Morecambe Offshore Windfarm: Generation Assets

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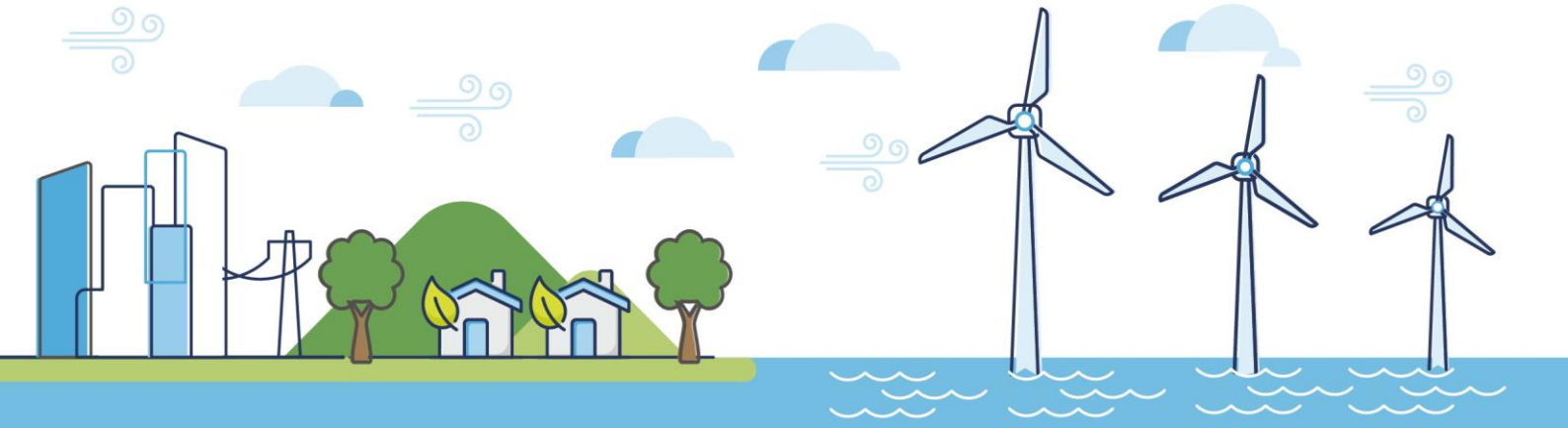

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Glossary of Acronyms

AON	Apparently Occupied Nests
AR	Avoidance Rate
BDMPS	Biologically Defined Minimum Population Scales
CEA	Cumulative Effect Assessment
CPGR	Counterfactual of Population Growth Rate
CPS	Counterfactual of Population Size
CRM	Collision Risk Model
DCO	Development Consent Order
EIA	Environmental Impact Assessment
ES	Environmental Statement
ExA	Examining Authority
HAT	Highest Astronomical Tide
LBBG	Lesser black-backed gull
LCL	Lower Confidence Limit
MERP	Marine Ecosystems Research Programme
OWF	Offshore windfarm
PVA	Population Viability Analysis
RIAA	Report to Inform the Appropriate Assessment
RR	Relevant Representation
sCRM	Stochastic Collision Risk Model
SD	Standard deviation
SNCB	Statutory Nature Conservation Body
SPA	Special Protection Area
TCE	The Crown Estate
UCL	Upper Confidence Limit

Glossary of Unit Terms

km	Kilometre
km^2	square kilometre
m	metre

Glossary of Terminology

Applicant	Morecambe Offshore Windfarm Ltd
Biologically defined minimum population scale (BDMPS)	The estimated population size of a species within a defined biogeographic area during a biologically relevant season, as defined by Furness (2015). For many seabird species present in United Kingdom (UK) waters there are two defined biogeographic areas; UK Western waters and UK North Sea and Channel. However, some species have different defined BDMPS areas, dependent on the distribution and movements of the species population through the year. Furness (2015) defines the BDMPS for non-breeding seasons; the breeding season BDMPS is defined as the breeding population within foraging range from the project, plus non-breeders and immatures.
Generation Assets (the Project)	Generation Assets associated with the Morecambe Offshore Windfarm. This is infrastructure in connection with electricity production, namely the fixed foundation wind turbine generators (WTGs), inter-array cables, offshore substation platform(s) (OSP(s)) and possible platform link cables to connect OSP(s).
Inter-array cables	Cables which link the WTGs to each other and the OSP(s).
Offshore substation platform(s) (OSP(s))	A fixed structure located within the windfarm site, containing electrical equipment to aggregate the power from the WTGs and convert it into a more suitable form for export to shore.
Platform link cable	An electrical cable which links one or more offshore substation platform.
Stochastic Collision Risk Model (sCRM)	A programme used to assess the collision risk (estimated mortality) of seabirds to operational turbines of offshore windfarms. A sCRM is used to account for uncertainty around input variables.
Wind turbine generator (WTG)	A fixed structure located within the windfarm site that converts the kinetic energy of wind into electrical energy.
Windfarm site	The area within which the WTGs, inter-array cables, OSP(s) and platform link cables would be present.

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1 Introduction

1. This document presents an update to the Report to Inform the Appropriate Assessment (RIAA) (APP-027) submitted as part of the assessment of the Morecambe Offshore Windfarm Generation Assets on offshore ornithology receptors.

2. The Applicant's response to Relevant Representations (RRs) was provided at Procedural Deadline A (PD1-011). The review and information provided in this note has been undertaken to provide information on outstanding issues from the Natural England Relevant Representations (RR-061) and at the request of the Examining Authority (ExA) in its Rule 9 Letter (PD-006) and Rule 8 Letter (PD-010). A summary of the relevant comments received and the Applicant's response, including where specific items are addressed within this document, are provided in **Table 1.1**.

Table 1.1 Summary of relevant representations addressed in this document

Natural England Comment summary	Natural England Reference (RR-061)	Applicant Reference (PD1-011)	Applicant response	Document location
In-combination assessment methodology. NE has requested that historic projects with 'zero' values are 'gap-filled' using a common approach with the Mona and Morgan projects. NE requested that this was specifically addressed for lesser black-backed gull for Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA, which are the only sites where Natural England disagreed with the Applicant's in-combination conclusions and data was not presented for one historic project (Robin Rigg).	B1 B3 (Item 1 of the Rule 9 letter)	RR-061-63 RR-061-65	The in-combination assessment for lesser black-backed gull (Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA) has been updated with data for Robin Rigg offshore windfarm, and also to align with data presented by the Mona Offshore Wind and Morgan Generation Offshore Wind projects.	**Section 3**
NE requested that 2023 colony counts for lesser black-backed gull are used for Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA assessments, noting that 2022 counts were used for the RIAA (APP-027).	B26 (Item 2 of the Rule 9 letter)	RR-061-88	2023 colony counts have been updated as the reference population for updated project alone and in-combination assessments for lesser black-backed gull (Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA).	**Sections 2 (2.1.2) and 3**
NE requested that for 'gap filled' historic projects (Ormonde, Walney 1&2, Walney Extension, West of Duddon Sands) for lesser black-backed gull (Morecambe Bay and Duddon Estuary SPA) a proxy apportioning value based on Walney 1&2 is used, rather than the	B27 (Item 2 of the Rule 9 letter)	RR-061-89	The apportioning of mortality to the Ormonde, Walney 1&2, Walney Extension, West of Duddon Sands projects for the in-combination assessment for Morecambe Bay and Duddon Estuary SPA has been updated, using a proxy value calculated by the Applicant for the Walney 1&2 project.	**Sections 3.1.1.2 and 3.1.2.1**

Natural England Comment summary	Natural England Reference (RR-061)	Applicant Reference (PD1-011)	Applicant response	Document location
rate for the Morecambe Project used in the RIAA (APP-027).				
NE requested that the lesser black-backed gull colonies used for the apportioning estimates for Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA are re-appraised to exclude more distant colonies unlikely to have connectivity to the Project.	B29 (Item 2 of the Rule 9 letter)	RR-061-91	The Project apportioning estimates have been updated to exclude more distant colonies, as set out by Natural England in its response (PD1-017) to the ExA's Rule 9 letter (PD-006).	**Sections 2.1.1, 2.2.2 and 2.2.5**
NE requested that the Project consider additional increase in air gap (beyond 25m) to further increase mitigation for sensitive species.	B30	RR-061-92	The Applicant has presented a review of the effects of increasing air gap on the assessment conclusions. This has confirmed that increasing air gap from 25m to 28m or 30m above HAT would make no measurable difference to the in-combination effects on lesser black-backed gull from Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA, and therefore further increase in air gap would not be warranted. As noted in RR-061-92 in the Applicant's Response to Relevant Representations (PD1-010), there are also other constraints that limit the ability to increase air gap further.	**Section 4**
NE requested that the assessment of effects on little gull from Liverpool Bay SPA are revisited to account for their advice regarding the cumulative effects on this species (B11/RR-061-74).	B35	RR-061-97	The Applicant has presented an update to the assessment of project alone and in-combination effects on little gulls from Liverpool Bay SPA. This confirms that there would be no changes to the assessment	**Section 3.2**

Natural England Comment summary	Natural England Reference (RR-061)	Applicant Reference (PD1-011)	Applicant response	Document location
			conclusions for this species, i.e. that there would be no adverse effect on integrity for this feature. The Applicant has also provided Natural England with the relevant input and output files for the collision risk model for this species.	
Additional comment from ExA in its Rule 8 Letter (PD-010) Annex B Item 4 The ExA has requested that collision risk modelling outputs are updated to reflect recent guidance issued by the Statutory Nature Conservation Bodies (August 2024).	n/a	n/a	Natural England provided the Applicant with an advanced draft of this guidance, which was used in the relevant assessment and submission documents. The Applicant can confirm that, as the draft guidance was used in the submitted assessment in the RIAA (APP-027), there are no changes within the final SNCB guidance that would affect the assessment outcomes. No other changes to parameters used in the assessment have been identified. Note that for the in-combination assessment, collision risk values from other projects have been adjusted to the recommended avoidance rates, as set out in the SNCB guidance (August 2024), to ensure consistency across all projects that may contribute to in-combination mortality.	n/a

2 Lesser black-backed gull assessment update (Project alone)

2.1 Approach

3. In accordance with Natural England's RRs (APP-061), the project alone HRA assessment for breeding lesser black-backed gull for Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA (as presented in Sections 8.5.2.2 and 8.6.3.2 of the RIAA (APP-027)) has been updated to reflect the following changes requested by Natural England:

   - Apportioning of potential lesser black-backed gull mortality to the two SPAs has been updated to remove more distant breeding colonies from the apportioning calculation.
   - Updated 2023 colony counts for the two SPAs have been used as the reference population for the assessment of Project-alone effect.

4. Further information is provided below.

2.1.1 Apportioning update

5. The NatureScot apportioning tool (NatureScot, 2018) has been used to estimate the proportion of lesser black-backed gulls present at the windfarm site during the breeding season from each of the SPAs. For the RIAA submission (APP-027), the Applicant included all lesser black-backed gull colonies within mean maximum foraging range plus one standard deviation (+1SD) (as defined by Woodward *et al*., 2019) in the apportioning calculation. In its RRs (RR-061), Natural England stated *'Natural England advise that in the absence of evidence, expert judgement is applied to critically appraise the likelihood of colonies contributing to the population observed within the project study area. Colonies considered unlikely to display connectivity, despite technically being within potential foraging range, should be disregarded during apportioning'*.

6. In its Rule 9 letter (PD-006), the ExA requested clarification from Natural England, to confirm which colonies should be excluded from the apportioning calculation. Natural England confirmed in its response (PD1-017) that inland (i.e. non-coastal) colonies and those beyond the mean maximum foraging range (127km; Woodward *et al.*, 2019 - as opposed to mean maximum +1SD) should be excluded. The Applicant presented apportioning estimates with inland colonies excluded in its original RIAA submission (APP-027), and therefore the updated apportioning estimates have excluded any remaining coastal colonies that are beyond 127km from the Project site. The update has also taken into account the most recent colony counts for this species (refer to **Section 2.1.2** below).

7. Details of the sites included in the apportioning calculation are included in **Appendix 1**. It is noted that in the RIAA (APP-027) the Applicant presented an assessment based on two apportioning scenarios, i.e. including and excluding inland breeding colonies. As Natural England has confirmed in its RRs (RR-061) that it considers that inland colonies should be excluded, only this scenario has been presented in the update. For the non-breeding periods the apportioning estimates are unchanged. The updated estimate has been used to recalculate the proportion of birds from the two SPAs potentially present at the Application Site, and hence the predicted collision mortality.

2.1.2 Updated colony counts

8. In its RRs (RR-061) Natural England advised that 2023 lesser black-backed colony counts for Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA should be used as the reference population for the assessment, as opposed to the 2021/22 counts used by the Applicant in the RIAA (APP-027). The updated counts are as follows (values previously used in the RIAA in brackets):

- Morecambe Bay and Duddon Estuary SPA: 862 apparently occupied nests (AON), equivalent to 1,724 breeding adults (530 AON/1,060 adults)
- Ribble and Alt Estuaries SPA: 2,319 AON, equivalent to 4,638 breeding adults (4,489 AON/8,978 adults)

2.2 Project-alone assessment update

2.2.1 Morecambe Bay and Duddon Estuary SPA

2.2.2 Apportioning of effects

9. The updated apportioning (refer to **Appendix 1**) estimates that 19.21% of adult lesser black-backed gulls present at the windfarm site should be apportioned to the SPA. This compares to 9.50% in the RIAA (APP-027). Of these, 71.2% are assumed to be adult birds (refer to paragraph 548 of the RIAA (APP-027)). As set out in the RIAA, this is likely to be an overestimate (i.e. precautionary), as not all birds showing adult plumage characteristics are likely to be breeding (i.e. may be sub-adult or sabbatical birds). During the non-breeding periods, apportioning estimates are unchanged from the RIAA (APP-027), comprising:

- 3.05% during the autumn migration period
- 4.85% during the winter period
- 3.05% during the spring migration period

10. Based on an adult breeding population of 1,724 breeding adults, and an adult baseline mortality rate of 0.115 (Horswill and Robinson, 2015), 198 breeding adults from the SPA population would be expected to die each year.

2.2.3 Operation and maintenance phase collision risk

11. The updated estimate of collision risk for breeding adult lesser black-backed gulls belonging to the Morecambe Bay and Duddon Estuary SPA population is presented in **Table 2.1**. Collision estimates, calculated using Option 2 of the sCRM (McGregor et al., 2018), are presented by biological season. A summary of the annual outputs and the corresponding increase in the annual baseline mortality rate is also presented.

12. The annual total of breeding adult lesser black backed gulls from the Morecambe Bay and Duddon Estuary SPA at risk of collision due to the Project is 0.33 birds. This would increase the existing background mortality of the SPA breeding population by 0.16%. This compares to a mortality of 0.19 birds and increase in background mortality of 0.15% previously presented in the RIAA (APP-027).

13. Increases in the existing mortality rate of less than 1% are likely to be undetectable against natural variation. This means that no detectable changes in mortality rates would occur in this population from the mean monthly collision estimates for the Project.

14. It is concluded that predicted lesser black-backed gull mortality due to collision at the Project windfarm site would not adversely affect the integrity of the Morecambe Bay and Duddon Estuary SPA and Ramsar. The assessment is therefore unchanged from that presented in the RIAA (APP-027).

Table 2.1 Predicted seasonal and annual collision mortality (Stochastic model Option 2, avoidance rate 0.9940 (±0.0004)) for breeding adult lesser black-backed gulls at the windfarm site, apportioned to Morecambe Bay and Duddon Estuary SPA, with corresponding increases to baseline mortality of the population

	Breeding Season	Autumn Migration	Winter	Spring Migration	Annual
Period	Apr-Aug	Sep-Oct	Nov-Feb	Mar	Jan-Dec
Total collisions[1] (mean and 95% CIs)	1.44 (0.00-4.53)	1.25 (0.00-5.63)	0.15 (0.00-0.80)	0.15 (0.00-0.94)	**2.98 (0.00-11.90)**
% apportioned to the SPA	19.21%	3.05%	4.85%	3.05%	-
Total SPA collisions (mean and 95% CIs)	0.28 (0.00-0.87)	0.04 (0.00-0.17)	0.01 (0.00-0.04)	0.00 (0.00-0.03)	**0.33 (0.00-1.11)**
Mortality increase[2] (mean and 95% CIs)	0.14% (0.00-0.44%)	0.02% (0.00-0.09%)	0.00% (0.00-0.02%)	0.00% (0.00-0.01%)	**0.16% (0.00-0.56%)**

[1] Breeding season collision values reduced to 71.9% of modelled value to reflect proportion of adult birds recorded during site surveys.
[2] Assuming predicted annual SPA mortality of 198 birds (1,724 x 0.115)

2.2.4 Ribble and Alt Estuaries SPA

2.2.5 Apportioning of effects

15. The updated apportioning (refer to **Appendix 1**) estimates that 42.34% of adult lesser black-backed gulls present at the windfarm site should be apportioned to the SPA. This compares to 60.94% in the RIAA (APP-027); the reduced proportion of birds reflects the smaller SPA breeding population used in the apportioning calculation. Of these, 71.2% are assumed to be adult birds (refer to paragraph 630 of the RIAA (APP-027)). As set out in the RIAA, this is likely to be an overestimate (i.e. precautionary), as not all birds showing adult plumage characteristics are likely to be breeding (i.e. may be sub-adult or sabbatical birds). During the non-breeding periods, apportioning estimates are unchanged from the RIAA (APP-027), comprising:

    - 5.06% during the autumn migration period
    - 8.03% during the winter period
    - 5.06% during the spring migration period

16. Based on an adult breeding population of 4,638 breeding adults, and an adult baseline mortality rate of 0.115 (Horswill and Robinson, 2015), 533 breeding adults from the SPA population would be expected to die each year.

2.2.6 Operation and maintenance phase collision risk

17. The updated estimate of collision risk for breeding adult lesser black-backed gulls belonging to the Ribble and Alt Estuaries SPA population is presented in **Table 2.2**. Collision estimates, calculated using Option 2 of the sCRM (McGregor *et al*., 2018), are presented by biological season. A summary of the annual outputs and the corresponding increase in the annual baseline mortality rate is also presented.

18. The annual total of breeding adult lesser black backed gulls from the Ribble and Alt Estuaries SPA at risk of collision due to the Project is 0.69. This would increase the existing background mortality of the SPA breeding population by 0.13%. This compares to a mortality of 0.96 birds and increase in background mortality of 0.09% previously presented in the RIAA (APP-027).

19. Increases in the existing mortality rate of less than 1% are likely to be undetectable against natural variation. This means that no detectable changes in mortality rates would occur in this population from the mean monthly collision estimates for the Project.

20. **It is concluded that predicted lesser black-backed gull mortality due to collision at the Project windfarm site would not adversely affect the integrity of the Ribble and Alt Estuaries SPA and Ramsar. The**

assessment is therefore unchanged from that presented in the RIAA (APP-027).

Table 2.2 Predicted seasonal and annual collision mortality (Stochastic model Option 2, avoidance rate 0.9940 (±0.0004)) for breeding adult lesser black-backed gulls at the windfarm site, apportioned to Ribble and Alt Estuaries SPA, with corresponding increases to baseline mortality of the population

	Breeding Season	Autumn Migration	Non-breeding/winter	Spring Migration	Annual
Period	Apr-Aug	Sep-Oct	Nov-Feb	Mar	Jan-Dec
Total collisions[1] (mean and 95% CIs)	1.44 (0.00-4.53)	1.25 (0.00-5.63)	0.15 (0.00-0.80)	0.15 (0.00-0.94)	**2.98 (0.00-11.90)**
% apportioned to the SPA	42.34%	5.06%	8.03%	5.06%	-
Total SPA collisions (mean and 95% CIs)	0.61 (0.00-1.92)	0.06 (0.00-0.28)	0.01 (0.00-0.06)	0.01 (0.00-0.05)	**0.69 (0.00-2.32)**
Mortality increase[2] (mean and 95% CIs)	0.11% (0.00-0.36%)	0.0% (0.00-0.05%)	0.00% (0.00-0.01%)	0.00% (0.00-0.01%)	**0.13% (0.00-0.43%)**

[1] Breeding season collision values reduced to 71.9% of modelled value to reflect proportion of adult birds recorded during site surveys.
[2] Assuming predicted annual SPA mortality of 533 birds (4,638 x 0.115)

3 In-combination assessment update

3.1 Lesser black-backed gull

3.1.1 Approach

21. As requested by Natural England in its RRs (APP-061), the in-combination assessment for lesser black backed gull (Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries) has been updated as follows:

    - Data for in-combination mortality has been updated to 'gap-fill' one historic project for which no data had previously been identified (Robin Rigg offshore windfarm), and values for other projects have been updated to reflect the 'gap fill' assessment updates for the Morgan Generation and Mona offshore windfarm projects (RPS, 2024a and 2024b, NIRAS, 2024)
    - The 'proxy' apportioning rate for some historic windfarms used in the in-combination assessment for Morecambe Bay and Duddon Estuary SPA (Ormonde, Walney 1&2, Walney 3&4 (Walney Extension) and West of Duddon Sands) has been reviewed and updated.
    - The in-combination totals have been updated to reflect the updated Project-alone contributions (as presented in **Section 2.2**).
    - Increase in background mortality and Population Viability Analysis (PVA) outputs have been updated to reflect the updated in-combination mortality estimates (as above) and updated colony counts for the two SPAs (refer to **Section 2.1.2**).

22. The Applicant reiterates its position, as set out in the RIAA (APP-027) that due to the very low predicted lesser black-backed gull collision mortality for the Project alone (equating to a small fraction of a bird for both SPAs), and for the reasons set in the RIAA (APP-027) (paragraphs 599 and 643), there would be no measurable contribution of the Project to in-combination effects. **Accordingly, no in-combination assessment is required for this feature. The conclusion of the Project-alone assessment is therefore unchanged, i.e. that predicted lesser black-backed gull mortality due to collision at the Project windfarm site would not adversely affect the integrity of the Morecambe Bay and Duddon Estuary SPA and Ramsar or the Ribble and Alt Estuaries SPA and Ramsar.** The in-combination updates are therefore presented without prejudice to this position, to provide context to the Project-alone assessment.

23. Further information on the approach is provided in the following sections.

3.1.1.1 Gap-filling approach

24. Unapportioned estimates of lesser black-backed gull mortality have been obtained from the cumulative effect assessment update for this species presented in the Offshore Ornithology Updates (EIA context) Technical Note (Ref 9.26) that has been issued alongside this note. Reference should be made to this document for the approach that was used to obtain this data. For each project, mortality was apportioned to the SPA using the same approach as for the RIAA (APP-027), noting that this approach has been updated for some projects (see **Section 3.1.1.2** below).

25. As set out in Paragraph 413 of the RIAA (APP-027), where published apportioned values were available from project assessment reports, these have been used in the in-combination assessment. For the majority of projects where no apportioning information was available, EIA values were apportioned using available rates from nearby projects (see also **Section 3.1.1.2** below). There is significant inconsistency between projects on the availability and presentation of seasonal values used for species in the assessment, and for that reason only annual values have been considered within the assessment conclusions. Where seasonal data were unavailable (or unclear), a weighted average apportioning rate was applied, using a suitable nearby proxy project. Weighting for each season was undertaken based on the proportion of months within the year for each season (as defined by Furness, 2015), and assuming that estimated total annual population estimates were evenly distributed across the year.

3.1.1.2 Proxy apportioning update

26. Natural England advised in its RRs (RR-061) that it did not consider it appropriate to use the Project apportioning values as a proxy for the Ormonde, Walney 1&2, Walney 3&4 and West of Duddon Sands projects. It advised that '*an appropriate value for apportioning birds from Walney 1 & 2 (as the central OWF in the cluster) to Morecambe Bay and Duddon Estuary SPA is calculated, and that this value is used as the proxy value for other wind farms in the cluster*'. The Applicant discussed this comment with Natural England during post-submission consultation meetings (12 September and 30 October 2024). The Applicant confirmed to Natural England that it would be disproportionate to provide bespoke breeding season apportioning for the Walney 1&2 project using the NatureScot tool, but that the Project apportioning rate for the breeding season would be adjusted proportionately to reflect the relative distance of the Walney 1&2 project from the SPA, when compared to the Project. It is noted that this update does not affect non-breeding seasons, as these are calculated separately based on data in Furness (2015).

3.1.1.3 Update to in-combination totals, background mortality and PVA

27. The total (annual) in-combination lesser black-backed gull mortality was calculated based on the parameters set out above. This total was used to estimate the increase in background mortality for each SPA population, based on 2023 colony counts (refer to **Section 2.1.2**), and an adult mortality rate of 0.115 (Horswill and Robinson, 2015). Finally, PVA was undertaken for the 35-year operational period of the Project using the Seabird PVA Tool developed by Natural England (Searle et al. 2019) via the 'Shiny App' interface. Refer to the Offshore Ornithology Updates (EIA context) Technical Note (Ref 9.26) for further information on the application of the PVA tool, and **Appendix 2** for the input parameters used in the PVA.

3.1.2 In-combination assessment update: Morecambe Bay and Duddon Estuary SPA

3.1.2.1 Proxy apportioning update

28. The proxy apportioning rate for lesser black-backed gull used for the Ormonde, Walney 1&2, Walney 3&4 and West of Duddon Sands projects has been updated, based on the Project apportioning rate but adjusted for the relative distance between the central point of the Project and the SPA breeding colony, and the same measurement between the central point of Walney 1&2 and the SPA breeding colony. Following the approach used in the NatureScot apportioning tool, this distance has been weighted to account for the reduced density of birds as they radiate from the colony; calculated as 1/distance^2. These distances were estimated using QGIS; and the relative proportions of the weighted distance used to adjust the Project breeding season apportioning. The results of this calculation, also including the contributions of the non-breeding seasons to generate a weighted average annual apportioning value, are presented in **Table 3.1**. It is noted that the distance weighting is not applied to the non-breeding seasons, as these values assume that the SPA population is distributed throughout the BDMPS region at this time, and are therefore the same for all projects within the BDMPS, irrespective of distance from the SPA.

Table 3.1 Apportioning calculation for Walney 1&2 project for lesser black-backed gull from Morecambe Bay and Duddon Estuary SPA

	The Project	Walney 1&2
Distance to colony (South Walney) (km)	38.1	32.1
Weighted distance (1/distance^2)	0.00068889	0.000970487
Relative weighted distance	n/a	1.41[1]
Breeding season apportioning rate	19.21%	27.06%[2]

	The Project	Walney 1&2
% adult birds[3]	71.20%	71.20%
Final breeding season apportioning rate[4]	**13.68%**	**19.27%**
Autumn apportioning rate	3.05%	3.05%
Winter apportioning rate	4.85%	4.85%
Spring apportioning rate	3.05%	3.05%
Weighted average apportioning rate[5]	**8.08%**	**10.41%**

[1] Calculated as the weighted distance for Walney 1&2 divided by the weighted distance for the Project.

[2] The Project apportioning rate multiplied by relative weighted distance of Walney 1&2

[3] Derived from the Project survey data (refer to paragraph 548 of the RIAA (APP-027))

[4] Breeding season apportioning rate multiplied by percentage of adult birds

[5] Product of seasonal apportioning value and proportion of months. The seasonal values are summed to produce the annual weighted mean.

3.1.2.2 In-combination assessment update

29. The updated in-combination mortality estimates for lesser black-backed gull for Morecambe Bay and Duddon Estuary SPA are presented in **Table 3.2**. The total annual in-combination mortality apportioned to the SPA is predicted to be 23 birds, which is equivalent to a 11.52% increase in background mortality. This compares to an increase of 8.40% predicted in the RIAA (APP-027). The Project only contributes a very small proportion (0.33 birds; less than 1.5%) of the total predicted in-combination mortality.

30. As background mortality, based on the estimates presented above, would exceed 1%, a PVA for the in-combination estimation has been undertaken. This is presented in **Section 3.1.2.3** below.

Table 3.2 Predicted in-combination annual collision mortality for breeding adult lesser black-backed gulls apportioned to Morecambe Bay and Duddon Estuary SPA. All values adjusted for avoidance rate of 0.9940 (SNCBs, August 2024)

Project	EIA mortality	HRA mortality	Proxy Apportioning	Annual apportioning rate	Annual Mortality
Burbo Bank Extension	52.80	-	Awel y Mor	2.38%	1.26
Ormonde	26.52	-	Walney1&2	10.41%	2.76
Walney 1&2	68.64	-	Walney1&2	10.41%	7.14
Walney 3&4	35.15	-	Walney1&2	10.41%	3.66
West of Duddon Sands	62.88	-	Walney1&2	10.41%	6.54
Gwynt y Môr	7.20	-	Awel y Mor	2.38%	0.17
Rhyl Flats	0.69	-	Awel y Mor	2.38%	0.02
Robin Rigg	5.33	-	Morgan	7.80%	0.42
Awel y Môr	0.00	0.002	n/a	n/a	0.00
Erebus	8.08	-	Awel y Mor	2.38%	0.19
Twin Hub	3.28	-	White Cross	2.38%	0.08
Morgan Offshore Wind Project Generation Assets	0.97	-	n/a	7.80%	0.08
Mona Offshore Wind Project	1.89	-	n/a	7.67%	0.14
Burbo Bank	2.07	-	Awel y Mor	2.38%	0.05
West of Orkney	0.00	0	n/a		0.00

Project	EIA mortality	HRA mortality	Proxy Apportioning	Annual apportioning rate	Annual Mortality
White Cross	0.40	-	n/a	2.38%	0.01
Sub-total excluding the Project	**275.89**	**-**	**-**	**-**	**22.52**
The Project	**3.57**	**0.33**	**-**	**-**	**0.33**
Total	**279.46**	**-**	**-**	**-**	**22.85**
Mortality increase[1]	**-**	**-**	**-**	**-**	**11.52%**

[1] Assuming an SPA breeding population of 1,724 adults and adult annual mortality of 0.115 = baseline mortality of 198 adult birds

3.1.2.3 PVA update

31. The updated PVA predicts that the in-combination annual lesser black-backed gull collision impact from OWFs (23 individuals) would reduce the annual growth rate of the Morecambe Bay and Duddon Estuary SPA population (1,724) by 0.90%, and result in a 27.75% decrease in population size relative to the unimpacted population by the end of the 35-year model run. The PVA also predicts a negative growth rate for the SPA population of 0.9989 compared with 1.008 of the unimpacted population. This indicates a small population decline that is likely the result of in-combination collision mortality.

32. A summary of the PVA outputs is provided in **Table 3.3** for three scenarios – baseline (unimpacted), in-combination collision mortality including the Project, and in-combination collision mortality excluding the Project. This confirms that the Project alone would make a very small difference to the PVA, with the reduction in growth rate predicted to be 0.90% (compared to 0.89% if the Project was excluded) and reduction in population size at the end of the 35-year period of 27.75% (compared to 27.45%) for all in-combination projects excluding the Project. These differences are considered well within the bounds of natural variation and therefore indistinguishable from the all-projects scenario.

33. There are no changes to the conclusions of the RIAA as a result of this assessment update. As the Project would make no measurable contribution to the in-combination mortality, **it has been concluded that there would be no adverse effect on integrity to Morecambe Bay and Duddon Estuary SPA. Therefore, no conclusion in respect of in-combination effects for the Project is required.**

Table 3.3 In-combination Lesser black-backed gull PVA results for Morecambe Bay and Duddon Estuary SPA

Scenario	Predicted mortality	Median growth rate	Median CPGR	Median CPS	Reduction in growth rate	Reduction in population size
Baseline (unimpacted)	0	1.0080	1.000	1.000	N/A	N/A
In-combination collision mortality (including the Project)	22.85	0.9989	0.9910	0.7225	0.90%	27.75%
In-combination collision mortality (excluding the Project)	22.52	0.9989	0.9911	0.7255	0.89%	27.45%

3.1.3 In-combination assessment update: Ribble and Alt Estuaries SPA

3.1.3.1 In-combination assessment update

34. The updated in-combination mortality estimates for lesser black-backed gull for Ribble and Alt Estuaries SPA are presented in **Table 3.4**. The total annual in-combination mortality apportioned to the SPA is predicted to be 37 birds, which is equivalent to a 6.90% increase in background mortality. This compares to an increase of 3.86% predicted in the RIAA (APP-027). The Project only contributes a very small proportion (0.69 birds; less than 2%) of the total predicted in-combination mortality.

35. As background mortality, based on the estimates presented above, would exceed 1%, a PVA for the in-combination estimation has been undertaken. This is presented in **Section 3.1.3.2** below.

Table 3.4 Predicted in-combination annual collision mortality for breeding adult lesser black-backed gulls apportioned to Ribble and Alt Estuaries SPA. All values adjusted for avoidance rate of 0.9940 (SNCBs, August 2024)

Project	EIA mortality	HRA mortality	Proxy Apportioning	Annual apportioning rate	Annual Mortality
Burbo Bank Extension	52.80	-	Awel y Mor	3.94%	2.08
Ormonde	26.52	-	Morecambe	16.50%	4.38
Walney 1&2	68.64	-	Morecambe	16.50%	11.33
Walney 3&4	35.15	-	Morecambe	16.50%	5.80
West of Duddon Sands	62.88	-	Morecambe	16.50%	10.38
Gwynt y Môr	7.20	-	Awel y Mor	3.94%	0.28
Rhyl Flats	0.69	-	Awel y Mor	3.94%	0.03
Robin Rigg	5.33	-	Morgan	15.44%	0.82
Awel y Môr	0.00	0.05	n/a	n/a	0.05
Erebus	8.08	-	Awel y Mor	3.94%	0.32
Twin Hub	3.28	-	White Cross	3.94%	0.13
Morgan Offshore Wind Project Generation Assets	0.97	-	n/a	15.44%	0.15
Mona Offshore Wind Project	1.89	-	n/a	15.11%	0.29
Burbo Bank	2.07	-	Awel y Mor	3.94%	0.08
West of Orkney	0.00	0	n/a	-	0.00

Project	EIA mortality	HRA mortality	Proxy Apportioning	Annual apportioning rate	Annual Mortality
White Cross	0.40	-	n/a	5.19%	0.02
Sub-total excluding the Project	**275.89**	**-**	**-**	**-**	**36.13**
The Project	**3.57**	**-**	**-**	**-**	**0.69**
Total	**279.46**	**-**	**-**	**-**	**36.82**
Mortality increase[1]	**-**	**-**	**-**	**-**	**6.90%**

[1] Assuming an SPA breeding population of 4,638 adults and adult annual mortality of 0.115 = baseline mortality of 534 adult birds

3.1.3.2 PVA update

36. The updated PVA predicts that the in-combination annual lesser black-backed gull collision impact from OWFs (37 individuals) would reduce the annual growth rate of the Ribble and Alt Estuaries SPA population (4,638) by 0.54%, and result in a 17.83% decrease in population size relative to the unimpacted population by the end of the 35-year model run. However, the PVA also predicts a positive growth rate for the SPA population of 1.0026 compared with 1.0080 of the unimpacted population. This indicates a slowing of the population growth rate, rather than a population decline, is likely a result of in-combination collision mortality.

37. A summary of the PVA outputs is provided in **Table 3.5** for three scenarios – baseline (unimpacted), in-combination collision mortality including the Project, and in-combination collision mortality excluding the Project. This confirms that the Project alone would make a very small difference to the PVA, with the reduction in growth rate predicted to be 0.54% (compared to 0.53% if the Project was excluded) and reduction in population size at the end of the 35-year period of 17.83% (compared to 17.53% for all in-combination projects excluding the Project). These differences are considered well within the bounds of natural variation and therefore indistinguishable from the all-projects scenario.

38. There are no changes to the conclusions of the RIAA as a result of this assessment update. As the Project would make no measurable contribution to the in-combination mortality, **it has been concluded that there would be no adverse effect on integrity to Ribble and Alt Estuaries SPA. Therefore, no conclusion in respect of in-combination effects for the Project is required.**

Table 3.5 In-combination Lesser black-backed gull PVA results for Ribble and Alt Estuaries SPA

Scenario	Predicted mortality	Median growth rate	Median CPGR	Median CPS	Reduction in growth rate	Reduction in population size
Baseline (unimpacted)	0	1.0080	1.000	1.000	N/A	N/A
Cumulative collision mortality (including the Project)	36.82	1.0026	0.9946	0.8217	0.54%	17.83%
Cumulative collision mortality (excluding the Project)	36.13	1.0027	0.9947	0.8247	0.53%	17.53%

3.2 Liverpool Bay SPA: Little gull

39. In its RRs (RR-061) NE commented *'Natural England cannot comment conclusively on the impact of the Project on little gull until NE Ref B11 regarding the sCRM methodology used for this species has been addressed'*.

40. In response to its comments, the Applicant has provided Natural England with the relevant input and output files for the little gull CRM, and also reviewed the cumulative assessment for this species at the EIA scale (refer to Section 3.2.2.4 of the Offshore Ornithology Updates (EIA context) Technical Note (Ref 9.26)). The cumulative assessment EIA update confirmed that for almost all projects no little gull mortality would be predicted, reflecting the low average density of this species across the Irish and Celtic Seas. For only one other windfarm project (Morgan Generation) was any measurable mortality identified, estimated by the Applicant (and noting that the Morgan Generation project did not present any mortality estimate for this species) at 0.59 birds annually. When combined with the predicted Project mortality of 2.92 birds, this would result in a total estimated annual mortality of 3.51 birds at an EIA scale.

41. As set out in the RIAA (APP-027), there is uncertainty as to what proportion of little gulls present at the relevant project sites should be apportioned to the Liverpool Bay SPA population. The reasons for this are set out in paragraphs 506, 507 and 511 of the RIAA (APP-027), but in summary:

- The SPA population (319 birds) is likely to be underestimated, and forms part of a much larger population of birds present within the Irish Sea and the wider North Atlantic which circulate through the SPA site during the winter and migratory periods (the total population of which may exceed 100,000 little gulls).
- Little gulls recorded within the project sites are likely to be additional to the SPA population count, although these may be birds that utilise the SPA as they circulate through the Irish Sea.
- The Project is located outside (adjacent to) the SPA, while the Morgan Generation project is located approximately 10km from the SPA boundary. On the basis of the above, it is considered reasonable to apportion few (or even zero) little gulls to the SPA population.

42. Notwithstanding this conclusion, if it is assumed that all of the birds present at the project sites (i.e. mortality of 3.51 birds combined from the Project and Morgan Generation project) are part of the Liverpool Bay SPA population, this would equate to an increase in background mortality of 5.50% (**Table 3.6**). This compares to an estimate of 4.57% in the RIAA (APP-027). Relating the collision estimate to the wider European winter population (which itself is likely to be underestimated) suggests an increase in annual mortality of 0.17% (based on maximum European population estimate) to 0.31% (based on

minimum European population estimate); see **Table 3.6**. This compares to estimates within the RIAA (APP-027) of 0.14% and 0.26% respectively.

Table 3.6 Little gull – Predicted in-combination increase in annual baseline collision mortality

	Liverpool Bay SPA	EU winter population (min)[1]	EU winter population (max)[1]
Population size	319	5,700	10,200
Predicted annual background mortality (20.0%[2])	63.8	1,140	2,040
Predicted in-combination mortality (all birds apportioned)	3.51	3.51	3.51
% Increase in predicted mortality	5.50%	0.31%	0.17%

[1] 2013-18 population from 'Population status and trends at the EU and Member State levels' https://nature-art12.eionet.europa.eu/article12

[2] Based on adult mortality rate of 0.2000, noting that this is considered precautionary (NE and NRW, 2024)

43. Based on the above, the conclusions of the RIAA (APP-027) are unchanged; i.e. **that there would be no adverse effect on the integrity of Liverpool Bay SPA, when considering the Project in-combination with other plans or projects.** This accords with the conclusions of the Round 4 offshore wind leasing HRA (NIRAS, 2021), which stated that '*for little gull the impact from the Round 4 Plan alone is considered to be negligible, and any additional impact from the Round 4 Plan alone would not make an appreciable difference to any in-combination impact*'.

4 Review of effect of air gap on lesser black-backed gull collision risk

4.1 Introduction

44. In its relevant representations (RR-061), Natural England stated *'The Applicant has committed to an air gap of 25m above HAT. However, their impacts on collision-sensitive species including from SPA colonies could be decreased further by increasing the air gap further. The Applicant should consider further increases to the air gap as a means of further mitigation.'* (RR-061-92).

45. In its response to the relevant representations (PD1-011), the Applicant stated that *'The Applicant made an increase to the air gap between PEIR and ES from 22m HAT to 25m HAT. The Applicant will present a review of the effects of further increasing air gap at Deadline 1. This will confirm that, as the contribution of the Project alone to in-combination mortality is so small, a further increase will make no measurable reduction to the change in background LBBG mortality. On that basis (and taking into account other constraints that limit the ability to increase air gap further), the Applicant considers that there is no justification to further increasing air gap.'* This section therefore presents an analysis of the effect of increasing air gap to support the Applicant's position. Lesser black-backed gull is considered by the Applicant most relevant as this is the only species vulnerable to collision for which Natural England has outstanding concerns as to whether adverse effect on integrity can be ruled out, in respect of Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA (refer to **Sections 2** and **3.1** above).

4.2 Approach

46. Collision risk modelling (CRM) for lesser black-backed gull has been undertaken using the stochastic CRM (sCRM) tool (McGregor, 2018), in accordance with the approach used for the ES Chapter 12 Offshore Ornithology (APP-049). The model was run for air gaps of 25m (the current worst case scenario; Table 12.2 of ES Chapter 12 (APP-049)), 28m and 30m above HAT (Highest Astronomical Tide). All other parameters used in the model were unchanged from those used for the DCO, with values presented using 'Option 2' of the sCRM tool, which assumes an even distribution of birds across the height of the rotors. Values have been estimated as follows:

- Estimated annual mortality as a result of the Project for each modelled air gap (equivalent to the information presented in ES Chapter 12

Offshore Ornithology (APP-049)), and resultant increase in background mortality in relation to the largest seasonal BDMPS[1].

- Estimated mortality for the project alone apportioned to the two SPAs (equivalent to the information presented in the RIAA (APP-027)).
- Estimated mortality for the two SPAs when considered in-combination with other projects, together with increase in background mortality for the adult SPA populations (based on the updated values presented in **Section 3.1** above).

4.3 Results

47. The results of the comparison are presented in **Table 4.1**. The original sCRM input and output files are available on request.

Table 4.1 Summary of collision risk estimates for lesser black-backed gull for different air gaps above HAT (mean mortality, using Option 2 of the sCRM tool)

	Air gap	25m	28m	30m
EIA	Annual Mortality	3.57	3.00	2.76
	Increase in background mortality[1]	0.01%	0.01%	0.01%
Morecambe Bay and Duddon Estuary SPA	Annual Mortality (project alone)	0.33	0.28	0.26
	Annual Mortality (in-combination)	22.85	22.80	22.78
	Increase in background mortality[2]	11.52%	11.50%	11.49%
Ribble and Alt Estuaries SPA	Annual Mortality (project alone)	0.69	0.59	0.55
	Annual Mortality (in-combination)	36.82	36.72	36.68
	Increase in background mortality[3]	6.90%	6.88%	6.88%

[1] Assumes a reference population of 240,750 and mean annual mortality rate of 0.1237 = 29,781 annual background mortality.

[2] Assumes an SPA breeding population of 1,724 adults and adult annual mortality of 0.115 = baseline mortality of 198 adult birds

[3] Assumes an SPA breeding population of 4,638 adults and adult annual mortality of 0.115 = baseline mortality of 534 adult birds

[1] Breeding season BDMPS for UK Western Waters = 240,750 birds (Furness, 2015)

4.4 Conclusion

48. The results presented above confirm that increasing air gap above 25m would make a very small difference to the predicted mortality, particularly when considered for the in-combination values presented in **Section 3.1**. For an air gap increase of 25m to 30m, this would result in a reduction of approximately 30% in predicted collision mortality for the project alone. However, as the number of impacted birds is small, this would result in a reduction in only 0.8 birds at the EIA scale. This would make no difference to the predicted change in background mortality (0.01% for all air gaps).

49. For the RIAA values, an increase in air gap would reduce the predicted mortality for both SPAs by only a fraction of one bird. When considered in-combination with other projects, the reduction in background mortality is very small (a maximum difference of 0.03% (from 11.52% to 11.49%) for Morecambe Bay and Duddon Estuary SPA for an increase of air gap from 25m to 30m). Such a change is likely to be undetectable at a population level, particularly when the uncertainties and level of precaution within the modelled estimates are taken into account. Therefore, the Applicant considers that a further increase in air gap would not be justified, as it would not provide measurable benefits.

5 References

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

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

McGregor, R.M., King, S., Donovan, C.R., Caneco, B., Webb, A (2018) A Stochastic Collision Risk Model for Seabirds in Flight. Marine Scotland. https://dmpstats.shinyapps.io/avian_stochcrm/

NatureScot (2018) Interim Guidance on apportioning impacts from marine renewable developments to breeding seabird populations in SPAs.

NIRAS (2024) Morgan Offshore Wind Project: Generation Assets Offshore Ornithology CEA and In-combination Gap-filling of Historical Projects Note. Document reference: S_D1_4.5. 03 October 2024. Examination Library: REP1-010

RPS (2024a) Mona Offshore Wind Project Offshore Ornithology Cumulative Effects Assessment and In-combination Gap-fulling Historical Projects Technical Note. 30 September 2024. Examination Library: REP3-044

RPS (2024b) Mona Offshore Wind Project Offshore Ornithology Errata Clarification Note. 30 September 2024. Examination Library: REP3-073

Searle, K., Mobbs, D., Daunt, F., & Butler, A. (2019) A Population Viability Analysis Modelling Tool for Seabird Species. Centre for Ecology & Hydrology report for Natural England. Natural England Commissioned Report NECR274.

SNCBs (2024). Joint advice note from the Statutory Nature Conservation Bodies (SNCBs) regarding bird collision risk modelling for offshore wind developments. JNCC, Natural England, Natural Resources Wales, NatureScot (August 2024)

Woodward, I., Thaxter, C.B., Owen, E., Cook, A.S.C.P. (2019) Desk-based revision of seabird foraging ranges used for HRA screening.

Appendix 1: Lesser Black-backed Gull Breeding Season Apportioning

Table A1.1 Apportioning of lesser black-backed gull present in the Windfarm Site to coastal breeding colonies within mean maximum foraging range (127km; Woodward et al., 2019)

Master Site	Species is a Qualifying Feature?	Year of Colony Count	Colony Population	Distance to Development (km) (Centroid to Centroid)	Distance squared (km)	1/Proportion of Foraging Range as Sea	Resulting Weight	Proportional Weight
Ribble and Alt Estuaries SPA	Yes	2023	4638	43.66	1906.20	2.743	1.1804	42.34%
Morecambe Bay and Duddon Estuary SPA	Yes	2023	1724	38.10	1451.61	2.550	0.5357	19.21%
Puffin Island SPA	No	2017	1052	61.04	3725.76	2.773	0.1385	4.97%
Anglesey Terns / Morwenoliaid Ynys Môn SPA	No	2023	280	79.73	6356.71	2.618	0.0204	0.73%
The Dee Estuary SPA	No	2013/2019	8	56.47	3188.97	2.931	0.0013	0.05%
Barrow-in-Furness	N/A	2010/2019/2022	2762	43.13	1860.54	2.572	0.6753	24.22%

Master Site	Species is a Qualifying Feature?	Year of Colony Count	Colony Population	Distance to Development (km) (Centroid to Centroid)	Distance squared (km)	1/Proportion of Foraging Range as Sea	Resulting Weight	Proportional Weight
South Solway	N/A	2009/2023	1436	117.88	13895.69	2.237	0.0409	1.47%
Haverigg and Millom	N/A	2013/2019	184	48.58	2359.53	2.555	0.0352	1.26%
Sellafield	N/A	2009	300	70.38	4953.06	2.518	0.0270	0.97%
Almorness Point	N/A	2021	746	117.81	13880.14	2.411	0.0229	0.82%
Askam-in-Furness	N/A	2019	84	50.32	2531.60	2.530	0.0148	0.53%
Heysham Power Station	N/A	2000	70	50.83	2583.99	2.509	0.0120	0.43%
Seaforth Nature Reserve and Liverpool City	N/A	1994/2019	66	57.82	3342.81	2.886	0.0101	0.36%
Manchester Ship Canal	N/A	2020/2022	100	80.91	6546.75	2.841	0.0077	0.28%
Maryport	N/A	2013	190	105.15	11056.10	2.387	0.0073	0.26%
South Island	N/A	1996/1999/2023	104	88.29	7794.59	2.833	0.0067	0.24%
Walney Urban Gulls	N/A	2019	22	39.65	1572.28	2.609	0.0065	0.23%

Master Site	Species is a Qualifying Feature?	Year of Colony Count	Colony Population	Distance to Development (km) (Centroid to Centroid)	Distance squared (km)	1/Proportion of Foraging Range as Sea	Resulting Weight	Proportional Weight
Whitehaven (Buildings)	N/A	2018	106	85.46	7303.75	2.483	0.0064	0.23%
Fleetwood	N/A	2019	18	39.18	1534.68	2.646	0.0055	0.20%
Thornton-Clevelys	N/A	1994	12	37.76	1426.04	2.679	0.0040	0.14%
Blackpool	N/A	2001	10	36.27	1315.51	2.712	0.0036	0.13%
East Island	N/A	1999/2017	34	70.80	5013.21	2.847	0.0034	0.12%
Workington	N/A	2009/2019	64	94.61	8950.67	2.435	0.0031	0.11%
Bangor and Caernarfon	N/A	2019	34	72.47	5252.19	2.620	0.0030	0.11%
North Island	N/A	1999/2017	42	86.60	7499.73	2.725	0.0027	0.10%
Rhoscolyn to Trearddur	N/A	2016	52	101.69	10341.47	2.532	0.0023	0.08%
Rhyl	N/A	2019	8	52.94	2802.11	2.952	0.0015	0.05%
Llanddulas Quarries	N/A	2002/2017	8	56.28	3167.21	2.902	0.0013	0.05%
Porth Llanlleiana to Porth Eilian	N/A	2016	12	67.77	4592.64	2.767	0.0013	0.05%
Point Lynas to Trwyn Du	N/A	2016	10	64.73	4189.97	2.763	0.0012	0.04%
Prestatyn	N/A	2019	6	51.99	2703.06	2.955	0.0012	0.04%

Master Site	Species is a Qualifying Feature?	Year of Colony Count	Colony Population	Distance to Development (km) (Centroid to Centroid)	Distance squared (km)	1/Proportion of Foraging Range as Sea	Resulting Weight	Proportional Weight
Ulverston	N/A	2013	6	55.99	3135.33	2.484	0.0008	0.03%
South Stack	N/A	2016/2022	14	93.85	8807.82	2.565	0.0007	0.03%
Fleet Bay	N/A	2018	16	121.80	14836.21	2.482	0.0005	0.02%
Carmel Head South	N/A	2001/2016	6	80.19	6429.95	2.696	0.0004	0.02%
Meikle Ross & Little Ross	N/A	2018	12	114.10	13019.27	2.483	0.0004	0.01%
Netherton	N/A	2019	2	52.80	2787.95	2.881	0.0004	0.01%
Kinmel Bay	N/A	2019	2	53.65	2878.32	2.947	0.0004	0.01%
Flimby and Risehow	N/A	2009/2019	8	102.17	10438.71	2.399	0.0003	0.01%
Morecambe	N/A	2000	2	55.61	3092.92	2.466	0.0003	0.01%
Bodorgan Head to Abermenai	N/A	2018	8	118.19	13969.11	2.512	0.0003	0.01%
Lillyhall	N/A	2019	4	95.98	9211.39	2.437	0.0002	0.01%
West Island	N/A	1998/2017	4	108.01	11665.51	2.811	0.0002	0.01%
Mull of Galloway	N/A	2015	4	126.97	16122.14	2.605	0.0001	0.00%
Llyn Dinam and Llyn Penrhyn	N/A	2019	2	97.84	9571.88	2.562	0.0001	0.00%

Master Site	Species is a Qualifying Feature?	Year of Colony Count	Colony Population	Distance to Development (km) (Centroid to Centroid)	Distance squared (km)	1/Proportion of Foraging Range as Sea	Resulting Weight	Proportional Weight
Port O'Warren	N/A	2020	2	119.50	14280.97	2.393	0.0001	0.00%
Siddick	N/A	2019	1	99.47	9893.29	2.418	0.0000	0.00%
Allonby	N/A	2013	0	113.52	12887.24	2.349	0.0000	0.00%
Beaumaris	N/A	2019	0	68.20	4651.51	2.711	0.0000	0.00%
Great Orme and Little Orme	N/A	2019	0	53.77	2890.89	2.877	0.0000	0.00%
Morecambe Bay	N/A	2019	0	64.75	4192.43	2.401	0.0000	0.00%
Rough Firth Merse	N/A	2020	0	121.92	14863.75	2.402	0.0000	0.00%
St Bees Head and Town	N/A	2020	0	77.92	6071.68	2.519	0.0000	0.00%
Totals	**-**	**-**	**14275**	**4064.50**	**350796.91**	**138.920**	**2.7882**	**-**

Appendix 2: PVA Input Parameters

Table A2-2 Lesser black-backed gull input parameters used in the in-combination PVA for Morecambe Bay and Duddon Estuary SPA

Parameter	Value
PVA model run type	simplescenarios
Model to use for environmental stochasticity	betagamma
Model for density dependence	No dd.
Include demographic stochasticity in the model?	Yes
Number of simulations	5000
Random seed	10
Years for burn-in	4
Case study selected	None
Species chosen to set initial values	Lesser black-backed gull
Age at first breeding	5
Upper constraint on productivity in the model?	Yes, constrained to 4 per pair
Number of sub-populations	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
Initial population values	1,724 in 2023
Productivity rate per pair	Mean 0.53, SD 0.325
Adult survival rate	Mean 0.885, SD 0.022
Immature survival rate – age class 0 to 1	Mean 0.798, SD 0.092
Immature survival rate – age class 1 to 2	Mean 0.885, SD 0.022
Immature survival rate – age class 2 to 3	Mean 0.885, SD 0.022
Immature survival rate – age class 3 to 4	Mean 0.885, SD 0.022
Immature survival rate – age class 4 to 5	Mean 0.885, SD 0.022
Number of impact scenarios	2
Are impacts applied separately to each subpopulation?	No
Are impacts of scenarios specified separately for immatures?	Yes
Are standard errors of impacts available?	No

Parameter	Value
Should random seeds be matched for impact scenarios?	Yes
Are impacts specified as relative value or absolute harvest?	Relative
Years in which impacts are assumed to begin and end	2028 to 2063
Scenario A: Including Morecambe	
Impact on productivity rate	None
Impact on adult survival rate	0.012168
Impact on immature survival rate	None
Scenario B: Excluding Morecambe	
Impact on productivity rate	None
Impact on adult survival rate	0.011977
Impact on immature survival rate	None
First year to include in outputs	2028
Final year to include in outputs	2063
How should outputs be produced, in terms of ages?	Breeding Adults

Table A2.3 Lesser black-backed gull input parameters used in the in-combination PVA for Ribble and Alt Estuaries SPA

Parameter	Value
PVA model run type	simplescenarios
Model to use for environmental stochasticity	betagamma
Model for density dependence	No dd.
Include demographic stochasticity in the model?	Yes
Number of simulations	5000
Random seed	10
Years for burn-in	4
Case study selected	None
Species chosen to set initial values	Lesser black-backed gull
Age at first breeding	5
Upper constraint on productivity in the model?	Yes, constrained to 4 per pair
Number of sub-populations	1
Are demographic rates applied separately to each subpopulation?	No

Parameter	Value
Units for initial population size	Breeding Adults
Are baseline demographic rates specified separately for immatures?	Yes
Initial population values	4,638 in 2023
Productivity rate per pair	Mean 0.53, SD 0.325
Adult survival rate	Mean 0.885, SD 0.022
Immature survival rate – age class 0 to 1	Mean 0.798, SD 0.092
Immature survival rate – age class 1 to 2	Mean 0.885, SD 0.022
Immature survival rate – age class 2 to 3	Mean 0.885, SD 0.022
Immature survival rate – age class 3 to 4	Mean 0.885, SD 0.022
Immature survival rate – age class 4 to 5	Mean 0.885, SD 0.022
Number of impact scenarios	2
Are impacts applied separately to each subpopulation?	No
Are impacts of scenarios specified separately for immatures?	Yes
Are standard errors of impacts available?	No
Should random seeds be matched for impact scenarios?	Yes
Are impacts specified as relative value or absolute harvest?	Relative
Years in which impacts are assumed to begin and end	2028 to 2063
Scenario A: Including Morecambe	
Impact on productivity rate	None
Impact on adult survival rate	0.007208
Impact on immature survival rate	None
Scenario B: Excluding Morecambe	
Impact on productivity rate	None
Impact on adult survival rate	0.007060
Impact on immature survival rate	None
First year to include in outputs	2028
Final year to include in outputs	2063
How should outputs be produced, in terms of ages?	Breeding Adults