake, guillemot and razorbill features of the Pen y Gogarth / Great Orme's Head Site of Special Scientific Interest (SSSI) [REP1-037]. NRW (A) provided a response on this at Deadline 2 [REP2-099], where we noted some aspects of the assessment approach that we have concerns / queries regarding, or that we do not agree with / advise are undertaken, regarding: • Non-breeding season age class apportioning • Calculation of non-breeding season apportionment rates to the Pen y Gogarth / Great Orme's Head SSSI. • Concerns regarding the foraging ranges used for guillemot and razorbill (as raised by JNCC in their Written Representations, REP1-066, with which we agree) and potential implications of this for the breeding season apportionment rate calculations for the SSSI. • Kittiwake seasonal definitions and calculations of Environmental Impact Assessment (EIA) scale seasonal collision totals used in calculating seasonal collision impacts to the SSSI. • The need to consider, and present, displacement impacts across the full range of SNCB advised % displacement and % mortality rates for auk displacement assessments, and, where predicted impacts equate to 1% or more of baseline mortality of the colony to give further consideration through Population Viability Analysis (PVA). • The need to undertake a cumulative assessment of impacts as well as assessment of project alone impacts.	The Applicant can confirm that following the submission of the Offshore Ornithology Assessment of Pen y Gogarth / Great Orme's Head Site of Special Scientific Interest (SSSI) (REP1-037) and NRW's comments received at Deadline 2 (REP2-099) and Deadline 3 (REP3-089), the Applicant has submitted an updated assessment for the Pen Pen y Gogarth / Great Orme's Head SSSI (S_D1_25 F02) at Deadline 4 which addresses these comments. The Applicant can confirm that additional clarity is provided within this technical note for the following points: • The methods for calculating non-breeding season age-class apportioning (Table 1-2); • The Applicant can confirm that the foraging range table was updated at Deadline 2 (see Table 1.7 of HRA Stage 1 Screening Report F02 (REP2-012)). The changes have not altered the breeding season apportioning undertaken for common guillemot or razorbill. • Updated the collision impact for black-legged kittiwake in line with the full breeding season (March to August) as presented in Table 5.13 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03); • This note considers the full range of SNCB advised displacement and mortality rates for common guillemot and razorbill; however, this note no longer presents displacement impacts on black-legged kittiwake, in line with NRW guidance. The removal of displacement does not amend the conclusions for the Mona Offshore Wind Project alone assessment (section 1.3.1). • This note provides a CEA for offshore wind projects with known impacts. The projects included are the same as those presented in Section 5.9 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03) plus the gap-filled historical projects considered in the Offshore Ornithology Cumulative Effects Assessment and In-combination Gap-filling Historical Projects Technical Note (S_D3_12 F02).
Virtual meeting on the 18 October 2024	NRW requested that, as part of the note, the following two items are included: • Visual presentation of the PVA outputs; • A matrix table showing the percentage increase in baseline mortality using the range of potential displacement impacts; and • Confirmation that their interim advice (alongside Natural England) has been followed for the survival rate of immature razorbill.	The Applicant has presented a visual PVA chart of each of the species for both the alone and cumulative assessments. The Applicant has also added the matrix table for razorbill and guillemot for the Mona Offshore Wind Project alone. No matrix table has been presented for the cumulative impact due to all displacement ranges (30-70% displacement and 1-10% mortality), indicating an increase of >1% in baseline mortality. The Applicant can also confirm that the interim advice (*NE and NRW interim advice regarding demographic rates, EIA scale mortality rates and reference populations for*

Source	Relevant Comment	Applicant's Response (as provided at the time)
		use in offshore wind impact assessments; Natural England and NRW, 2024) has been followed in this report in regards to the immature survival rate for razorbill as requested by NRW.
Virtual meeting on the 29 October 2024	NRW requested the following: • that the gap-filled projects are included within the cumulative assessment for the three species considering within this assessment. • that all projects with no site-specific age class apportioning should be considered adults during the breeding season. • that if there was no site apportioning value for projects considered the cumulative assessment that a proxy can be used. If a proxy is used that it's source is specifically stated.	The Applicant has updated the assessment to include the gap-filled projects from the Offshore Ornithology Cumulative Effects Assessment and In-combination Gap-filling Historical Projects Technical Note (S_D3_12 F02). The detailed methodology on the calculation of the gap-filled project's impacts has been submitted into Examination at Deadline 4 (Offshore Ornithology Cumulative Effects Assessment and In-combination Gap-filling Historical Projects Technical Note (S_D3_12 F02). The Applicant notes that the SNCBs have published no formal guidance on quantifying the impacts of 'gap-filled' projects; however, the Applicant considers that it has taken a robust approach, in consultation with the SNCBs, which aligns with the advice received. The Applicant does not consider that assuming all birds within the breeding season are adults would be a true representation of the risk and has continued to use the stable-age structure from Furness (2015) within the cumulative assessment. The Applicant notes, the SCNBs requested the inclusion of stable-age structures as part of the regional population for EIA scale impacts during the breeding season as part of the EPP. The Applicant considers using the age-class structures when considering 17 projects over a wide spatial scale as a robust assessment of the risk. Furness (2015) sets out how the ratios used are a precautionary estimate due to seabird species life history. Including 100% of birds as adults in the breeding season would lead to unrealistic and overly precautionary impacts that would give little confidence in the assessment. The inclusions of a proportion of birds being adults has been utilised for multiple other consented offshore wind projects and the Crown Estate's Plan Level HRAs, therefore the inclusion of stable-age structures has precedent. Finally, the Applicant can confirm that proxy sites were used for the site apportioning if an apportioning value was not available from the site-specific documentation (e.g. for the gap-filled projects). The source of the proxy apportioning value is presented above each of the cumulative tables for the three species assessed.

1.2 Method of assessment

1.2.1.1 The impact and assessment for black-legged kittiwake, razorbill and common guillemot from Pen y Gogarth/Great Orme's Head SSSI from the Mona Offshore Wind Project presented in this clarification note have used the same methodology as presented within Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). As advised by NRW in their Relevant Representation (RR-011) (detailed in Table 1-1), the Applicant has reviewed the approach adopted by Awel y Môr to assess its impact on the Pen y Gogarth/Great Orme's Head SSSI (RWE, 2022) and does not consider it to be appropriate to present a PVA without first assessing whether this level of assessment is necessary (i.e. the project is predicted to result in a sufficient increase in baseline mortality to warrant further assessment). Therefore, in accordance with the assessment methodology presented in Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03), the Applicant has first assessed if the predicted impact of the Mona Offshore Wind Project alone and/or cumulatively would surpass the threshold for requiring further assessment using PVA (i.e. >1% increase in baseline mortality), before undertaking a PVA.

1.2.1.2 The impacts presented within Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03) are supported by the technical reports, specifically Volume 6, Annex 5.2: Offshore Ornithology Displacement Technical Report (REP2-018), Volume 6, Annex 5.3: Offshore Ornithology Collision Risk Modelling Technical Report (REP2-020) and Volume 6, Annex 5.5: Offshore Ornithology Apportioning Technical Report (REP2-022).

1.2.1.3 During the breeding season the Pen y Gogarth/Great Orme's Head SSSI was included within Volume 6, Annex 5.4: Offshore Ornithology Apportioning Technical Report (APP-095) for black-legged kittiwake, common guillemot and razorbill. Specifically, 15.6% of black-legged kittiwake, 15.6% of common guillemot and 21.1% of razorbill recorded within the Mona Offshore Wind Project during the breeding season are likely to originate from the Pen y Gogarth/Great Orme's Head SSSI. The calculations of these percentages are presented in table 1.17, table 1.8 and table 1.11 of Volume 6, Annex 5.5: Offshore Ornithology Apportioning Technical Report (REP2-022), respectively.

1.2.1.4 During the breeding season, 100% of birds are considered to be adults for both common guillemot and razorbill, and 95.2% for black-legged kittiwake as presented in Table 1.4 of Volume 6, Annex 5.5: Offshore Ornithology Apportioning Technical Report (REP2-022). NRW stated agreement with this approach within NRW's Deadline 2 Submission (REP2-099).

1.2.1.5 During the non-breeding season, the apportioning calculations were taken from Furness (2015). Furness (2015) defined Biologically Defined Minimum Population Scales (BDMPS) populations during the non-breeding season for most seabird species within the UK. The report (Furness, 2015) and subsequent BDMPS populations focused on Special Protection Areas (SPAs) with SSSIs cumulatively presented within a single 'colony' called "West coast UK non-SPA populations" for each species. As no individual SSSIs were reported in Furness (2015) the impact during the non-breeding season on SSSIs was not quantified within Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). This included the Pen y Gogarth/Great Orme's Head SSSI.

1.2.1.6 The species-specific calculation of non-breeding season impact on the Pen y Gogarth/Great Orme's Head SSSI is presented within Table 1-2.

1.2.1.7 The proportion of adults from Pen y Gogarth/Great Orme's Head SSSI within the BDMPS during the non-breeding bioseason has used the values assigned to Rathlin Island SPA within the Appendix tables of Furness (2015) as this is the closest colony with suitable data. NRW stated agreement with using Rathlin Island SPA as a proxy within NRW's Deadline 2 Submission (REP2-099).

1.2.1.8 When calculating the proportion of the non-breeding population, which could have originated from Pen y Gogarth/Great Orme's Head SSSI, the population estimate from 2000 was used (Seabird Monitoring Programme, 2024). This data was chosen as Furness (2015) used the 2000 population estimates to determine the population estimate of "West coast UK non-SPA populations". The apportioning in Furness (2015) uses historical count data but is still the recommended resource (Parker *et al*., 2022).

Table 1-2: Species-specific calculation of non-breeding season apportioning for features of the Pen y Gogarth/Great Orme's Head SSSI.

Species	Bioseason	Population at Pen y Gogarth/Great Orme's Head SSSI (breeding adults from 2000)	Proportion of adults from Pen y Gogarth/Great Orme's Head SSSI within the BDMPS	Number of adult birds from Pen y Gogarth/Great Orme's Head SSSI within the BDMPS	Total adult population of the BDMPS	Proportion of adult population of the BDMPS from Pen y Gogarth/Great Orme's Head SSSI (adult birds)
Black-legged kittiwake	Spring migration	2,294	0.8	1,835	375,111	0.0049
	Autumn migration		0.6	1,376	498,970	0.0028
Common guillemot	Non-breeding	2,026	1.0	2,026	656,156	0.0031
Razorbill	Migration seasons (spring and autumn)	302	0.98	296	316,928	0.0009
	Winter		0.4	121	179,183	0.0007

1.3 Species assessments

1.3.1 Black-legged kittiwake

Project alone assessment

1.3.1.1 The apportioned annual collision impact from the Mona Offshore Wind Project alone is presented in Table 1-3 for black-legged kittiwake from Pen y Gogarth/Great Orme's Head SSSI. The un-apportioned impact of the Mona Offshore Wind Project is presented in Table 1-3 (and Table 5.38 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)). The CRM was undertaken using the stochastic CRM via the shiny app (Caneco, 2022) using the species-group avoidance rate of 0.9928. The collision impacts are rounded to two decimal places and therefore the combined impact when summing the numbers presented in the tables may not equal the number presented in the 'total' row due to this rounding.

1.3.1.2 During the spring migration bioseason, the estimated impact on black-legged kittiwake from Pen y Gogarth/Great Orme's Head SSSI was 0.04 birds (0.01 to 0.08 birds), which could increase the baseline mortality by 0.02% (0.01% to 0.05%) (Table 1-3). The impacts presented are mean collision estimates with lower 95% confidence intervals (LCI) and upper 95% confidence intervals (UCI) presented in brackets.

1.3.1.3 During the breeding bioseason, the estimated impact on black-legged kittiwake from Pen y Gogarth/Great Orme's Head SSSI was 2.31 birds (0.84 to 4.70 birds), which could increase the baseline mortality by 1.40% (0.51% to 2.85%) (Table 1-3).

1.3.1.4 During the autumn migration bioseason, the estimated impact on black-legged kittiwake from Pen y Gogarth/Great Orme's Head SSSI was 0.02 birds (0.01 to 0.05 birds), which could increase the baseline mortality by 0.01% (0.00% to 0.03%) (Table 1-3).

1.3.1.5 When considering the annual impact on black-legged kittiwake from Pen y Gogarth/Great Orme's Head SSSI, the predicted collision impact is 2.37 birds (0.87 to 4.83) which equates to an estimated 1.44% (0.53% to 2.93%) increase in baseline mortality. Considering the latest population estimate of 564 apparently occupied nests (1,128 adult birds) in 2023 (Seabird Monitoring Programme, 2024) and the baseline mortality rate of 0.146, the baseline mortality could be 165 birds.

Table 1-3: Predicted impact of collisions from Mona Offshore Wind Project on black-legged kittiwake from Pen y Gogarth/Great Orme's Head SSSI

Bioseason	Un-apportioned impact - mean collisions (LCI and UCI)	Apportioning percentage	Percentage of adult type birds from DAS	Apportioned impact on Pen y Gogarth/Great Orme's Head SSSI	Percentage increase in baseline mortality (165 birds)
Spring migration (January and February)	8.74 (3.09 to 18.15)	0.49%	92.01%	0.04 (0.01 to 0.08)	0.02% (0.01% to 0.05%)
Breeding (March to August)	15.52 (5.68 to 31.60)	15.6%	95.36%	2.31 (0.84 to 4.70)	1.40% (0.51% to 2.85%)
Autumn migration (September to December)	8.41 (2.96 to 17.53)	0.28%	92.01%	0.02 (0.01 to 0.05)	0.01% (0.00% to 0.03%)

Bioseason	Un-apportioned impact - mean collisions (LCI and UCI)	Apportioning percentage	Percentage of adult type birds from DAS	Apportioned impact on Pen y Gogarth/Great Orme's Head SSSI	Percentage increase in baseline mortality (165 birds)
Annual	**32.67 (11.73 to 67.27)**	**N/A**	**N/A**	**2.37 (0.87 to 4.83)**	**1.44% (0.53% to 2.93%)**

1.3.1.6 The predicted increase in baseline mortality from the Mona Offshore Project alone is predicted to be >1% and, therefore warrants further investigation via PVA. The summary outputs of the project alone PVA are presented in Table 1-4. When considering the mean collision impacts, the PVA predicted a stable population (median growth rate 1.000) and is therefore neither increasing or decreasing in size. The counterfactual of the growth rate is close to 1 (0.998) and, therefore, within natural variation of the growth rate. When the UCI of collision impacts are assumed in the PVA, there is predicted to be a small annual decline in the population (median growth rate of 0.998). However, as set out above, the other scenarios (e.g. LCI and mean scenarios) do not indicate a decline in growth rate for the black-legged kittiwake population and as such, the risk of a decline in the population is low (i.e. only in the UCI scenario). A visual representation of the Mona Offshore Wind Project alone impact scenarios, baseline scenario and the UCI and LCI is shown in Figure 1.1.

1.3.1.7 Given that all but the most conservative scenario (i.e. UCI) indicate stable population after 35 years (in 2065), this would be considered a negligible to low magnitude impact. Following the EIA methodology (set out in section 5.4 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)) black-legged kittiwake is deemed to be of high vulnerability, low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be high.

1.3.1.8 Overall, as the sensitivity of black-legged kittiwake is high and the magnitude of impact is considered negligible to low, this could lead to a potential minor significant impact to black-legged kittiwake from Pen y Gogarth/Great Orme's Head SSSI from the project alone. Therefore, as the predicted impact is of minor significant impact, this is considered non-significant..

Table 1-4: PVA outputs for the annual impact on black-legged kittiwake from Pen y Gogarth/Great Orme's Head SSSI from the Mona Offshore Wind Project alone

Year	Impact scenario	Simulated population size (adult birds)	Median population change since 2023 (%)	Median growth rate	2.5 percentile of simulated growth rate	97.5 percentile of simulated growth rate	Median counterfactual of growth rate	Median counterfactual of population size
2030	Baseline	1,156	1.34%	1.013	0.810	1.165	-	-
2030	Mean impact (2.37 birds)	1,153	1.15%	1.012	0.806	1.162	0.998	0.997
2030	UCI impact (4.83 birds)	1,151	0.71%	1.007	0.804	1.159	0.995	0.995
2065	Baseline	1,272	10.65%	1.003	0.981	1.023	-	-
2065	Mean impact (2.37 birds)	1,164	1.52%	1.000	0.978	1.020	0.998	0.914
2065	UCI impact (4.83 birds)	1,060	-7.61%	0.998	0.976	1.018	0.995	0.833

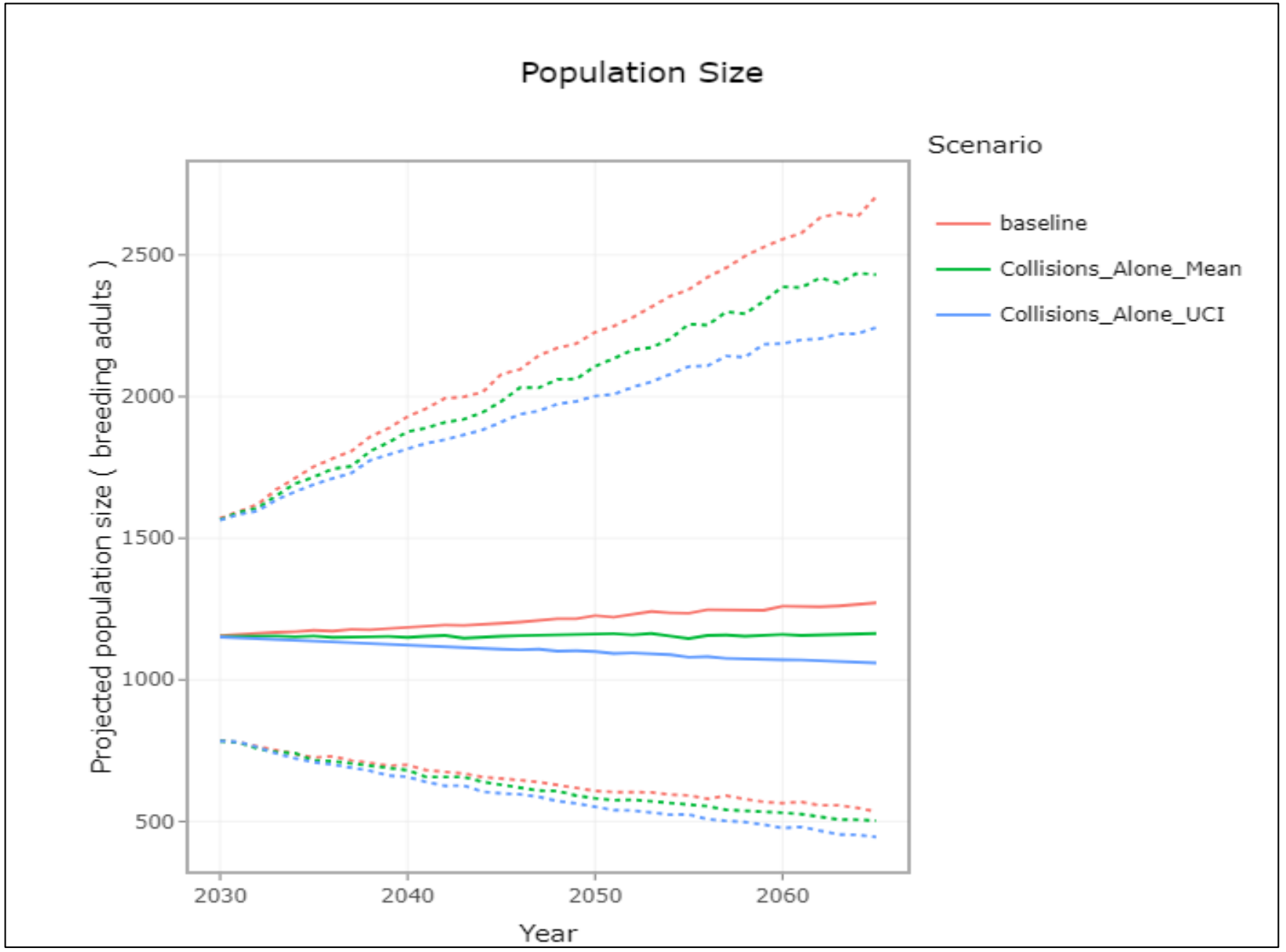

Figure 1.1: PVA output chart showing the black-legged kittiwake population size under the baseline and collision scenarios from the Project alone. Dashed lines present the LCI and UCI of the population size

Cumulative assessment

1.3.1.9 As set out in Table 1-1 NRW specifically requested a cumulative assessment on the potential impact to black-legged kittiwake from the Pen y Gogarth/Great Orme's Head SSSI.

1.3.1.10 Table 1-5 provides project by project un-apportioned and apportioned impact on black-legged kittiwake from Pen y Gogarth/Great Orme's Head SSSI. The projects included in this assessment are the same as those presented in Offshore Ornithology Supporting Information in line with SNCB advice (S_D3_19 F02)F2.5 F03. As the predicted cumulative impact on black-legged kittiwake from Pen y Gogarth/Great Orme's Head SSSI increases baseline mortality of >1%, further investigation via a PVA has been undertaken. The summary output of the PVA is presented in Table 1-6.

Table 1-5: Apportioned predicted impact on adult black-legged kittiwake from the Pen y Gogarth/Great Orme's Head SSSI as a result of the Mona Offshore Wind Project acting cumulatively.

a – the apportioning value during the breeding season has used that of Morecambe Offshore Wind Generation Assets, specifically 0.0609.

b – the apportioning value during the breeding season was taken from project specific documentation

c - the apportioning value during the breeding season has used that of Awel y Môr Offshore Wind Farm, specifically 0.53.

d – the project only presented an annual impact, for precaution the annual impact is considered to occur in the breeding season

e – the plans/projects included within this cumulative assessment cover a large spatial area, and therefore, it is considered necessary to apply a correction factor to account for the number of adult birds within the whole area. All projects have used the proportion of adults/immatures within the Appendix tables of from Furness (2015) for age-class apportioning which is 53.2% of birds are adults during the breeding season, 54.33% of birds are adults in the spring migration and 54.74% are adults in the autumn migration.

Project	Un-apportioned impact (all age-classes)			Apportioning value			Apportioned collision values (species-group avoidance rate 99.28) – adult birds[e]			
	Pre-breeding	Breeding	Post-breeding	Pre-breeding	Breeding	Post-breeding	Pre-breeding	Breeding	Post-breeding	Annual
Awel y Môr Offshore Wind Farm	15.3	11.66	8.29	0.0049	0.53[b]	0.0028	0.04	3.29	0.01	3.34
Burbo Bank Extension Offshore Wind Farm	N/A	23.04[d]	N/A	0.0049	0.0609[a]	0.0028	N/A	0.75	N/A	0.75
Erebus Floating Wind Demo	12.51	0.5	24.64	0.0049	No connectivity	0.0028	0.03	No connectivity	0.04	0.07
TwinHub (Wave Hub Floating Wind Farm)	N/A	9.78[d]	N/A	0.0049	No connectivity	0.0028	N/A	No connectivity	N/A	0.00
Mona Offshore Wind Project	8.74	15.52	8.41	0.0049	0.156[b]	0.0028	0.01	1.29	0.01	1.32
Morecambe Offshore Windfarm Generation Assets	5.34	15.03	11.63	0.0049	0.0609[a]	0.0028	0.01	0.49	0.02	0.52
Morgan Offshore Wind Project Generation Assets	13.18	5	21.63	0.0049	0.07[b]	0.0028	0.03	0.19	0.03	0.25
Ormonde Wind Farm	N/A	3.27[d]	N/A	0.0049	0.0609[a]	0.0028	N/A	0.11	N/A	0.11
Rampion Offshore Wind Farm	41.76	70.56	15.84	0.0049	No connectivity	0.0028	0.11	No connectivity	0.02	0.14
Rampion 2 Offshore Wind Farm	17	1	10	0.0049	No connectivity	0.0028	0.04	No connectivity	0.01	0.06
Walney (3 & 4) Extension Offshore Wind Farm	15.19	18.79	86.4	0.0049	0.0609[a]	0.0028	0.04	0.61	0.13	0.78
West of Orkney Windfarm	20.99	17.06	16.44	0.0049	No connectivity	0.0028	0.05	No connectivity	0.02	0.08
White Cross Offshore Windfarm	9.26	3.7	1.85	0.0049	No connectivity	0.0028	0.02	No connectivity	0.00	0.03
Gap-filled projects										
Burbo Bank	0.54	0.84	0.84	0.0049	0.0609[a]	0.0028	0.00	0.03	0.00	0.03

Project	Un-apportioned impact (all age-classes)			Apportioning value			Apportioned collision values (species-group avoidance rate 99.28) – adult birds[e]			
	Pre-breeding	Breeding	Post-breeding	Pre-breeding	Breeding	Post-breeding	Pre-breeding	Breeding	Post-breeding	Annual
Gwynt y Môr Offshore Wind Farm	0.84	1.45	1.33	0.0049	0.53[c]	0.0028	0.00	0.41	0.00	0.41
Robin Rigg	0.74	1.33	1.27	0.0049	0.0609[a]	0.0028	0.00	0.04	0.00	0.05
Rhyl Flats Offshore Wind Farm	0.75	1.34	1.18	0.0049	0.53[c]	0.0028	0.00	0.38	0.00	0.38
Walney 1	1.16	1.81	1.87	0.0049	0.0609[a]	0.0028	0.00	0.06	0.00	0.06
Walney 2	0.56	3.26	0.71	0.0049	0.0609[a]	0.0028	0.00	0.11	0.00	0.11
West of Duddon Sands Offshore Wind Farm	2.59	3.99	4.16	0.0049	0.0609[a]	0.0028	0.01	0.13	0.01	0.14
Combined impact	**166.45**	**208.87**	**967.13**	**N/A**	**N/A**	**N/A**	**0.44**	**7.86**	**0.33**	**8.64**
									Increase in baseline mortality	**5.23%**

Table 1-6: PVA outputs for the annual cumulative impact on black-legged kittiwake from Pen y Gogarth/Great Orme's Head SSSI

Year	Impact scenario	Median adult population size	Population change (%) since 2023	Median growth rate	2.5 percentile of growth rate	97.5 percentile of growth rate	Median counterfactual of growth rate	Median counterfactual of population size
2030	Baseline	1,156	2.5%	1.014	0.806	1.166	-	-
2030	Impact (8.64 birds)	1,144	1.4%	1.005	0.798	1.152	0.991	0.990
2065	Baseline	1,270	12.6%	1.003	0.981	1.023	-	-
2065	Impact (8.64 birds)	914	-18.6%	0.994	0.972	1.014	0.991	0.720

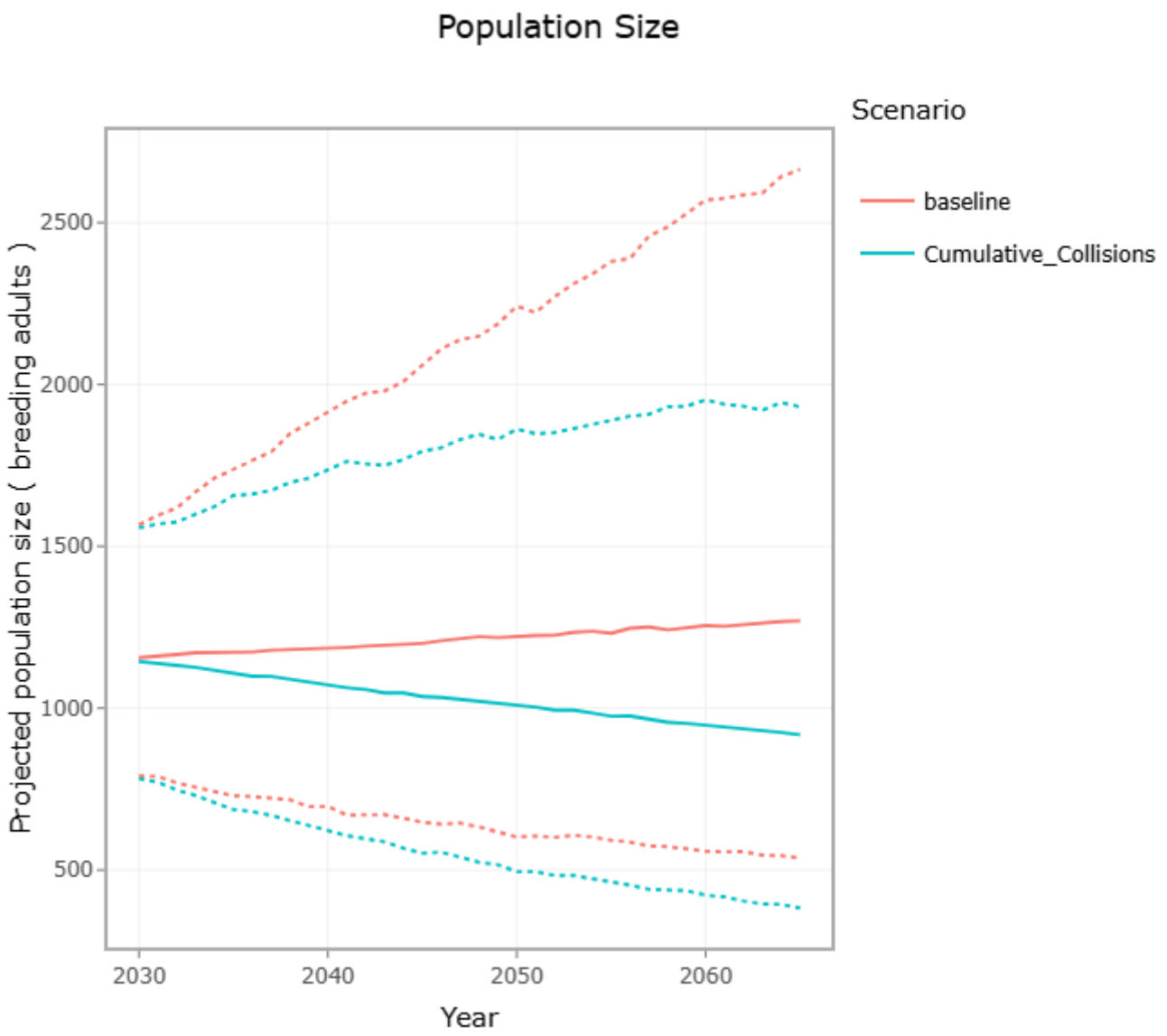

Figure 1.2: PVA output chart showing the black-legged kittiwake population size under the baseline and cumulative collision scenario. Dashed lines present the LCI and UCI of the population size

1.3.1.11 The annual impact on black-legged kittiwake from the Mona Offshore Wind Project cumulatively with other projects is predicted to be 8.64 birds. When considering the latest population estimate of 564 apparently occupied nests (1,128 adult birds) in 2023 and the baseline mortality rate of 0.146, the baseline mortality at this SSSI can be estimated at 165 birds. Based on this assumption, the additional impact of up to 8.64 birds annually would result in an increase in the baseline mortality of 5.23% (Table 1-5).

1.3.1.12 The cumulative PVA for black-legged kittiwake at Pen y Gogarth/Great Orme SSSI indicated that predicted collisions may reduce the unimpacted baseline population growth rate by 0.9% (i.e. 0.991 counterfactual of population growth rate; Table 1-6). Although this change in the growth rate is very small (i.e. 1%), there is a risk that under the cumulative impact scenario, the population could decline in size (due to a 0.994 annual growth rate). Figure 1.2 presents a visual representation of the predicted growth under the baseline and impacted scenarios, and this demonstrates the variability inherent in PVA modelling, where both baseline and impacted scenarios result in increasing and declining populations when considering the LCI and UCI shown as the dashed lines on Figure 1.2 (depending on the input parameters, assumptions etc.). This also highlights the sensitivity of the PVA tool, where even very small changes in a population growth rate (0.9%) can suggest a declining population (especially for small colonies with stable populations under baseline scenarios).

1.3.1.13 It should also be noted that the cumulative impacts would not persist for the entire 35-year modelled period, with existing offshore wind farms likely to be decommissioned (or subject to further applications for repowering that would require additional assessment) and, therefore, no longer presenting a collision risk to black-legged kittiwake. The PVA does not account for a reduced impact as the years progress, and therefore, there is an innate overestimation of the potential risk.

1.3.1.14 Recent population data has shown that the population of black-legged kittiwake from Pen y Gogarth/Great Orme's Head SSSI has increased in size over the latest colony counts (2013 to 2021; Figure 1.3; Seabird Monitoring Programme, 2014), however, the counts within 2022 and 2023 are likely to be impacted by highly pathogenic avian influenza (HPAI), which was prevalent during the 2022 and 2023 breeding seasons (Tremlett *et* al., 2024). Within Figure 1.3 the last 13 years are presented which is the average lifespan of black-legged kittiwake (BTO, 2024).

1.3.1.15 This increase in the population (between 2010 and 2021) of black-legged kittiwake from Pen y Gogarth/Great Orme's Head SSSI (Figure 1.3) should be considered in light of the introduction of thirteen offshore windfarms and their associated potential impacts. Figure 1.3 provides the cumulative capacity of these offshore wind farms (measured in MW) within theoretical connectivity to the Pen y Gogarth/Great Orme's Head SSSI during the breeding and non-breeding seasons which includes North Hoyle (operational since 2003), Barrow (operational since 2006), Burbo Bank (operational since 2007), Rhyl Flats (operational since 2009), Walney 1 (operational since 2011), Walney 2 (operational since 2012), Ormonde (operational since 2012), West of Duddon Sands (operational since 2014), Gwynt y Môr (operational since 2015), Burbo Bank Extension (operational since 2017), Rampion 1 (operation since 2018) and Walney Extension (operational since 2018). As set out in Table 1-5, impacts from a number of these wind farms have already been accounted for within the PVA, which emphasises the precautionary nature of the CEA, i.e. project impacts are considered in the impact assessment, while also being accounted for within the latest colony counts and productivity rates used within the PVA input parameters (e.g. impacts on this colony from Burbo Bank will have been occurring since 2011). This also demonstrates that the increase in installed capacity of offshore wind in the Irish Sea

over the last 20 years has not shown empirical effects on the Pen y Gogarth/Great Orme's Head SSSI colony (beyond natural variability).

1.3.1.16 The recent population size increase set out above (pre-HPAI) should be noted alongside the long-term (37-year) decrease in colony size since 1986 (Seabird Monitoring Programme, 2024)). This decline is mirrored at the national (Wales) and British level (Burnell *et al*, 2024). The only national population of black-legged kittiwake which have recorded a long-term increase is in Northern Ireland (Burnell *et al*, 2024), with a 33% increase since 2000 (when the latest UK and Ireland-wide seabird census took place). There is proven connectivity between colonies in north Wales (Puffin Island) and Northern Ireland, so interannual variation in nesting location may occur (BTO, 2024).

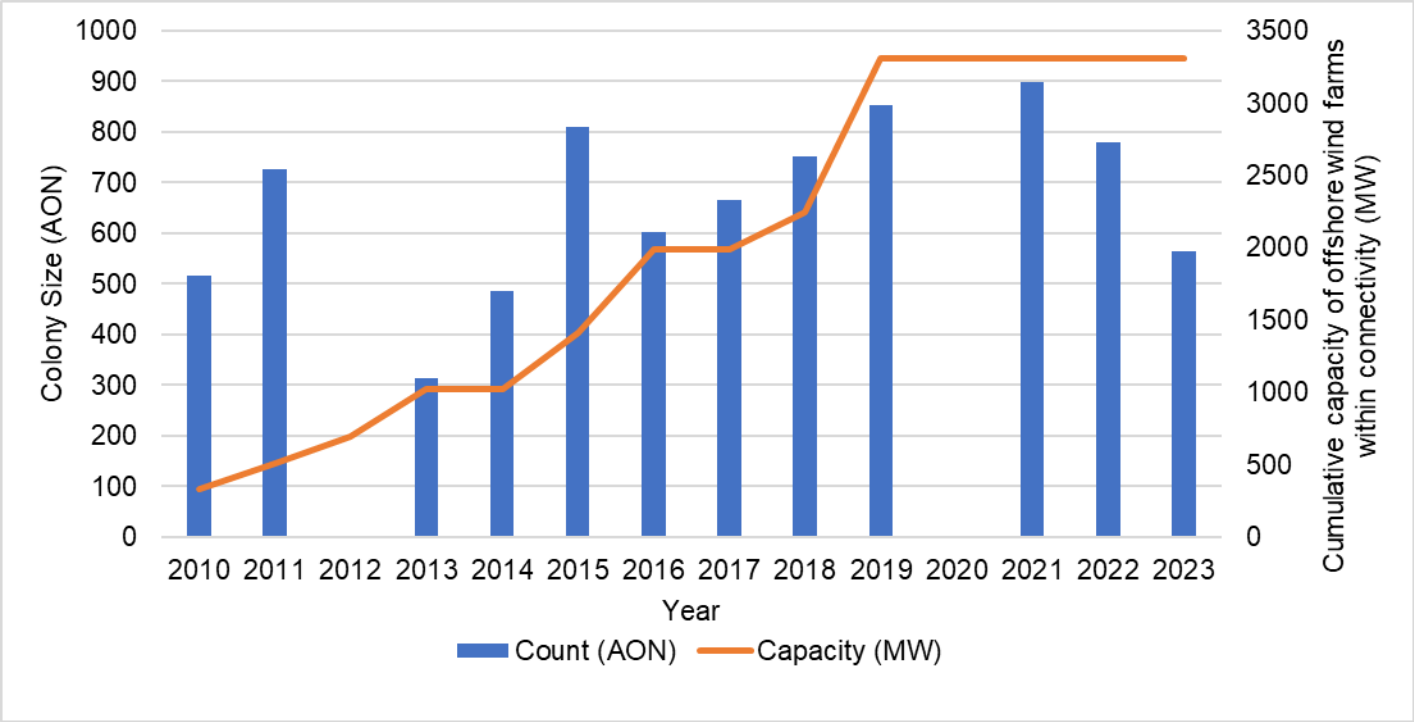

Figure 1.3: Recent (2010 to 2023) colony counts of black-legged kittiwake from Pen y Gogarth/Great Orme's Head SSSI (blue bars) alongside the generation capacity of the cumulative offshore wind farms (orange line)

1.3.1.17 The evidence presented and the PVA outputs indicate the potential for a small decline (change in the growth rate of <1%) in the black-legged kittiwake population from Pen y Gogarth/Great Orme's Head SSSI under the cumulative impact scenario. However, as noted above, there is a high degree of conservatism within the CEA, with predicted cumulative impacts likely to be overestimated (or already accounted for within the PVA inputs), leading to an overestimation of risk through the modelled period. In addition, the small change in the predicted growth rate (i.e. <1%) even in this conservative cumulative scenario, combined with the high level of variability in PVA outputs (when considering the LCI and UCI), suggests that the actual risk of a decrease in growth rate (and therefore a population decline) due to cumulative effects of collision is low and it is likely that any effects will be within the range of natural variability. As such, the impact is predicted to be of low magnitude. F2.5 F03

1.3.1.18 Following the EIA methodology (set out in section 5.4 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)), black-legged kittiwake is deemed to be of high vulnerability,

low recoverability and medium value. The sensitivity of the receptor is, therefore, considered to be high.

1.3.1.19 Overall, and following the EIA methodology set out in section 5.4 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03), as the sensitivity of black-legged kittiwake is high and the magnitude of impact is considered low, this could lead to a potential minor significant impact on black-legged kittiwake from Pen y Gogarth/Great Orme's Head SSSI.

1.3.2 Common guillemot

Project alone assessment

1.3.2.1 The apportioned annual displacement impact from the Mona Offshore Wind Project alone is presented in Table 1-7 for common guillemot from Pen y Gogarth/Great Orme's Head SSSI. As requested by NRW (and the JNCC) for precaution, 100% of birds are considered adults for the project alone assessment; this will, therefore, present an overestimation of the risks on common guillemot from Pen y Gogarth/Great Orme's Head SSSI. The un-apportioned impact of the Mona Offshore Wind Project is presented in Table 1-7 (and Table 5.30 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)). The predicted impacts from displacement are presented considering 50% displacement and 1% mortality and the range using 30-70% displacement and 1-10% mortality, as advised by NRW (see Table 1-1). The displacement impacts are rounded to two decimal places, and therefore, the combined impact when summing the numbers presented in the tables may not equal the number presented in the 'total' row due to this rounding.

1.3.2.2 During the breeding bioseason, the estimated impact was 3.29 (1.97 to 46.08) common guillemot from Pen y Gogarth/Great Orme's Head SSSI, which could increase the baseline mortality by 1.51% (0.91% to 21.12%; Table 1-7).

1.3.2.3 During the non-breeding bioseason the estimated impact was 0.06 (0.03 to 0.82) common guillemot from Pen y Gogarth/Great Orme's Head SSSI, which could increase the baseline mortality by 0.03% (0.02% to 0.37%; Table 1-7).

1.3.2.4 When considering the annual impact on common guillemot from Pen y Gogarth/Great Orme's Head SSSI, the predicted displacement impact is 3.35 (2.01 to 46.90), which equates to an estimated 1.54% (0.95% to 21.49%; Table 1-7) increase in baseline mortality.

1.3.2.5 The red text within Table 1-8, is when the percentage increase in baseline mortality is >1% and therefore a PVA would be required.

1.3.2.6 Table 1-8The red text within Table 1-8, is when the percentage increase in baseline mortality is >1% and therefore a PVA would be required. Table 1-8 presents the matrix table of the increase in baseline mortality, with red text used where >1% is predicted.

1.3.2.7 The predicted increase in baseline mortality from the Mona Offshore Project alone is >1%; therefore, a PVA is required. The summary outputs of the project alone PVA for common guillemot from Pen y Gogarth/Great Orme's Head SSSI is presented in Table 1-9.

1.3.2.8 A visual representation of the Mona Offshore Wind Project alone impact scenarios and baseline scenario is shown in Figure 1.4.

Table 1-7: Predicted impact of displacement from Mona Offshore Wind Project alone on common guillemot from Pen y Gogarth/Great Orme's Head SSSI

Bioseason	Un-apportioned impact when considering 50% displacement and 1% mortality (30-70% displacement and 1-10% mortality)	Apportioning percentage	Percentage of birds considered to be adults	Apportioned impact on Pen y Gogarth/Great Orme's Head SSSI	Percentage increase in baseline mortality (218 birds)
Breeding (March to July)	21 (13 to 295)	15.6%	100%	3.29 (1.97 to 46.08)	1.51% (0.91% to 21.12%)
Non-breeding (August to February)	19 (11 to 263)	0.31%	100%	0.06 (0.03 to 0.82)	0.03% (0.02% to 0.37%)
Annual	40 (24 to 558)	N/A	N/A	**3.35 (2.01 to 46.90)**	**1.54% (0.92% to 21.49%)**

1.3.2.9 The red text within Table 1-8, is when the percentage increase in baseline mortality is >1% and therefore a PVA would be required.

Table 1-8: Matrix table showing the percentage increase in baseline mortality for the range of potential annual impacts from displacement on common guillemot from Pen y Gogarth/Great Orme's Head SSSI from the project alone

		Percentage mortality					
		1%	2%	3%	4%	5%	10%
Percentage displacement	30%	0.92%	1.84%	2.76%	3.68%	4.61%	9.21%
	40%	1.23%	2.46%	3.68%	4.91%	6.14%	12.28%
	50%	1.54%	3.07%	4.61%	6.14%	7.68%	15.35%
	60%	1.84%	3.68%	5.53%	7.37%	9.21%	18.42%
	70%	2.15%	4.30%	6.45%	8.60%	10.75%	21.49%

Table 1-9: PVA outputs for the annual impact on common guillemot from Pen y Gogarth/Great Orme's Head SSSI from the Mona Offshore Wind Project alone

Year	Impact scenario	Median adult population size	Population change (%) since 2023	Median growth rate	2.5 percentile of growth rate	97.5 percentile of growth rate	Median counterfactual of growth rate	Median counterfactual of population size
2030	Baseline	4,250	2.80%	1.028	0.951	1.095	-	-
2030	30% displacement and 1% mortality (2.06 birds)	4,247	2.75%	1.028	0.951	1.096	0.999	0.999
2030	50% displacement and 1% mortality (3.33 birds)	4,245	2.72%	1.027	0.950	1.095	0.999	0.999
2030	70% displacement and 10% mortality (46.84 birds)	4,190	1.30%	1.013	0.937	1.081	0.986	0.986
2065	Baseline	10,412	152.61%	1.026	1.017	1.035	-	-
2065	30% displacement and 1% mortality (2.06 birds)	10,176	146.58%	1.025	1.016	1.034	0.999	0.978
2065	50% displacement and 1% mortality (3.33 birds)	10,019	143.10%	1.025	1.016	1.033	0.999	0.963
2065	70% displacement and 10% mortality (46.84 birds)	6,129	48.50%	1.011	1.002	1.020	0.985	0.589

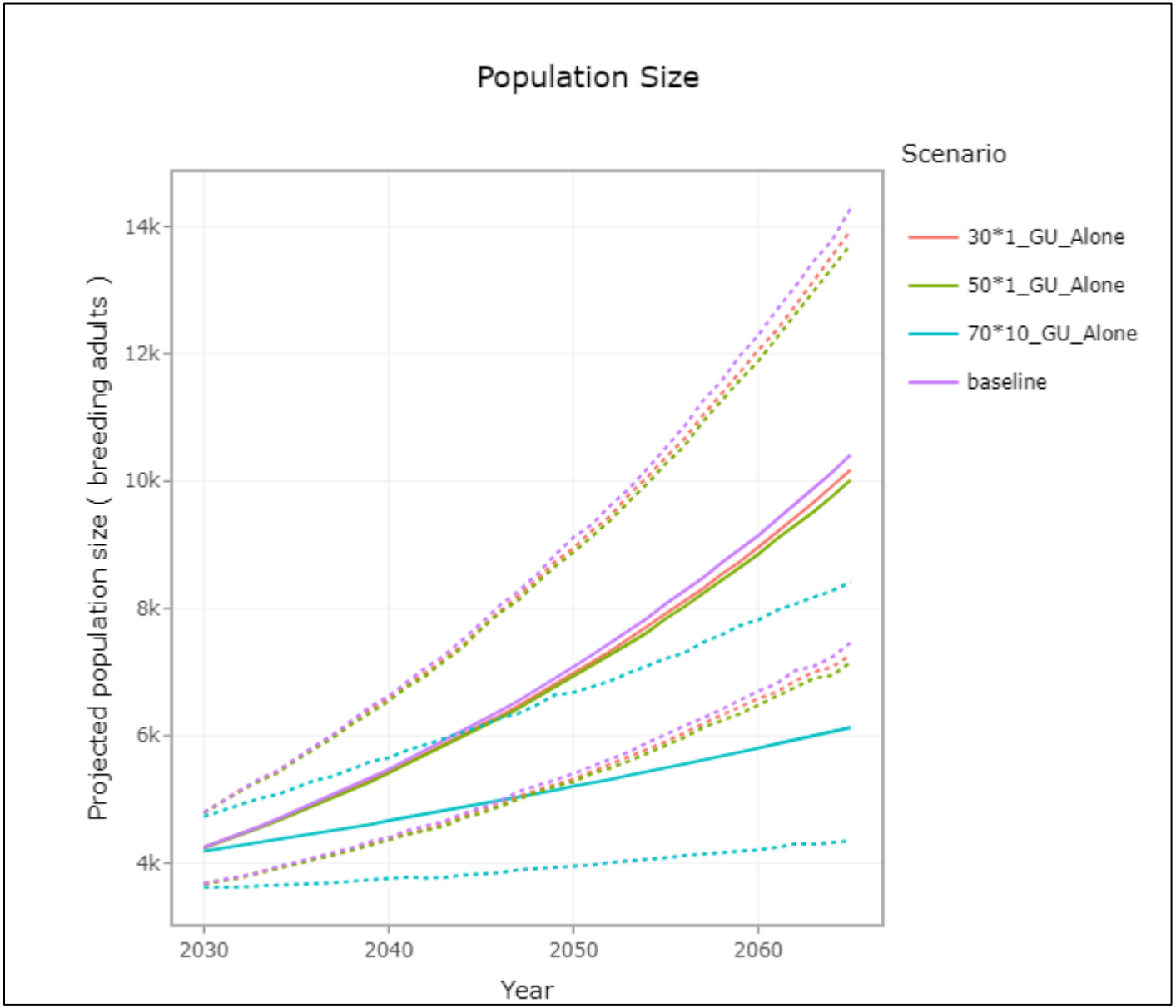

Figure 1.4: PVA output chart showing the common guillemot population size under the baseline and three displacement scenarios from the Project alone. Dashed lines present the LCI and UCI of the population size

1.3.2.10 The PVA for common guillemot from Pen y Gogarth/Great Orme SSSI indicated that when considering the worst-case impact scenario of 70% displacement and 10% mortality would reduce the unimpacted baseline population growth rate by 0.015. When assessing the 50% displacement and 1% mortality scenario, the PVA predicted a growth rate reduction of 0.1% compared to the baseline (counterfactual of median growth rate of 0.999). In all scenarios modelled (displacement rate 30%-70%, mortality rate 1%-10%), a positive population growth rate was sustained indicating that the population is predicted to be growing and is predicted to be 48.75% to 146.54% larger than the current size after 35 years (2065) (Figure 1.4).

1.3.2.11 The population of common guillemot from Pen y Gogarth/Great Orme's Head SSSI has been increasing in size consistently since 2000 (average annual growth rate of 1.043 between 2000 and 2023, JNCC, 2024). This empirical annual average growth rate is higher than predicted by the PVA. Given that the PVA is predicting a continuation of the increasing population, the predicted impact can be considered to be of negligible to low magnitude.

1.3.2.12 Following the EIA methodology (set out in section 5.4 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)), common guillemot is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is, therefore, considered to be medium. Overall, as the sensitivity of common guillemot is medium and the magnitude of impact is considered negligible to low, this could lead to a potential minor significant impact on common guillemot from Pen y Gogarth/Great Orme's Head SSSI from the project alone. Therefore, as the predicted impact is of minor significant impact, this is considered non-significant.

Cumulative assessment

1.3.2.13 As set out in Table 1-1 NRW specifically requested a cumulative assessment of the potential impact on common guillemot from the Pen y Gogarth/Great Orme's Head SSSI.

1.3.2.14 Table 1-10 provides project by project un-apportioned, and apportioned impact on common guillemot from Pen y Gogarth/Great Orme's Head SSSI. The projects included in this assessment are the same as those presented in Section 5.9 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). As the predicted cumulative impact on common guillemot from Pen y Gogarth/Great Orme's Head SSSI increased baseline mortality by >1%, a PVA was undertaken. The summary output presented in Table 1-11.

Table 1-10: Apportioned predicted impact on adult common guillemot from the Pen y Gogarth/Great Orme's Head SSSI as a result of the Mona Offshore Wind Project acting cumulatively.

a – the apportioning value during the breeding season has used that of Morgan Offshore Wind Generation Assets, specifically 0.02.

b – the apportioning value during the breeding season was taken from project specific documentation

c – the plans/projects included within this cumulative assessment cover a large spatial area and therefore, it is considered necessary to apply a correction factor to account for the number of adult birds within the whole area. All projects have used the proportion of adults/immatures within the Appendix tables of from Furness (2015) for age-class apportioning, which is 57.5% of birds are adults during the breeding season, 57.6% of birds are adults in the non-breeding season.

d – the apportioning value during the breeding season has used that of Awel y Môr Offshore Wind Farm, specifically 0.365.

Plan or project	Abundance estimate		Apportioning value		Apportioned adult mortalities from displacement when considering 50% displacement and 1% mortality (30-70% displacement and 1-10% mortality)[c]		
	Breeding	Non-breeding	Breeding	Non-breeding	Annual	Breeding	Non-breeding
Awel y Môr Offshore Wind Farm	1,569	2,919	0.365[b]	0.0031	1.67 (1.00 to 23.40)	1.65 (0.99 to 23.04)	0.03 (0.02 to 0.36)
Burbo Bank Extension Offshore Wind Farm	1,000	1,561	0.02[a]	0.0031	0.07 (0.04 to 1.00)	0.06 (0.03 to 0.80)	0.01 (0.01 to 0.19)
Erebus Floating Wind Demo	7,001	28,338	No connectivity	0.0031	0.25 (0.15 to 3.53)	No connectivity	0.25 (0.15 to 3.53)
Mona Offshore Wind Project	4,220	3,756	0.156[b]	0.0031	1.93 (1.16 to 26.95)	1.89 (1.14 to 26.48)	0.03 (0.02 to 0.47)
Morecambe Offshore Windfarm Generation Assets	4,050	7,647	0.02[a]	0.0031	0.30 (0.18 to 4.21)	0.23 (0.14 to 3.26)	0.07 (0.04 to 0.95)
Morgan Offshore Wind Project Generation Assets	4,893	4,101	0.02[b]	0.0031	0.32 (0.19 to 4.45)	0.28 (0.17 to 3.94)	0.04 (0.02 to 0.51)
Ormonde Wind Farm	912	39	0.02[a]	0.0031	0.05 (0.00 to 0.74)	0.05 (0.03 to 0.73)	0.00 (0.00 to 0.00)
TwinHub (Wave Hub Floating Wind Farm)	39	217	No connectivity	0.0031	0.00 (0.00 to 0.03)	No connectivity	0.00 (0.00 to 0.03)
Walney (3 & 4) Extension Offshore Wind Farm	4,169	1,927	0.02[a]	0.0031	0.26 (0.15 to 3.59)	0.24 (0.14 to 3.35)	0.02 (0.01 to 0.24)
West of Duddon Sands Offshore Wind Farm	1,321	166	0.02[a]	0.0031	0.08 (0.00 to 1.08)	0.08 (0.05 to 1.06)	0.00 (0.00 to 0.02)
West of Orkney Windfarm	4,861	4,275	No connectivity	0.0031	0.04 (0.02 to 0.53)	No connectivity	0.04 (0.02 to 0.53)
White Cross Offshore Windfarm	3,304	1,059	No connectivity	0.0031	0.01 (0.01 to 0.13)	No connectivity	0.01 (0.01 to 0.13)
Gap-filled projects							

Plan or project	Abundance estimate		Apportioning value		Apportioned adult mortalities from displacement when considering 50% displacement and 1% mortality (30-70% displacement and 1-10% mortality)[c]		
	Breeding	Non-breeding	Breeding	Non-breeding	Annual	Breeding	Non-breeding
Burbo Bank	41	58	0.02[a]	0.0031	0.00 (0.00 to 0.04)	0.00 (0.00 to 0.03)	0.00 (0.00 to 0.01)
Gwynt y Môr Offshore Wind Farm	149	205	0.365[d]	0.0031	0.16 (0.09 to 2.21)	0.16 (0.09 to 2.19)	0.00 (0.00 to 0.03)
Rhyl Flats Offshore Wind Farm	49	68	0.365[d]	0.0031	0.05 (0.03 to 0.73)	0.05 (0.03 to 0.72)	0.00 (0.00 to 0.01)
Robin Rigg	138	88	No connectivity	0.0031	0.00 (0.00 to 0.01)	No connectivity	0.00 (0.00 to 0.01)
Walney 1 & 2	161	227	0.02[a]	0.0031	0.01 (0.01 to 0.16)	0.01 (0.01 to 0.13)	0.00 (0.00 to 0.03)
Combined impact	**N/A**	**N/A**	**N/A**	**N/A**	**5.20 (3.12 to 72.82)**	**4.70 (2.82 to 65.74)**	**0.51 (0.30 to 7.08)**
Annual increase in baseline mortality					**2.38% (1.43% to 33.38%)**		

Table 1-11: PVA outputs for the annual cumulative impact on common guillemot from Pen y Gogarth/Great Orme's Head SSSI

Year	Impact scenario	Median adult population size	Population change (%) since 2023	Median growth rate	2.5 percentile of growth rate	97.5 percentile of growth rate	Median counterfactual of growth rate	Median counterfactual of population size
2030	Baseline	4,914	37.34%	1.051	0.967	1.125		
2030	30% displacement and 1% mortality (3.12 birds)	4,909	37.20%	1.050	0.966	1.124	0.999	0.999
2030	50% displacement and 1% mortality (5.20 birds)	4,909	37.19%	1.050	0.966	1.124	0.998	0.999
2030	70% displacement and 10% mortality (72.82 birds)	4,807	34.33%	1.029	0.946	1.102	0.978	0.978
2065	Baseline	26,550	642.03%	1.050	1.040	1.058		
2065	30% displacement and 1% mortality (3.12 birds)	25,606	615.65%	1.048	1.039	1.057	0.999	0.966
2065	50% displacement and 1% mortality (5.20 birds)	24,987	598.34%	1.048	1.038	1.057	0.998	0.943
2065	70% displacement and 10% mortality (72.82 birds)	11,554	222.92%	1.026	1.016	1.034	0.977	0.435

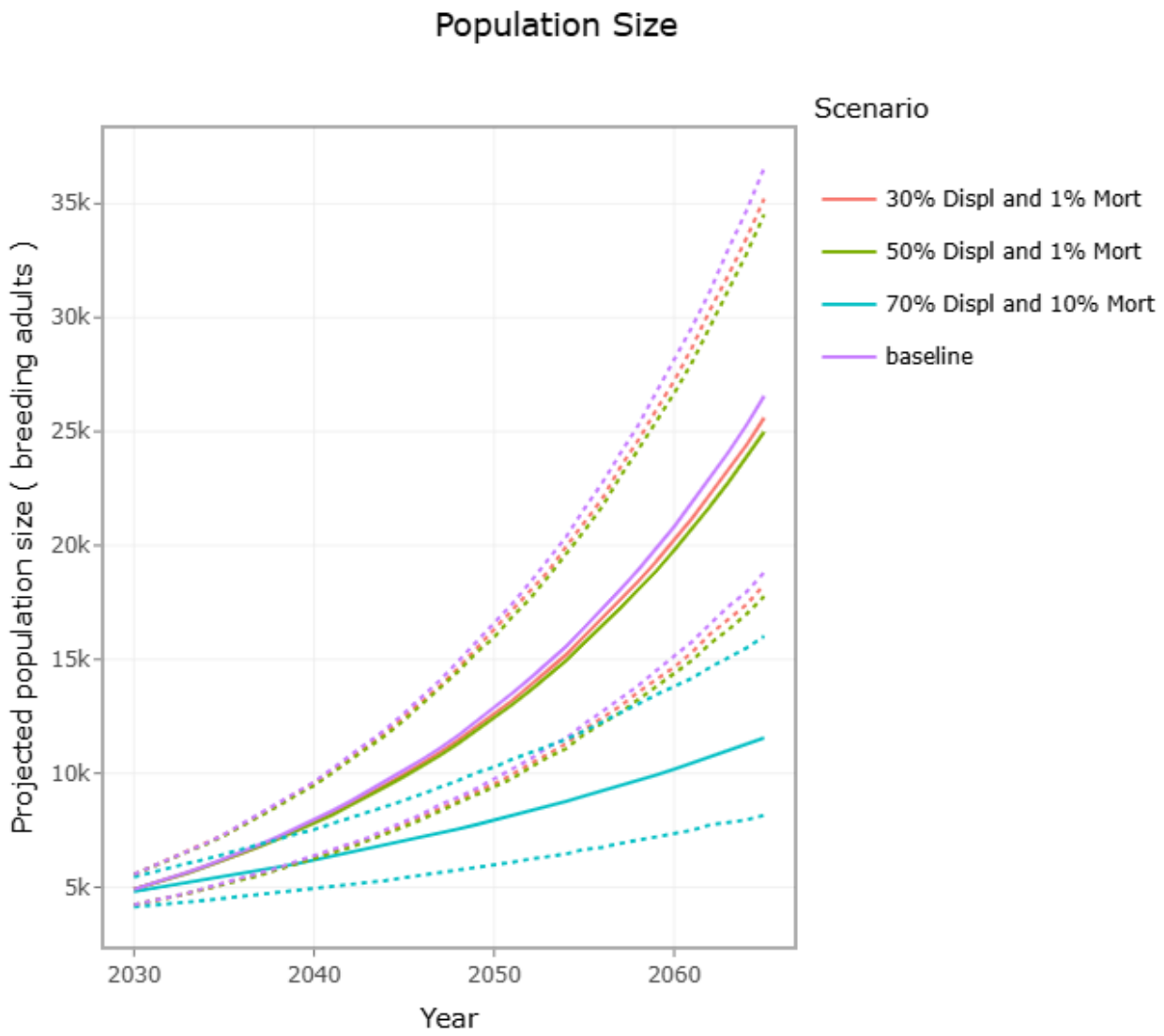

Figure 1.5: PVA output chart showing the common guillemot population size under the baseline and three displacement scenarios from the cumulative impact. Dashed lines present the LCI and UCI of the population size

1.3.2.15 The annual impact on common guillemot from the Mona Offshore Wind Project alongside other projects is predicted to be 5.20 (3.12 to 72.82) adult birds (Table 1-10). Considering the latest population estimate of 2,670 individuals, which equates to 3,578 adult birds in 2023 and the baseline mortality rate of 0.061, the baseline mortality could be 218 birds annually. The additional impact of up to 5.20 (3.12 to 72.81)adult birds annually could increase the baseline mortality by 2.38% (1.43% to 33.38%).

1.3.2.16 Given the predicted cumulative impact is >1% increase in baseline mortality, a PVA was undertaken for common guillemot from Pen y Gogarth/Great Orme's Head SSSI (Table 1-11).

1.3.2.17 The cumulative PVA for common guillemot from Pen y Gogarth/Great Orme SSSI indicated that when considering worst-case scenario of 70% displacement and 10% mortality could reduce the unimpacted baseline population growth rate by 0.023 (Table 1-11). When considering a 50% displacement and 1% mortality scenario the PVA predicted a growth rate reduction of 0.002. In all scenarios modelled (displacement rate 30% to 70%, mortality rate 1% to 10%), a positive population growth rate was sustained, indicating that the population is predicted to increase in size and will be 222.92% to 615.65% larger than the current (2023) size after 35 years (Figure 1.5).

1.3.2.18 The population of common guillemot from Pen y Gogarth/Great Orme's Head SSSI has been increasing in size consistently since 2000 (average annual growth rate of 1.043 between 2000 and 2023, JNCC, 2024). This annual average growth rate is higher than predicted by the PVA. Given that the PVA predicts a continuation of the increasing population the impact can be considered to be of negligible to low magnitude.

1.3.2.19 Following the EIA methodology (set out in section 5.4 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)), common guillemot is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be medium. Overall, as the sensitivity of common guillemot is medium and the magnitude of impact is considered negligible to low, this could lead to a potential minor significant impact on common guillemot from Pen y Gogarth/Great Orme's Head SSSI from the project alone. Therefore, as the predicted impact is of minor significant impact, this is considered non-significant..

1.3.3 Razorbill

Project alone assessment

1.3.3.1 The apportioned annual displacement impact from the Mona Offshore Wind Project alone is presented in Table 1-12 for razorbill from Pen y Gogarth/Great Orme's Head SSSI. As requested by NRW (and the JNCC) for precaution, 100% of birds are considered adults for the project alone assessment; this will, therefore, present an overestimation of the risks on razorbill from Pen y Gogarth/Great Orme's Head SSSI. The un-apportioned impact of the Mona Offshore Wind Project is presented in Table 5.31 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). The displacement impacts are rounded to two decimal places and therefore the combined impact when summing the numbers presented in the tables may not equal the number presented in the 'total' row due to this rounding.

1.3.3.2 During the spring migration bioseason, the estimated impact was 0.01 (0.01 to 0.12) razorbill from Pen y Gogarth/Great Orme's Head SSSI, which could increase the baseline mortality by 0.02% (0.01% to 0.23%; Table 1-12).

1.3.3.3 During the breeding bioseason, the estimated impact was 0.09 (0.05 to 1.22) razorbill from Pen y Gogarth/Great Orme's Head SSSI, which could increase the baseline mortality by 0.17% (0.10% to 2.36%; Table 1-12).

1.3.3.4 During the autumn migration bioseason, the estimated impact was 0.00 (0.00 to 0.01) razorbill from Pen y Gogarth/Great Orme's Head SSSI, which could increase the baseline mortality by 0.00% (0.00% to 0.01%; Table 1-12).

1.3.3.5 During the non-breeding bioseason the estimated impact was 0.00 (0.00 to 0.02) razorbill from Pen y Gogarth/Great Orme's Head SSSI, which could increase the baseline mortality by 0.00% (0.00% to 0.04%; Table 1-12).

1.3.3.6 When considering the annual impact on razorbill from Pen y Gogarth/Great Orme's Head SSSI, the predicted collision impact is 0.10 (0.06 to 1.37) birds, which equates to an estimated 0.19% (0.11% to 2.64%; Table 1-12) increase in baseline mortality.

1.3.3.7 Table 1-13 presents the matrix table of the increase in baseline mortality, with red text used where >1% is predicted.

1.3.3.8 The increase in baseline mortality from the Mona Offshore Project alone is >1% when considering the worst-case scenario advised by the SNCBs (70% displacement and 10% mortality); therefore, a PVA is required. The summary outputs of the project alone PVA is presented in Table 1-14. A visual representation of the Mona Offshore Wind Project alone impact scenarios and baseline scenario is shown in Figure 1.6.

Table 1-12: Predicted impact of displacement from Mona Offshore Wind Project on razorbill from Pen y Gogarth/Great Orme's Head SSSI

Bioseason	Un-apportioned impact when considering 50% displacement and 1% mortality (30-70% displacement and 1-10% mortality)	Apportioning percentage	Percentage of birds considered to be adults	Apportioned impact on Pen y Gogarth/Great Orme's Head SSSI	Percentage increase in baseline mortality (52 birds)
Spring migration (January to March)	10 (6 to 135)	0.09%	100%	0.01 (0.01 to 0.12)	0.02% (0.01% to 0.23%)
Breeding (April to July)	0 (0 to 6)	21.1%	100%	0.09 (0.05 to 1.22)	0.17% (0.10% to 2.36%)
Autumn migration (August to October)	0 (0 to 6)	0.09%	100%	0.00 (0.00 to 0.01)	0.00% (0.00% to 0.01%)
Non-breeding (November to December)	2 (1 to 29)	0.07%	100%	0.00 (0.00 to 0.02)	0.00% (0.00% to 0.04%)
Annual	**13 (8 to 176)**	**N/A**	**N/A**	**0.10 (0.06 to 1.37)**	**0.19% (0.11% to 2.64%)**

Table 1-13: Matrix table showing the percentage increase in baseline mortality for the range of potential annual impacts from displacement on razorbill from Pen y Gogarth/Great Orme's Head SSSI from the project alone

		Percentage mortality					
		1%	2%	3%	4%	5%	10%
Percentage displacement	30%	0.11%	0.23%	0.34%	0.45%	0.57%	1.13%
	40%	0.15%	0.30%	0.45%	0.60%	0.75%	1.51%
	50%	0.19%	0.38%	0.57%	0.75%	0.94%	1.88%
	60%	0.23%	0.45%	0.68%	0.90%	1.13%	2.26%
	70%	0.26%	0.53%	0.79%	1.05%	1.32%	2.64%

Table 1-14: PVA outputs for the annual impact on razorbill from Pen y Gogarth/Great Orme's Head SSSI from the project alone

Year	Impact scenario	Simulated population size (adult birds)	Median population change since 2023 (%)	Median growth rate	2.5 percentile of simulated growth rate	97.5 percentile of simulated growth rate	Median counterfactual of growth rate	Median counterfactual of population size
2030	Baseline	531	2.22%	1.022	0.835	1.134	-	-
2030	30% displacement and 1% mortality (0.06 birds)	531	2.22%	1.022	0.830	1.132	1.000	1.000
2030	50% displacement and 1% mortality (0.10 birds)	531	2.26%	1.023	0.829	1.132	1.000	1.001
2030	70% displacement and 10% mortality (1.37 birds)	530	1.92%	1.019	0.830	1.127	0.997	0.998
2065	Baseline	726	39.34%	1.009	0.991	1.026	-	
2065	30% displacement and 1% mortality (0.06 birds)	728	39.27%	1.009	0.991	1.026	1.000	1.001
2065	50% displacement and 1% mortality (0.10 birds)	724	38.61%	1.009	0.991	1.026	1.000	1.001
2065	70% displacement and 10% mortality (1.37 birds)	652	24.36%	1.006	0.987	1.023	0.997	0.899

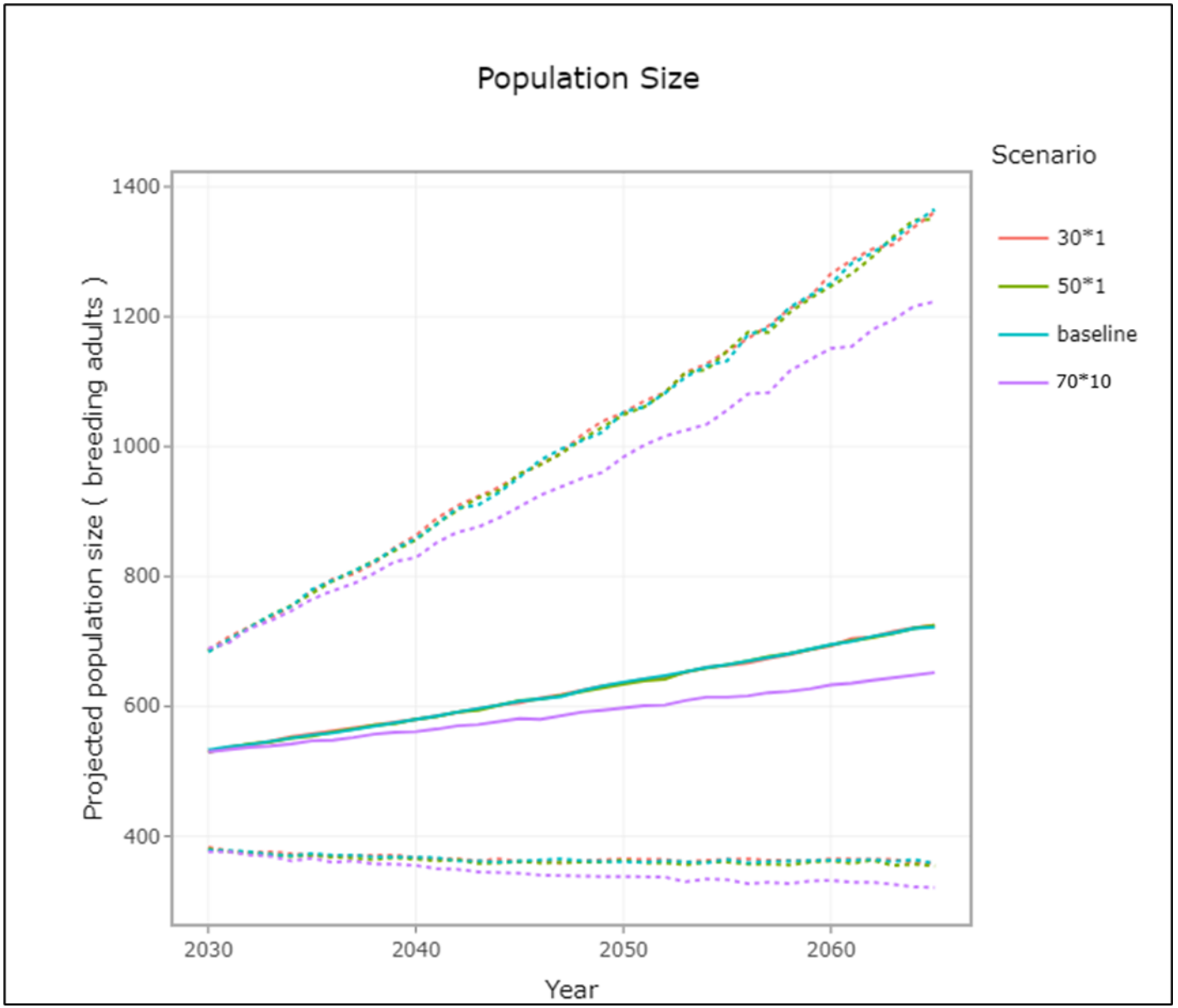

Figure 1.6: PVA output chart showing the razorbill population size under the baseline and three displacement scenarios from the Project alone. Dashed lines present the LCI and UCI of the population size

1.3.3.9 The PVA for razorbill at Pen y Gogarth/Great Orme SSSI revealed that the worst-case scenario of 70% displacement and 10% mortality would reduce the unimpacted baseline population growth rate by 0.003 (Table 1-14). When considering 50% displacement and 1% mortality, there would be no change to the growth rate. In all scenarios modelled (displacement rate 30%-70%, mortality rate 1%-10%), a positive population growth rate was sustained indicating that the population is predicted to be growing and would be 24.36% to 39.27% larger than the current size after 35 years (2065).

1.3.3.10 The population of razorbill from Pen y Gogarth/Great Orme's Head SSSI has been increasing in size consistently since 2000 (average annual growth rate of 1.036 between 2000 and 2023, JNCC, 2024). This annual average growth rate is higher than predicted by the PVA. Therefore, even if the worst-case displacement and mortality scenario were to occur (70% displacement and 10% mortality), the population should continue to increase. This empirical annual average growth rate is higher than predicted by the PVA. Given the PVA predicts a continuation of the increasing population the impact can be considered to be of negligible to low magnitude.

1.3.3.11 Following the EIA methodology (set out in section 5.4 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)), razorbill is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is, therefore, considered to be medium. Overall, as the sensitivity of razorbill is medium and the magnitude of impact is considered negligible to low, this could lead to a potential minor significant impact to razorbill from Pen y Gogarth/Great Orme's Head SSSI from the project alone. Therefore, as the predicted impact is of minor significant impact, this is considered non-significant.

Cumulative assessment

1.3.3.12 As set out in Table 1-1 NRW specifically requested a cumulative assessment of the potential impact to razorbill from the Pen y Gogarth/Great Orme's Head SSSI.

1.3.3.13 Table 1-15 provides project by project un-apportioned, and apportioned impact on razorbill from Pen y Gogarth/Great Orme's Head SSSI. The projects included within this assessment are the same as those presented in Section 5.9 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03). As the predicted cumulative impact on razorbill from Pen y Gogarth/Great Orme's Head SSSI increased baseline mortality of >1%, a PVA was undertaken. The summary output presented in Table 1-16 and visual presentation within Figure 1.7.

Table 1-15: Apportioned predicted impact on adult razorbill from the Pen y Gogarth/Great Orme's Head SSSI as a result of the Mona Offshore Wind Project acting cumulatively.

a – the apportioning value during the breeding season has used that of Morecame Offshore Wind Generation Assets, specifically 0.1211.

b – the apportioning value during the breeding season was taken from project specific documentation

c - the apportioning value during the breeding season has used that of Awel y Môr Offshore Wind Farm, specifically 0.399.

d – the plans/projects included within this cumulative assessment cover a large spatial area and therefore it is considering necessary to apply a correction factor to account for the number of adult birds within the whole area. All projects have used the proportion of adults/immatures within the Appendix tables of from Furness (2015) for age-class apportioning which is 57.1% of birds are adults during the breeding season, 52.22% of birds are adults during migration periods (pre-breeding and post-breeding) and 52.48% of birds are adults in the non-breeding season.

Plan or project	Abundance estimate				Apportioning value				Apportioned adult moralities from displacement when considering 50% displacement and 1% mortality (30-70% displacement and 1-10% mortality)[d]				
	Pre-breeding	Breeding	Post-breeding	Non-breeding	Pre-breeding	Breeding	Post-breeding	Non-breeding	Annual	Pre-breeding	Breeding	Post-breeding	Non-breeding
Awel y Môr Offshore Wind Farm	336	140	66	150	0.0009	0.399[b]	0.0009	0.0007	0.16 (0.10 to 2.25)	0.00 (0.00 to 0.01)	0.16 (0.10 to 2.23)	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.00)
Burbo Bank Extension	-	64	-	29	0.0009	0.1211[a]	0.0009	0.0007	0.02 (0.01 to 0.31)	0.00 (0.00 to 0.00)	0.02 (0.01 to 0.31)	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.00)
Erebus Floating Wind Demo	896	194	1,708	1,069	0.0009	No connectivity	0.0009	0.0007	0.01 (0.00 to 0.11)	0.00 (0.00 to 0.03)	No connectivity	0.00 (0.00 to 0.06)	0.00 (0.00 to 0.03)
Mona Offshore Wind Project	1,924	83	91	421	0.0009	0.211[b]	0.0009	0.0007	0.06 (0.03 to 0.78)	0.00 (0.00 to 0.07)	0.05 (0.03 to 0.70)	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.01)
Morecambe Offshore Windfarm Generation Assets	389	222	674	596	0.0009	0.1211[b]	0.0009	0.0007	0.08 (0.05 to 1.13)	0.00 (0.00 to 0.01)	0.08 (0.05 to 1.08)	0.00 (0.00 to 0.02)	0.00 (0.00 to 0.02)
Morgan Offshore Wind Project Generation Assets	166	120	103	233	0.0009	0.04[b]	0.0009	0.0007	0.01 (0.01 to 0.21)	0.00 (0.00 to 0.01)	0.01 (0.01 to 0.19)	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.01)
TwinHub (Wave Hub Floating Wind Farm)	-	12	-	53	0.0009	No connectivity	0.0009	0.0007	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.00)	No connectivity	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.00)
Walney (3 & 4) Extension Offshore Wind Farm	-	76	874	3,066	0.0009	0.1211[a]	0.0009	0.0007	0.03 (0.02 to 0.48)	0.00 (0.00 to 0.00)	0.03 (0.02 to 0.37)	0.00 (0.00 to 0.03)	0.01 (0.00 to 0.08)
West of Duddon Sands Offshore Wind Farm	-	-	-	202	0.0009	0.1211[a]	0.0009	0.0007	0.00 (0.00 to 0.01)	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.01)
West of Orkney Windfarm	97	70	144	15	0.0009	No connectivity	0.0009	0.0007	0.00 (0.00 to 0.01)	0.00 (0.00 to 0.00)	No connectivity	0.00 (0.00 to 0.01)	0.00 (0.00 to 0.00)
White Cross Offshore Windfarm	345	40	40	361	0.0009	No connectivity	0.0009	0.0007	0.00 (0.00 to 0.02)	0.00 (0.00 to 0.01)	No connectivity	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.01)
Gap-fill projects													
Burbo Bank	10	3	6	9	0.0009	0.1211[a]	0.0009	10	0.00 (0.00 to 0.02)	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.01)	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.00)
Gwynt y Môr Offshore Wind Farm	39	12	22	32	0.0009	0.399[c]	0.0009	39	0.01 (0.01 to 0.19)	0.00 (0.00 to 0.00)	0.01 (0.01 to 0.19)	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.00)
Ormonde Offshore Wind Farm	10	174	6	8	0.0009	0.1211[a]	0.0009	10	0.06 (0.04 to 0.84)	0.00 (0.00 to 0.00)	0.06 (0.04 to 0.84)	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.00)
Robin Rigg	15	63	11	14	0.0009	No connectivity	0.0009	15	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.00)	No connectivity	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.00)
Rhyl Flats Offshore Wind Farm	12	4	7	10	0.0009	0.399[c]	0.0009	12	0.00 (0.00 to 0.06)	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.06)	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.00)
Walney 1 and 2	40	12	25	34	0.0009	0.1211[a]	0.0009	40	0.00 (0.00 to 0.06)	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.06)	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.00)
Combined impact									**0.46 (0.27 to 6.48)**	**0.01 (0.01 to 0.14)**	**0.43 (0.26 to 6.05)**	**0.01 (0.00 to 0.12)**	**0.01 (0.00 to 0.16)**
Increase in baseline mortality									**0.89% (0.52% to 12.46%)**	**0.02% (0.01% to 0.27%)**	**0.83% (0.50% to 11.63%)**	**0.02% (0.00% to 0.24%)**	**0.02% (0.01% to 0.31%)**

Table 1-16: PVA outputs for the annual cumulative impact on razorbill from Pen y Gogarth/Great Orme's Head SSSI

Year	Impact scenario	Median adult population size	Population change (%) since 2023	Median growth rate	2.5 percentile of growth rate	97.5 percentile of growth rate	Median counterfactual of growth rate	Median counterfactual of population size
2030	Baseline	533	12.80%	1.022	0.833	1.134	-	-
2030	30*1 (0.27 birds)	530	12.30%	1.023	0.833	1.132	1.000	1.000
2030	50*1 (0.46 birds)	531	12.50%	1.020	0.831	1.131	0.999	0.999
2030	70*10 (6.48 birds)	523	10.89%	1.008	0.819	1.118	0.986	0.985
2065	Baseline	722	51.01%	1.009	0.991	1.026	-	-
2065	30*1 (0.27 birds)	713	49.19%	1.009	0.990	1.025	0.999	0.981
2065	50*1 (0.46 birds)	701	46.77%	1.008	0.990	1.025	0.999	0.965
2065	70*10 (6.48 birds)	424	-9.07%	0.994	0.975	1.011	0.985	0.584

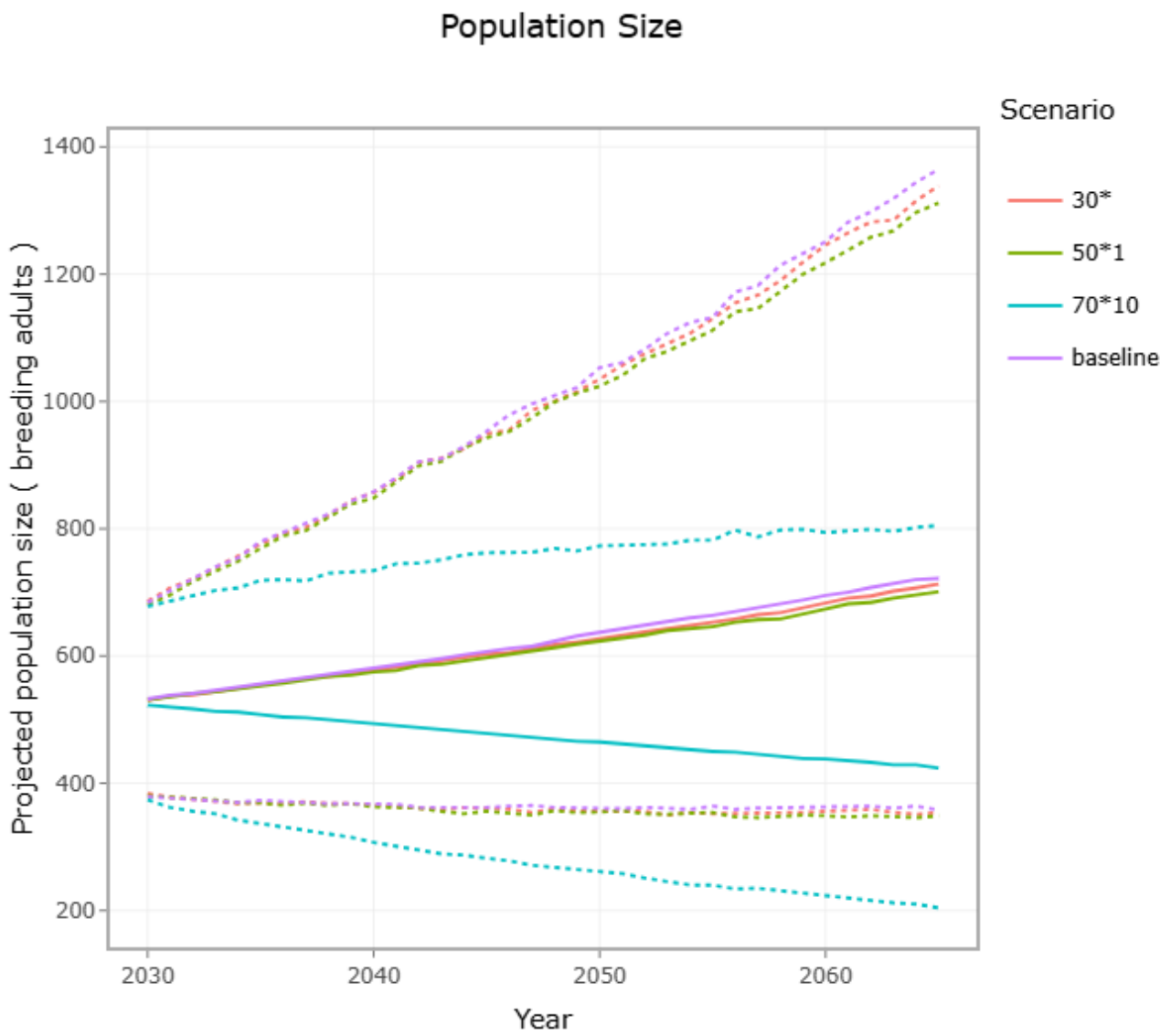

Figure 1.7: PVA output chart showing the razorbill population size under the baseline and three displacement scenarios from the cumulative impact. Dashed lines present the LCI and UCI of the population size.

1.3.3.14 The annual impact on razorbill from the Mona Offshore Wind Project alongside other projects is predicted to be 0.46 (0.27 to 6.48) adult birds (Table 1-15). When considering the latest population estimate of 370 individuals, which equates to 496 adult birds in 2023 and the baseline mortality rate of 0.105, the baseline mortality could be 52 birds. The additional impact of up to 0.46 (0.27 to 6.48) adult birds annually, could increase the baseline mortality by 0.89% (0.52% to 12.46%).

1.3.3.15 The cumulative PVA for razorbill at Pen y Gogarth/Great Orme SSSI revealed that the most extreme scenario of 70% displacement and 10% mortality would reduce the unimpacted baseline population growth rate by 0.014 (Table 1-16). The more likely scenario of 50% displacement and 1% mortality would result in a growth rate reduction of 0.001. In two of the three scenarios modelled (displacement rate 30% to 50% and mortality rate 1%), a positive population growth rate was sustained, indicating that the population is predicted to be growing and will be 46.8% to 49.1% larger than the current size after 35 years. When considering the worst-case scenario, a negative growth rate is predicted after 35 years (median growth of 0.994).

1.3.3.16 The population of razorbill from Pen y Gogarth/Great Orme's Head SSSI has been increasing in size consistently since 2000 (average annual growth rate of 1.036 between 2000 and 2023, JNCC, 2024). This annual average growth rate is higher than predicted by the PVA, and therefore, even if the worst-case estimate of displacement and mortality scenario were to occur (70% displacement and 10% mortality), the population should continue to increase. This empirical annual average growth rate is higher than predicted by the PVA. Given that the PVA predicts a continuation of the increasing population, the impact can be considered to be of negligible to low magnitude.

1.3.3.17 Following the EIA methodology (set out in section 5.4 of Volume 2, Chapter 5: Offshore Ornithology (F2.5 F03)), razorbill is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is, therefore, considered to be medium. Overall, as the sensitivity of razorbill is medium and the magnitude of the cumulative impact is considered negligible to low, this could lead to a potential minor significant impact to razorbill from Pen y Gogarth/Great Orme's Head SSSI from the project alone. Therefore, as the predicted impact is of minor significant impact, this is considered non-significant.

1.4 Conclusions

1.4.1.1 Following NRW's request within their Relevant Representation (RR-011.7), an annual assessment of black-legged kittiwake, common guillemot, and razorbill from the Pen y Gogarth/Great Orme's Head SSSI has been provided in this note submitted at Deadline 4.

1.4.1.2 The annual impact assessment of the Mona Offshore Wind Project alone and cumulatively indicate that razorbill and common guillemot from Pen y Gogarth/Great Orme's Head SSSI are predicted to continue to grow in line with the empirical evidence from colony monitoring counts.

1.4.1.3 The annual impact assessment of the Mona Offshore Wind Project alone and cumulatively indicate that black-legged kittiwake population from Pen y Gogarth/Great Orme's Head SSSI is predicted to decline in line with the empirical evidence from colony monitoring counts. The additional impact of up to 9.68 birds changes the annual median growth rate by up to 1.0%, which is considered a minor non-significant impact.

1.5 References

DESNZ, 2023. Awel Y Môr Habitats Regulations Assessment

Natural England and NRW (2024). NE and NRW interim advice regarding demographic rates, EIA scale mortality rates and reference populations for use in offshore wind impact assessments

RWE, 2022. Awel Y Môr Offshore Wind Farm. Marine Ornithology Great Orme Assessment (Clean). Document reference: 3a.19

RWE, 2023. Awel Y Môr Offshore Wind Farm. Report 5.2: Report to Inform Appropriate Assessment. Deadline 8. Document reference: 8.40

Appendix A: PVA Inputs

A.1 Black-legged kittiwake – Mona Offshore Wind Project alone

A.1.1 Set up

The log file was created on: 2024-10-10 10:09:12 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"
```

A.1.2 Basic information

This run had reference name “Kittiwake_GOH_Alone”.
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.

A.1.3 Baseline demographic rates

Species chosen to set initial values: Black-Legged Kittiwake.
Region type to use for breeding success data: Global.
Available colony-specific survival rate: National. Sector to use within breeding success region: Global.
Age at first breeding: 4.
Is there an upper constraint on productivity in the model?: Yes, constrained to 2 per pair.
Number of subpopulations: 1.
Are demographic rates applied separately to each subpopulation?: No.
Units for initial population size: breeding.adults
Are baseline demographic rates specified separately for immatures?: Yes.

A.1.3.1 Population 1

Initial population values: Initial population 1128 in 2023

Productivity rate per pair: mean: 0.619, sd: 0.121

Adult survival rate: mean: 0.854 , sd: 0.077

Immatures survival rates:

Age class 0 to 1 - mean: 0.79 , sd: 0.001 , DD: NA

Age class 1 to 2 - mean: 0.854 , sd: 0.077 , DD: NA

Age class 2 to 3 - mean: 0.854 , sd: 0.077, DD: NA

Age class 3 to 4 - mean: 0.854 , sd: 0.077, DD: NA

Age class 4 to 5 - mean: 0.854 , sd: 0.077, DD: NA

A.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

A.1.5 Impact on Demographic Rates

A.1.5.1 Scenario A - Name: Collisions_Alone_Mean

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.00210093, se: NA

A.1.5.2 Scenario B - Name: Collisions_Alone_UCI

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.00428191, se: NA

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

A.2 Black-legged kittiwake – Cumulative Impact

A.2.1 Set up

The log file was created on: 2024-10-08 10:08:08 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"
```

A.2.2 Basic information

This run had reference name “Kittiwake_GOH_Cumulative”.
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.

A.2.3 Baseline demographic rates

Species chosen to set initial values: Black-Legged Kittiwake.
Region type to use for breeding success data: Global.
Available colony-specific survival rate: National. Sector to use within breeding success region: Global.
Age at first breeding: 4.
Is there an upper constraint on productivity in the model?: Yes, constrained to 2 per pair.
Number of subpopulations: 1.
Are demographic rates applied separately to each subpopulation?: No.
Units for initial population size: breeding.adults
Are baseline demographic rates specified separately for immatures?: Yes.

A.2.3.1 Population 1

Initial population values: Initial population 1128 in 2023

Productivity rate per pair: mean: 0.619, sd: 0.121

Adult survival rate: mean: 0.854 , sd: 0.077

Immatures survival rates:

Age class 0 to 1 - mean: 0.79 , sd: 0.001 , DD: NA

Age class 1 to 2 - mean: 0.854 , sd: 0.077 , DD: NA

Age class 2 to 3 - mean: 0.854 , sd: 0.077, DD: NA

Age class 3 to 4 - mean: 0.854 , sd: 0.077, DD: NA

Age class 4 to 5 - mean: 0.854 , sd: 0.077, DD: NA

A.2.4 Impacts

Number of impact scenarios: 1.

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

A.2.5 Impact on Demographic Rates

A.2.5.1 Scenario A - Name: Cumulative Collisions

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.008582562, se: NA

A.2.6 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
Quasi-extinction threshold to use in calculating impact metrics: NA

A.3 Common guillemot – Mona Offshore Wind Project alone

A.3.1 Set up

The log file was created on: 2024-10-22 13:39:49 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"
```

A.3.2 Basic information

This run had reference name “Guillemot_GOH_Alone”.
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.

A.3.3 Baseline demographic rates

Species chosen to set initial values: Guillemot.
Region type to use for breeding success data: Global.
Available colony-specific survival rate: National. Sector to use within breeding success region: Global.
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: breeding.adults
Are baseline demographic rates specified separately for immatures?: Yes.

A.3.3.1 Population 1

Initial population values: Initial population 3578 in 2023

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

Adult survival rate: mean: 0.94 , 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: 0.94 , sd: 0.025 , DD: NA

Age class 5 to 6 - mean: 0.94 , sd: 0.025 , DD: NA

A.3.4 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

A.3.5 Impact on Demographic Rates

A.3.5.1 Scenario A - Name: 30*1

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.00056174, se: NA

A.3.5.2 Scenario B - Name: 50*1

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.00093623, se: NA

A.3.5.3 Scenario C - Name: 70*10

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.01310717, se: NA

A.3.6 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
Quasi-extinction threshold to use in calculating impact metrics: NA

A.4 Common guillemot – Cumulative impact

A.4.1 Set up

The log file was created on: 2024-10-22 14:39:49 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"
```

A.4.2 Basic information

This run had reference name “Guillemot_GOH_Cumulative”.
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.

A.4.3 Baseline demographic rates

Species chosen to set initial values: Guillemot.
Region type to use for breeding success data: Global.
Available colony-specific survival rate: National. Sector to use within breeding success region: Global.
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: breeding.adults
Are baseline demographic rates specified separately for immatures?: Yes.

A.4.3.1 Population 1

Initial population values: Initial population 3578 in 2023

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

Adult survival rate: mean: 0.94 , 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: 0.94 , sd: 0.025 , DD: NA

Age class 5 to 6 - mean: 0.94 , sd: 0.025 , DD: NA

A.4.4 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

A.4.5 Impact on Demographic Rates

A.4.5.1 Scenario A - Name: 30*1

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.000872108, se: NA

A.4.5.2 Scenario B - Name: 50*1

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.001453513, se: NA

A.4.5.3 Scenario C - Name: 70*10

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.020349183, se: NA

A.4.6 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
Quasi-extinction threshold to use in calculating impact metrics: NA

A.5 Razorbill – Mona Offshore Wind Project alone

A.5.1 Set up

The log file was created on: 2024-10-11 13:33:31 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"
```

A.5.2 Basic information

This run had reference name “Razorbill_GOH_Alone”.
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.

A.5.3 Baseline demographic rates

Species chosen to set initial values: Razorbill.
Region type to use for breeding success data: Global.
Available colony-specific survival rate: National. Sector to use within breeding success region: Global.
Age at first breeding: 5.
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: breeding.adults
Are baseline demographic rates specified separately for immatures?: Yes.

A.5.3.1 Population 1

Initial population values: Initial population 496 in 2023

Productivity rate per pair: mean: 0.532 , sd: 0.084

Adult survival rate: mean: 0.895 , sd: 0.067

Immatures survival rates:

Age class 0 to 1 - mean: 0.794 , sd: 0.001 , DD: NA

Age class 1 to 2 - mean: 0.794 , sd: 0.001 , DD: NA

Age class 2 to 3 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 4 to 5 - mean: 0.895 , sd: 0.067 , DD: NA

A.5.4 Impacts

Number of impact scenarios: 4.

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

A.5.5 Impact on Demographic Rates

A.5.5.1 Scenario A - Name: 30*1

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.0001187 , se: NA

A.5.5.2 Scenario B - Name: 50*1

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.0001978 , se: NA

A.5.5.3 Scenario C - Name: 70*10

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.0027691 , se: NA

A.5.6 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
Quasi-extinction threshold to use in calculating impact metrics: NA

A.6 Razorbill – Cumulative impact

A.6.1 Set up

The log file was created on: 2024-10-08 07:55:53 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"
```

A.6.2 Basic information

This run had reference name “Razorbill_GOH_Cumulative”.
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.

A.6.3 Baseline demographic rates

Species chosen to set initial values: Razorbill.
Region type to use for breeding success data: Global.
Available colony-specific survival rate: National. Sector to use within breeding success region: Global.
Age at first breeding: 5.
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: breeding.adults
Are baseline demographic rates specified separately for immatures?: Yes.

A.6.3.1 Population 1

Initial population values: Initial population 496 in 2023

Productivity rate per pair: mean: 0.532 , sd: 0.084

Adult survival rate: mean: 0.895 , sd: 0.067

Immatures survival rates:

Age class 0 to 1 - mean: 0.794 , sd: 0.001 , DD: NA

Age class 1 to 2 - mean: 0.794 , sd: 0.001 , DD: NA

Age class 2 to 3 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 4 to 5 - mean: 0.895 , sd: 0.067 , DD: NA

A.6.4 Impacts

Number of impact scenarios: 4.

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

A.6.5 Impact on Demographic Rates

A.6.5.1 Scenario A - Name: 30*1

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.000546989, se: NA

A.6.5.2 Scenario B - Name: 50*1

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.000932787, se: NA

A.6.5.3 Scenario C - Name: 70*10

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.013059012, se: NA

A.6.6 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
Quasi-extinction threshold to use in calculating impact metrics: NA