BERWICK BANK WIND FARM
OFFSHORE ENVIRONMENTAL IMPACT ASSESSMENT

APPENDIX 11.5: ORNITHOLOGY APPORTIONING TECHNICAL REPORT

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1. INTRODUCTION

1. Berwick Bank Wind Farm Limited (BBWFL) is a wholly owned subsidiary of SSE Renewables Limited and will hereafter be referred to as 'the Applicant'. The Applicant is developing the Berwick Bank Wind Farm (hereafter referred to as 'the Project') located in the outer Forth and Tay region (Figure 1.1).

2. The Proposed Development is located adjacent to the consented Firth of Forth offshore wind farms consisting of Seagreen to the north, Inch Cape to the northwest and Neart na Gaoithe to the west (Figure 1.1).

3. The proposed Berwick Bank development will, if consented, provide an estimated 4.1 GW of renewable energy, making it one of the largest offshore wind farms in the world. Given the anticipated operational life span of 35 years, the Project will make a critical contribution to Scotland's renewable energy target of 11 GW of new offshore wind by 2030.

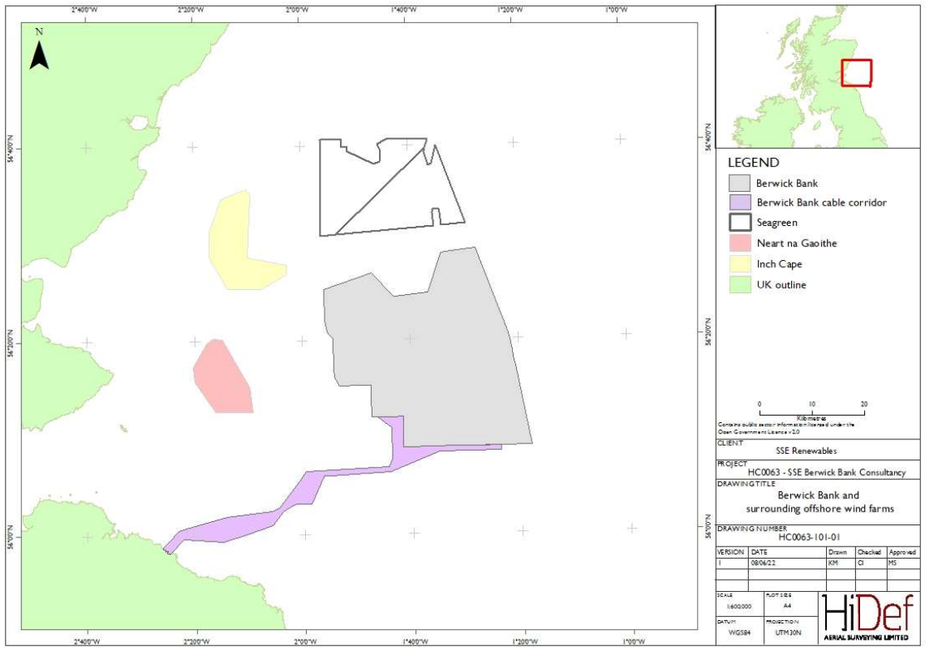

Figure 1.1: Site boundaries for all consented and proposed wind farms currently within the Outer Firth of Forth.

2. PURPOSE OF THE REPORT

4. This Technical Report describes the seasonal apportioning of seabirds at the Proposed Development area to non-designated colonies and Special Protection Areas (SPAs) to inform the Environmental Impact Assessment Report (EIAR) and Habitats Regulation Appraisal (HRA) for the Proposed Development.

5. Apportioning provides a means of estimating the proportions of birds present within the impacted area that derive from different colony populations. Consequently, the results from apportioning allow the impacts of the Proposed Development to be allocated across each of the relevant SPA populations. Potential impacts from collision and displacement/barrier effects are presented in the Ornithology Technical Appendices 11.3 and 11.4, respectively, and the apportioned population-level impacts by age class in the Technical Appendix 11.6: Population Viability Analysis.

6. The apportioning of breeding season birds has been undertaken for all species listed in Section 3.1, except kittiwake, guillemot and razorbill, using a "theoretical approach" presented in NatureScot's interim guidance note (NatureScot, 2018) and implemented using R software (R version 4.0.5 (2021-03-31)). This method was advised by NatureScot and Marine Scotland Science (MSS) through their Scoping representations and advice (4th February 2022). The method provides an apportioning "weighting" to each of the breeding colonies within the mean maximum foraging range plus one standard deviation (SD) (Woodward *et al.,* 2019) of the Proposed Development Array area.

7. Marine Scotland's Apportioning Tool (Butler *et al.*, 2020) was used for breeding season apportionment of guillemot, razorbill and kittiwake, as advised by MSS in their Scoping representation and advice (4th February 2022). The method used is based on statistical models of GPS data for birds tracked from their breeding colonies (Wakefield *et al*., 2017; 2019).

8. In the non-breeding season, the information from Furness (2015) on Biologically Defined Minimum Population Scales (BDMPS) was used for all species to apportion birds, except guillemot and herring gull. The methodology for gannet took account of revised information on seasonal movements (McArthur Green, 2015).

9. For guillemot, non-breeding season estimates were apportioned based on breeding season regional populations using the approach outlined in the NatureScot interim guidance, advised by MSS (24th August 2021) and confirmed by NatureScot based on the analyses of geolocator data presented in Buckingham *et al.* (2022).

10. For herring gull, apportioning for the non-breeding season was also carried out using the breeding season NatureScot approach but with a correction applied to the regional breeding numbers, to account for the influx of non-UK and west coast UK birds into the North Sea BDMPS. This approach was confirmed through the Ornithology Roadmap Process (RM6; Appendix 11.8).

11. In the case of puffin, no apportionment of impacts was required for the non-breeding season because this species leaves UK colonies and the immediately adjacent sea area by late August and disperses widely over vast areas (Furness, 2015).

12. Apportionment of Arctic tern estimates of collisions has also not been undertaken. The Arctic tern is a designated species of the Forth Islands SPA which comprises seabird colonies on Inchmickey, Isle of May, Fidra, The Lamb, Craigleith and Bass Rock. Of these islands, Artic terns are only present on the Isle of May; the closest distance between the Development Array area and the Isle of May colony is 40.9 km, which is only just within the breeding season foraging range (40.5 km, see Table 3.2; the mean max foraging range + 1 SD from Woodward *et al*., 2019) of the Isle of May colony. The Applicant concludes that the Development Array area has little, if any, connectivity to the SPA population.

3. METHODS

3.1. SPECIES AND RELEVANT COLONIES

13. Apportioning was undertaken for the species outlined in Table 3.1.

Table 3.1: Species and Impacts for which Apportioning was Undertaken.

Species	Scientific name	Nature of impact
Kittiwake	*Rissa tridactyla*	Collision & displacement/barrier
Herring gull	*Larus argentatus*	Collision
Lesser black backed gull	*Larus fuscus*	Collision
Guillemot	*Uria aalge*	Displacement/barrier
Razorbill	*Alca torda*	Displacement/barrier
Puffin	*Fratercula arctica*	Displacement/barrier
Gannet	*Morus bassanus*	Collision & displacement /barrier

14. These species are protected as features of breeding colony SPAs. The SPA and non-SPA colonies to which birds have been apportioned are those within species-specific breeding season foraging ranges from the Development Array area, defined as the mean max foraging range + 1 SD from Woodward *et al*. (2019) (Table 3.2), as advised by NatureScot in their scoping advice (7th December 2021).

15. The HRA Screening Report identified a long list of SPAs within breeding season foraging range of the Proposed Development Array area. This list was used to ensure that all relevant breeding season SPAs were considered in the apportioning process using both NatureScot (2018) and MSS Tool (Butler *et al*., 2020) methods (Table 3.3). A small number of SPA populations were screened in but were beyond the mean max foraging range +1 SD from the Development Array area on the basis of distance measurements undertaken for the apportioning. This was due to differences in how distances between the colonies and the Proposed Development Array area were measured; connectivity for HRA screening was determined using the closest points of the Array area (prior to the boundary revision) and the relevant SPA, whereas apportioning used the centre of the Array area to the closest point of the relevant SPA and "at-sea" distance.

16. The full suite of SPAs considered for apportioning are shown in Table 3.3.

17. The colony counts for each of the SPAs were provided from JNCC as two validated datasheets of all colony count data for the UK and Ireland within the Seabird Monitoring Programme (SMP) database for 1998 – 2019 and 1998-2021 to HiDef on 10th January 2022. For the species of interest here, the database summarised counts by subsites and whole SPAs; "counts" are recorded as individuals or Apparently Occupied Nests (AON) or Apparently Occupied Sites (AOS). For guillemot and razorbill, counts of individuals were converted to estimates of the population size by multiplying by the correction factor 1.34. Where counts were provided as AON/AOS, these were treated as equivalent to pairs and therefore doubled to arrive at a number of individuals and then multiplied by the correction factor of 1.34, which is an Isle of May specific correction factor but which has been applied in previous applications to guillemot and razorbill. Ideally, counts should be concurrent across breeding colonies of interest. However, for many SPAs, counts are divided by subsite and not all subsites are censused every year. Entire counts for SPAs comprising multiple subsites are often only achieved over a period of years.

18. For kittiwake, lesser black-backed gull, razorbill and gannet any additional colonies which occur within the BDMPS were advised to be screened in by NatureScot and MSS in their scoping advice (16th December 2021). The relevant colonies are reported in Section 4.3.

Table 3.2: Species and Foraging Ranges as per Woodward *et al.* (2019).

Species	Mean Max (km)	1 SD (km)	Total (km)
Kittiwake	156.1	144.5	300.6
Herring gull	58.8	26.8	85.6
Lesser black-backed gull	127.0	109.0	236
Guillemot	73.2	80.5	153.7
Razorbill	88.7	75.9	164.6
Puffin	137.1	128.3	265.4
Gannet	315.2	194.2	509.4

Table 3.3: SPA Colonies (Feature or Assemblage) Identified for Apportioning based on Breeding Season Foraging Range, where Distance to SPA has been Measured from the Centre of the Development Array Area to the Closest Point of the SPA Boundary *SPAs Beyond Foraging Range but Screened In[1]. Non-Designated Colonies Within Foraging Range are presented in Annex A.

SPAs	Species	Foraging range	Distance to SPA (km)	Count of breeding adults (ind)	Year of count
Buchan Ness to Collieston Coast SPA	Kittiwake	300.6	120	22590	2019
	Guillemot	153.7		39553	2019
Copinsay SPA	Kittiwake	300.6	307	1910	2015
Coquet Island SPA	Kittiwake	300.6	110	932	2021
	Lesser black-backed gull	236		40	2019
	Puffin	265.4		50058	2019
East Caithness Cliffs SPA	Kittiwake	300.6	274	48920	2015
Fair Isle SPA	Gannet	509.4	358	9942	2021
Farne Islands SPA	Kittiwake	300.6	76	8804	2019
	Herring gull	85.6		1496	2019

[1] The different lists of SPAs between screening and apportioning breeding season connectivity are due to the different approaches to measuring distances between the SPA and the Development Array area.

SPAs	Species	Foraging range	Distance to SPA (km)	Count of breeding adults (ind)	Year of count
	Lesser black-backed gull	236		1362	2019
	Guillemot	153.7		85816	2019
	Razorbill	164.6		572	2019
	Puffin	265.4		87504	2019
Flamborough and Filey Coast SPA	Kittiwake	300.6	263	91008	2017
	Puffin	265.4		958	2008
	Gannet	509.4		26784	2017
Forth Islands SPA					
	Kittiwake	300.6		9034	2018 / 2021
	Herring gull	85.6		11868	2019 – 2021
	Lesser black-backed gull	236		4006	2018 – 2021
	Guillemot	153.7		34580	2018 – 2021
	Razorbill	164.6		7878	2017 – 2021
	Puffin	265.4		87240	2017 – 2021
	Gannet	509.4		150518	2014
Fowlsheugh SPA	Kittiwake	300.6	73	26542	2018
	Herring gull	85.6		1414	2018
	Guillemot	153.7		91358	2018
	Razorbill	164.6		17817	2018
Hermaness, Saxa Vord and Valla Field SPA	Gannet	509.4	507	51160	2014
Hoy SPA	Kittiwake*	300.6	312	608	2016 – 2017
	Puffin*	265.4		361	2017
North Caithness Cliffs SPA	Kittiwake*	300.6	280	7712	2015/2016
	Puffin*	265.4		3034	2015/2016
North Rona and Sula Sgeir SPA	Gannet	509.4	475	22460	2013
Noss SPA	Gannet	509.4	429	27530	2019
St Abb's Head to Fast Castle SPA	Kittiwake	300.6	56	10904	2016 – 2020
	Herring gull	85.6		612	2016 – 2020
	Guillemot	153.7		61408	2016 – 2018
	Razorbill	164.6		3928	2016 – 2018
Sule Skerry and Sule Stack SPA	Gannet	509.4	391	18130	2013 /18
Troup, Pennan and Lion's Heads SPA	Kittiwake	300.6	171	21232	2017
	Guillemot*	153.7		31893	2017
	Razorbill *	164.6		6054	2017

3.2. DEFINITIONS OF SEASONS

19. Through the Ornithology Road Map Process (RM1: Technical Appendix 11.8), advice was provided to define breeding and non-breeding seasons using the definitions in NatureScot (2020).

20. This was the basis for bio-seasons used within this technical report and summarised in Table 3.4.

- **Breeding season:** birds are strongly associated with a nest site, including nesting, egg-laying and provisioning young; and
- **Non-breeding season:** birds are more widely dispersed and no longer strongly associated with colonies. This period subsumes the short "pre-breeding" seasons defined separately in NatureScot (2020).

21. Non-breeding season apportioning is reliant on information within BDMPS (Furness, 2015). For kittiwake, gannet and razorbill, Furness (2015) identifies autumn and spring passage and winter periods within the non-breeding season and therefore apportioning weightings were derived for these periods. The weightings from the apportioning were applied to mortality estimates for these species in Furness (2015) seasons which were foreshortened where they overlapped with the NatureScot breeding season definitions to avoid overestimating seasonal mortality estimates (Table 3.4).

Table 3.4: Bio-Seasons for Each Species Based on i) NatureScot (2020) in the Breeding Season for All Species and ii) NatureScot (2020) Used for All Species in the Non-Breeding Season Except for Kittiwake, Razorbill and Gannet which Were Adapted from Furness (2015). Apportioning Was Carried Out for All Species in Both Bio-Seasons, Except for Puffin (Breeding Season Only).

Species	Bio-season	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Kittiwake	Breeding					■	■	■	■				
	Autumn migration									■	■	■	■
	Spring migration	■	■	■	■								
Herring gull	Breeding				■	■	■	■	■				
	Non-breeding	■	■	■						■	■	■	■
Lesser black-backed gull	Breeding			■	■	■	■	■	■				
	Non-breeding	■	■	■						■	■	■	■
Guillemot	Breeding				■	■	■	■	■				
	Non-breeding	■	■	■					■	■	■	■	■
Razorbill	Breeding				■	■	■	■	■				
	Autumn migration								■	■	■		
	Winter											■	■
	Spring migration	■	■	■									
Puffin	Breeding				■	■	■	■	■				
	Non-breeding	■	■	■					■	■	■	■	■
Gannet	Breeding			■	■	■	■	■	■	■			
	Autumn migration										■	■	

Species	Bio-season	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Spring migration												

3.3. APPORTIONING METHODS

22. The weightings derived from the apportioning were used to assign seasonal estimates of mortality for each species by age class to seabird colonies. The mortality estimates are reported in Technical Appendices 11.3 and 11.4 concerning ornithology collision risk modelling and displacement. Impacts were estimated for the Developer Approach and Scoping Approaches, the latter segregated into two (a and b) based on advised mortality and displacement rates. Apportioning was carried out using the mortality estimates for each of these approaches.

BREEDING SEASON

NatureScot apportioning method

23. The apportioning calculation as advised in NatureScot (2018) is a weighting based on colony population size (adult individuals) of those within foraging range, distance between the centre of the Development Array area and the nearest boundary of the relevant breeding colonies within foraging range (see below), and area of sea encompassed by the foraging range. These three weighting factors are combined to obtain a proportional weight for each colony:

$$= \left(\frac{Colony\ population}{Sum\ of\ populations}\right) \times \left(\frac{\Sigma(Distance^2)}{Distance^2}\right) \times \left(\frac{\frac{1}{Proportion\ of\ foraging\ range\ as\ sea}}{\sum\frac{1}{Proportion\ of\ foraging\ range\ as\ sea}}\right)$$

24. This apportioning calculation has been coded by HiDef Aerial Surveying Ltd. ("HiDef") into the R programming language and a copy of the code can be provided upon request.

25. The seabird population estimates at the relevant SPAs used in the calculation are summarised in Table 3.3 and were obtained from the Seabird Monitoring Programme (SMP) database: JNCC provided two validated datasheets of all colony count data for the UK and Ireland within the SMP for 1998 – 2019 and 1998-2021 to HiDef on 10th January 2022. NatureScot (2018) advise that counts must be concurrent across breeding colonies of interest; if there is a significant temporal gap between the counts at different sites then an earlier baseline should be used to ensure counts of comparable age across the sites. However, for many SPAs, counts are divided by subsite and not all subsites are censused every year. Entire counts for SPAs comprising multiple subsites are often achieved over a period of years (see 'Year of count' Table 3.3). The most recent counts available were used in all cases. Relevant non-designated colonies are presented in Annex A.

26. The distance of the colony was measured as the distance between the geometric centre of the Windfarm Array to the closest point on the boundary of the colony, as per approach taken in Seagreen Optimised Addendum (2019). This was a compromise between options within the NatureScot guidance (2018) advocating a centroid-to-centroid approach and an approach that uses shortest distance between site and colony boundaries. To be biologically meaningful, these are the 'at sea' distances, rather than straight-line i.e., the actual shortest distance the bird flies across water between the breeding site and the Proposed Development.

Marine Scotland Science (MSS) apportioning method

27. The method available in the MS Apportioning Tool (Butler *et al,*. 2020) derives apportioning percentages using a statistical model that incorporates spatial distributions of seabirds using tracking data and model parameters related to accessibility, competition, and environmental effects (Wakefield *et al.,* 2017; 2019). The dependency on the modelled density layers of Wakefield *et al.* (2017; 2019) means that, amongst the species of concern for this Project, this method can only be used for kittiwake, guillemot and razorbill.

28. This method differs from the NatureScot approach by accounting for environmental heterogeneity and drivers of species distributions and allowing segregation of foraging ranges between colonies. Both may impact where birds from a certain colony are most likely to be found. It also empirically estimates colony-specific bird density at a certain location from the tracking data, rather than using a pre-defined, uniform density-distance decay that is identical for all species/colonies, as is assumed in the NatureScot approach. This approach is considered more biologically meaningful.

29. The MS method uses population counts from the Seabird 2000 census to derive the relative weightings on which the apportionment is based.

30. HiDef identified several issues with the use of the MS Tool, and these were discussed at the Marine Scotland Ornithology Impact Assessment Workshop (14 February 2022). One of the issues concerned how the tool measured distances between colonies and developments. The application of the MSS method within the Tool assigns weightings to SPAs that are beyond the breeding season foraging range as defined by the mean max distance + 1 SD from Woodward *et al*. (2019) due to the way in which the method defines "foraging range". The MSS method within the Apportioning Tool uses the maximum observed foraging range from GPS data and adds a 10% buffer to account for potentially unobserved foraging trips. For any given species, the list of colonies that result from the use of the tool therefore differs from that which would be obtained via the application of the NatureScot approach. This results in a weighting assigned to sites that may not have been screened in.

31. Another issue was how sub-site information was aggregated to SPA level. On the latter point, the Applicant received advice from MS-LOT on the use of the MS Tool on 31st May 2022 which confirmed the three approaches to aggregation that are available in the Tool:

    1. Level 1 – no aggregation, outputs are at Seabird 2000 sub-site level.
    2. Level 2 – aggregated to Seabird 2000 site level.
    3. Level 3 – aggregation to SPA.

32. The advice stated that when using the aggregation option Level 3 the outputs for some SPAs are erroneous and that the "manual for the MS Apportioning Tool notes that this tool option is only for illustrative purposes". However, the user manual of the R "apportionment tool" version 3 (Butler *et al.,* 2020) states "that the tool now allows the user to directly output data at the level of an SPA"; HiDef used V3 and had used Level 3 prior to receiving the MS-LOT advice (31st May 2022).

33. The apportioning was re-run in the Tool using option Level 1. Using this option, weightings are provided against individual subsites. The subsites then need to be aggregated and manually assigned to their corresponding SPA. The list of subsites and assignment to SPAs are given in Annex C. Following the approach suggested by MS-LOT, apportioning percentages for each subsite assigned to the SPA were summed. For sub-sites that straddled SPAs all birds were assigned to the SPA; this was a precautionary approach but in the absence of sub-site boundary files was the only option available.

NON-BREEDING SEASON

34. In the non-breeding season, seabirds are not tied to their breeding colonies, and many migrate to different regions or otherwise range widely. For all species, except guillemot and herring gull, non-breeding season birds were apportioned back to SPA breeding colonies using the information available in the report on

BDMPS (Furness, 2015). The BDMPS and associated abundance estimates were derived using a combination of data on demography, migration, and modelled population age structure from the UK and overseas.

35. The relevant BDMPS for the proposed Project for most species, is the UK North Sea and Channel waters; the exception is kittiwake where the relevant BDMPS is the UK North Sea waters. For most species the apportioning estimate for the non-breeding season wind farm effects is a proportion derived from the number of adult birds from each of the SPA populations of interest, expressed as a proportion of the total BDMPS population. This is then repeated to estimate the proportion of immature birds, with the adult to immature ratio determined from the stable age structure of population models for each species (Tables in Appendix A of Furness (2015)).

36. For kittiwake at Coquet Island SPA and several species at Farne Islands SPA (herring gull, lesser black-backed gull and razorbill) the population of adults and immatures in the UK North Sea waters BDMPS (or North Sea and Channel) were not available in Appendix A of Furness (2015). For these colonies and species, the most recent colony count (Table 3.3) was multiplied by the proportion of adults from the "UK North Sea non-SPA colonies" which are estimated to occur in the BDMPS during the non-breeding season. The number of adults was then multiplied by a correction (total number of UK North Sea & Channel immatures / total UK North Sea & Channel adults) to determine the number of immatures associated with the SPA in the BDMPS. The resulting number of adults and immatures was then expressed as a proportion of the total BDMPS population (as per pt. 34).

37. Non-breeding seasons have been defined according to NatureScot (2020). However, for the purposes of non-breeding season apportioning, seasonal adult and immature counts for the relevant BDMPS have been used for the BDMPS-defined seasons that best match those of NatureScot (2020). For kittiwake, gannet and razorbill the non-breeding season is more finely defined in Furness (2015) and apportioning weightings were derived accordingly (Table 3.3).

38. For guillemot, non-breeding season effects were apportioned against a regional population using the NatureScot approach (2018). The regional population is defined by the breeding season mean-max foraging range plus 1 SD, following NatureScot's Scoping advice (4th February 2022), and follow-on advice based on the results of Buckingham *et al*. (2022) (20th May 2022). Whilst this approach is conservative in terms of the number of SPAs considered, use of the wider BDMPS may underestimate effects on regional SPAs given that this species does not disperse widely in the non-breeding season (Buckingham *et al*., 2022). In the Firth of Forth, guillemots may return to their breeding colonies as early as October (Harris *et al*., 2006; Forrester *et al*., 2007).

39. Similarly for herring gull, non-breeding season effects are apportioned against a regional population using the NatureScot approach (2018). The regional population is defined by the breeding season mean-max foraging range plus 1 SD, following NatureScot's Scoping advice (4th February 2022). However, a correction was needed for the winter influx of continental breeding birds to eastern Scotland/UK. MSS advised (RM5; Technical Appendix 11.8) that the correction should be calculated from the proportions of overseas and western UK birds in the UK North Sea and Channel BDMPS (Furness, 2015). First the proportion of overseas breeders in the BDMPS was estimated; 135,130 birds from overseas populations within the BDMPS population of 466,511 (0.29), Secondly, the proportion of birds from western UK SPAs and non-SPA colonies within the BDMPS population was estimates (16,521/466,511 = 0.04). The final correction was the reciprocal of the sum of the proportions. The resultant correction (multiplier) 0.67 was used to adjust the number of estimated mortalities of herring gulls associated with each SPA after the apportionment had been undertaken and so is not apparent in the apportionment weightings shown for this species below.

40. For gannet, information on the proportions of birds migrating south or north from each colony based on tracking data of adults during the autumn and spring migrations (timings of which are defined by Furness (2015)) has been considered. The method follows that of McArthur Green (2015) for cumulative assessment of gannet collision risk in the UK North Sea and Channel at East Anglia THREE; the approach was subsequently used to apportion birds to gannet colonies for Seagreen (2019). For each colony, the method involved three steps:

- **Step 1:** Calculate the number of adult and immature birds from the SPAs moving north or south in the North Sea and Channel BDMPS during the relevant season (the "migrant population") (Table 3.5);
- **Step 2:** Adjust the abundance of birds in the migrant population that will potentially pass-through Berwick Bank taking account of the location of the Project with respect to the colonies and proportion flying north/south (i.e., south flying birds at colonies south of Berwick Bank are subtracted from the migrant population whilst north flying birds are added; north flying birds from colonies north of Berwick Bank are subtracted and south flying birds are added); and
- **Step 3:** Finally, for each SPA, multiply the total number of SPA individuals (step 1) by the proportion of adults/immatures, and as a proportion of the total seasonal migrant population in the North Sea and Channel that may fly through the proposed Berwick Bank.

41. The UK colony counts summarised in McArthur Green (2015) have, where possible, been updated in Table 3.5. These counts are consistent with those used for the NatureScot breeding season apportioning.

42. From step 1, the abundance of gannets estimated within the North Sea and Channel that could migrate through Berwick Bank during autumn migration was 276,570 birds. During spring migration, the abundance increased to 299,879 gannets.

Table 3.5: Updated Table Based on McArthur Green (2015) Summarising Gannet Colony Sizes and Numbers of Birds Flying North or South in the North Sea and English Channel BDMPS. AON = Apparently Occupied Nests; Prop = Proportion.

				Autumn migration through N Sea & English Channel				Spring migration through N Sea and English Channel			
				Fly south		Fly north		Fly north		Fly south	
Breeding colony	AON	No. adults	All ages	Prop	No.	Prop	No.	Prop	No.	Prop	No.
Iceland	37216	74432	134722	0.42	56583	0	0	0.1	13472	0	0
Norway	6000	12000	21720	0.5	10860	0	0	0.2	4344	0	0
Faroes	2500	5000	9050	0.42	3801	0	0	0.2	1810	0	0
Hermaness	15633	51160	92681	0.5	46341	0	0	0.5	46341	0	0
Noss	8652	27530	49873	0.5	24937	0	0	0.5	24937	0	0
Foula	1226	2452	4438	0.5	2219	0	0	0.5	2219	0	0
Fair Isle	1817	9942	18011	0.5	9006	0	0	0.5	9006	0	0
West Westray	751	1502	2719	0.5	1360	0	0	0.5	1360	0	0
Sule Skerry & Sule Stack	4675	18130	32844	0.1	3284	0	0	0	0	0	0
North Rona & Sula Sgeir	9225	22460	40688	0.1	4069	0	0	0	0	0	0
St. Kilda	60290	120580	218250	0.1	21825	0	0	0	0	0	0
Troup, Pennan & Lion's Heads	6456	12912	23371	0.63	14724	0.37	8647	0.27	6310	0.73	17061

Breeding colony	AON	No. adults	All ages	Autumn migration through N Sea & English Channel: Fly south Prop	Fly south No.	Fly north Prop	Fly north No.	Spring migration through N Sea and English Channel: Fly north Prop	Fly north No.	Fly south Prop	Fly south No.
Bass Rock	75259	150518	272437.8	0.63	171636	0.37	100802	0.27	73558	0.73	198880
Flamborough Head & Filey Coast	13392	26784	48479.26	0.75	36359	0.25	12120	0.5	24240	0.5	24240
Helgoland	656	1312	2375	1	2375	0	0	1	2375	0	0
Total	268357	536714	971942	-	374018	-	121569	-	176933	-	240180

4. RESULTS

4.1. BREEDING SEASON: NATURESCOT METHOD

43. The weightings derived for the breeding season were used to apportion mortality estimates to the SPAs and non-designated colonies. The apportionment also took account of age class information. For all species except the auks, age class information was derived from the data collected during the HiDef digital video surveys and reported in Technical Appendix 11.1: Ornithology Baseline.

44. For auks, the proportions of mature and immature birds for SPA populations were derived from the stable age structure of the population models developed and reported in Technical Appendix 11.6: Ornithology Population Viability Analysis.

HERRING GULL

45. The weightings for apportioning breeding season herring gulls to SPAs are given in Table 4.1 and a full list of all colonies in Annex A.

46. The weightings were used to apportion the estimates of the number of adult and immature herring gulls impacted during the breeding season by collision (Technical Appendix 11.3: Ornithology Collision Risk Modelling Report) to each of the SPAs and non-SPAs (Annex D).

Table 4.1: Apportionment of Herring Gulls to SPAs Which Include this Species As a Feature or As a Named Component of the Seabird Assemblage. The Residual Weight Assigned to Non-SPA Colonies Is also Shown.

SPA name	Count of adults	Distance to development (km)	1/proportion foraging range as sea	Resulting weight	Proportional weight
Forth Islands	11868	67	3.131	0.896	0.588
Fowlsheugh	1414	73	1.835	0.053	0.035
Farne Islands	1496	76	1.604	0.045	0.030
St Abb's Head to Fast Castle	612	56	1.883	0.040	0.026
Non-SPA colonies	12018	57 - 105	-	-	0.321

LESSER BLACK-BACKED GULL

47. The weightings for apportioning breeding season lesser black-backed gulls to SPAs are given in Table 4.2 and a full list of all colonies in Annex A.

48. The weightings were used to apportion the estimates of the number of adult and immature lesser black-backed gulls impacted during the breeding season by collision (Technical Appendix 11.3: Ornithology Collision Risk Modelling Report) to each of the SPAs and non-SPAs (Annex D).

Table 4.2: Apportionment of Lesser Black-backed Gulls to SPAs Which Include this Species As a Feature or As a Named Component of the Seabird Assemblage. The Residual Weight Assigned to Non-SPA Colonies Is also Shown.

SPA name	Count of adults	Distance to development (km)	1/proportion foraging range as sea	Resulting weight	Proportional weight
Forth Islands	4006	67	1.827	1.366	0.525
Farne Islands	1362	76	1.787	0.353	0.136
Coquet Island	40	110	1.774	0.005	0.002
Non-SPA colonies	6553	57-245	-	-	0.335

PUFFIN

49. The weightings for apportioning breeding season puffins to SPAs are given in Table 4.3 and a full list of all colonies in Annex A.

50. The weightings were used to apportion the estimates of the number of puffins impacted during the breeding season by displacement (Technical Appendix 11.4: Ornithology Displacement Report) to each of the SPAs and non-SPAs (Annex D).

Table 4.3 Apportionment of Puffins to SPAs Which Include this Species As a Feature or As a Named Component of the Seabird Assemblage. The Residual Weight Assigned to Non-SPA Colonies Is also Shown.

SPA name	Count of adults	Distance to development (km)	1/proportion foraging range as sea	Resulting weight	Proportional weight
Forth Islands	87240	67	1.733	3.725	0.500
Farne Islands	87504	76	1.697	2.843	0.382
Coquet Island	50058	110	1.735	0.794	0.107

SPA name	Count of adults	Distance to development (km)	1/proportion foraging range as sea	Resulting weight	Proportional weight
North Caithness Cliffs	3034	280	1.263	0.005	0.001
Flamborough & Filey Coast	958	263	1.731	0.003	0.001
Hoy	361	312	1.244	0.001	0.000
Non-SPA colonies	4395	59 - 282	-	-	0.008

GANNET

51. The weightings for apportioning breeding season gannets to SPAs are given in Table 4.4 and a full list of all colonies in Annex A.

52. The weightings were used to apportion the estimates of the number of adult and immature gannets impacted during the breeding season by collision (Technical Appendix 11.3: Ornithology Collision Risk Modelling Report) and displacement (Technical Appendix 11.4: Ornithology Displacement Report) at each SPA and non-SPAs (Annex D).

Table 4.4: Apportionment of Gannets to SPAs Which Include this Species As a Feature or As a Named Component of the Seabird Assemblage. The Residual Weight Assigned to Non-SPA Colonies Is also Shown.

SPA name	Count of adults	Distance to development (km)	1/proportion foraging range as sea	Resulting weight	Proportional weight
Forth Islands	150518	67	1.42	14.840	0.971
Flamborough & Filey Coast	26784	263	1.658	0.200	0.013
Hermaness, Saxa Vord and Valla Field	51160	507	1.162	0.072	0.005
Noss	27530	429	1.178	0.055	0.004
Sule Skerry and Sule Stack	18130	391	1.139	0.042	0.003
Fair Isle	9942	358	1.175	0.028	0.002
North Rona and Sula Sgeir	22460	475	1.133	0.035	0.002
Non-SPA colonies	7662	59 - 441	-	-	0.001

4.2. BREEDING SEASON: MSS METHOD

53. In the tables below, only those SPAs that were assigned a weighting greater than zero are summarised. The full list of SPAs presented as outputs by the MS Tool are given in Annex B.

54. Furthermore, those SPAs that are beyond the breeding season foraging range (mean max distance + 1 SD as per Woodward *et al.* (2019)) are given but identified *. Consequently, some SPA/species combinations included in the apportioning were not considered to have connectivity and were not screened in for assessment by the LSE screening exercise (SSE Renewables, 2021).

KITTIWAKE

55. The weightings for apportioning breeding season kittiwakes to SPAs are given in Table 4.5.The full outputs from the MS Tool are provided in Annex B.

56. The weightings were used to apportion the estimates of the number of adult and immature kittiwakes impacted during the breeding season by collision (Technical Appendix 11.3: Ornithology Collision Risk Modelling Report) and displacement (Technical Appendix 11.4: Ornithology Displacement Report) to each of the SPAs and non-SPAs (Annex D).

Table 4.5: Apportionment of Kittiwakes to SPAs Which Include this Species As a Feature or As a Named Component of the Seabird Assemblage. The Residual Weight Assigned to Non-SPA Colonies Is also Shown.

SPA name	Colony count	Distance to colony (km)	Proportional weight
St Abb's Head to Fast Castle	10904	51	0.522
Fowlsheugh	26542	81	0.172
Forth Islands	9034	88	0.057
Farne Islands	8804	65	0.045
Buchan Ness to Collieston Coast	22590	115	0.012
Troup, Pennan and Lion's Heads	21232	169	0.005
East Caithness Cliffs	48920	269	0.001
Flamborough and Filey Coast	91008	257	0.001
Coquet Island	932	96	0.000
Copinsay	1910	279	0.000
North Caithness Cliffs	7712	316	0.000
Hoy	608	309	0.000
Non-SPA total	**	-	0.173

***Not provided as output in the MS Tool.*

GUILLEMOT

57. The weightings for apportioning breeding season guillemots to SPAs are given in Table 4.6. The full outputs from the MS Tool are provided in Annex B.

58. The weightings were used to apportion the estimate of the number of guillemots impacted during the breeding season by displacement (Technical Appendix 11.4: Ornithology Displacement Report) to each SPA and non-SPAs (Annex D).

Table 4.6: Apportionment of Guillemots to SPAs Which Include this Species As a Feature or As a Named Component of the Seabird Assemblage. The Residual Weight Assigned to Non-SPA Colonies Is also Shown.

SPA name	Colony count	Distance to colony (km)	Proportional weight
St Abb's Head to Fast Castle	61408	54	0.416
Fowlsheugh	91358	80	0.359
Forth Islands	34580	67	0.109
Farne Islands	85816	76	0.088
Buchan Ness to Collieston Coast	39553	114	0.009
Troup, Pennan and Lion's Heads	31893	170	0.005
East Caithness Cliffs*	199966	268	0.002
North Caithness Cliffs*	38300	280	0.001
Non-SPA colonies	**	-	0.010

** Not screened in based on breeding season foraging range.*

***Not provided as output in the MS Tool.*

RAZORBILL

59. The weightings for apportioning breeding season razorbills to SPAs are given in Table 4.7. The full outputs from the MS Tool are provided in Annex B.

60. The weightings were used to apportion the estimated displacement mortality of razorbills during the breeding season (Technical Appendix 11.4: Ornithology Displacement Report) to each of the SPAs and non-SPAs (Annex D).

Table 4.7: Apportionment of Razorbills to SPAs Which Include this Species As a Feature or As a Named Component of the Seabird Assemblage. The Residual Weight Assigned to Non-SPA Colonies Is also Shown.

SPA name	Colony count	Distance to colony (km)	Proportional weight
Fowlsheugh	13296	79	0.292
Forth Islands	7878	87	0.265
St Abb's Head to Fast Castle	3928	52	0.231
East Caithness Cliffs	40117	269	0.023
Troup, Pennan and Lion's Heads	6054	172	0.021
Flamborough and Filey Coast *	37476	255	0.007
Farne Islands	572	66	0.004
North Caithness Cliffs*	3060	307	0.001
Non-SPA total	**	-	0.120

**Not screened in based on breeding season foraging range.*

***Not provided as output in the MS Tool.*

4.3. NON-BREEDING SEASON

61. For those species assessed at the scale of the relevant BDMPS, the tables below show those SPAs that were screened in based connectivity and those where the assigned weighting for the entire non-breeding season resulted in an apportioned mortality estimate of one bird or more; the full list of SPAs and weightings for those species assessed at the scale of the relevant BDMPS are given in Annex D.

62. For guillemot and herring gull, which were assessed at the regional population scale, the full list of weightings to SPA and non-SPA colonies is given in Annex A.

KITTIWAKE

63. The non-breeding season defined by NatureScot (2020) is approximated by the post-breeding migration (August-December) and return migration (January – April) of Furness (2015).

64. The weightings for apportioning non-breeding season adult and immature kittiwake to SPAs are given in Table 4.8 for the post-breeding migration, and Table 4.9 for the return migration.

65. The weightings were used to apportion the estimates of the numbers of adult and immature kittiwakes in the UK North Sea BDMPS during the non-breeding season by collision (Technical Appendix 11.3: Ornithology Collision Risk Modelling Report) and displacement (Technical Appendix 11.4: Ornithology Displacement Report) to each of the SPAs and non-SPAs (Annex D).

Table 4.8: Apportionment of Mortality for Adult and Immature Kittiwakes within the UK North Sea BDMPS During the Non-Breeding Season (Post-breeding Migration: August - December). The Residual Weight Assigned to Non-SPA Colonies Is also Shown.

SPA name	UK North Sea adults associated with the SPA	UK North Sea immatures associated with the SPA	UK North Sea total birds	Proportion adults	Proportion immatures
St Abb's Head to Fast Castle	4084	2396	829937	0.005	0.003
Fowlsheugh	11204	6573	829937	0.013	0.008
Forth Islands	3720	2182	829937	0.004	0.003
Farne Islands	4132	2424	829937	0.005	0.003
Buchan Ness to Collieston Coast	15050	8830	829937	0.018	0.011
Troup, Pennan and Lion's Heads	17875	10487	829937	0.022	0.013
East Caithness Cliffs	48492	28449	829937	0.058	0.034
Flamborough and Filey Coast	45140	26482	829937	0.054	0.032
Coquet Island	559-	336-	829937-	0.001	0.000
Copinsay	799	469	829937	0.001	0.001
North Caithness Cliffs	12180	7146	829937	0.015	0.009
Hoy	476	279	829937	0.001	0.000
West Westray	14466	8487	829937	0.017	0.010
Rousay	2117	1242	829937	0.003	0.001
UK North Sea non-SPA total	84000	49280	829937	0.101	0.059
UK Western non-SPA colonies	600	2640	829937	0.001	0.003

Table 4.9: Apportionment of Adult and Immature Kittiwake within the UK North Sea BDMPS During the Non-Breeding Season (Return Migration: January - April). The Residual Weight Assigned to Non-SPA Colonies Is also Shown.

SPA name	UK North Sea adults associated with the SPA	UK North Sea immatures associated with the SPA	UK North Sea total birds	Proportion adults	Proportion immatures
St Abb's Head to Fast Castle	4084	1797	627816	0.007	0.003
Fowlsheugh	11204	4930	627816	0.018	0.008
Forth Islands	3720	1637	627816	0.006	0.003
Farne Islands	4132	1818	627816	0.007	0.003
Buchan Ness to Collieston Coast	15050	6622	627816	0.024	0.011
Troup, Pennan and Lion's Heads	17875	7865	627816	0.028	0.013
East Caithness Cliffs	48492	21336	627816	0.077	0.034
Flamborough and Filey Coast	45140	19862	627816	0.072	0.032
Coquet Island	559-	336-	627816-	0.001	0.000
Copinsay	799	352	627816	0.001	0.001
North Caithness Cliffs	12180	5359	627816	0.019	0.009
Hoy	476	210	627816	0.001	0.000
West Westray	14466	6365	627816	0.023	0.010
UK North Sea non-SPA total	84000	36960	627816	0.134	0.059
UK Western non-SPA colonies	600	1056	627816	0.001	0.002

HERRING GULL

66. Apportioning of non-breeding season herring gulls from SPAs was carried out as per the breeding season using the NatureScot method. The weightings for apportioning non-breeding season impacts on herring gulls to SPAs are given in Table 4.10.

67. The weightings were used to apportion the estimates of mortality from collision (Technical Appendix 11.3: Ornithology Collision Risk Modelling Report) to each of the SPAs and non-SPAs. The apportioned mortalities associated with each SPA were corrected (paragraph 38) to take account of the influx of birds from non-UK colonies.

Table 4.10: Apportionment of Adult Herring Gulls within a Regional Population During The Non-Breeding Season. The Residual Weight Assigned to Non-SPA Colonies Is also Shown.

SPA name	Count of adults	Distance to development	1/proportion foraging range as sea	Resulting weight	Proportional weight
Forth Islands	11868	67	3.131	0.896	0.588
Fowlsheugh	1414	73	1.835	0.053	0.035
Farne Islands	1496	76	1.604	0.045	0.030
St Abb's Head to Fast Castle	612	56	1.883	0.04	0.026
Non-SPA total	12018	57 - 105	-	-	0.326

LESSER BLACK-BACKED GULL

68. The non-breeding season defined by NatureScot (2020) is approximated by the autumn migration (August – October), winter (November - February) and spring migration (March – April) of Furness (2015).

69. The non-breeding season estimates of adult and immature birds impacted by collision were zero (Technical Appendix 11.3: Ornithology Collision Risk Modelling Report). Therefore, apportioned mortality estimates to all SPAs for this species during the non-breeding season are all zero.

70. However, the weightings for apportioning non-breeding season lesser black-backed gull to SPAs are given in Annex D

GUILLEMOT

71. Apportioning of non-breeding season guillemots from SPAs was carried out as per the breeding season using the NatureScot method and given in Table 4.11. Annex A has the full list of colonies.

72. The weightings have been used to apportion the estimates of the numbers of guillemots during the non-breeding season at risk of mortality from displacement (Technical Appendix 11.4: Ornithology Displacement Report) to each of the SPAs and non-SPAs (Annex D).

Table 4.11 Apportionment of Guillemot within a Regional Population During the Non-Breeding Season. The Residual Weight Assigned to Non-SPA Colonies Is also Shown.

SPA name	Count of adults	Distance to development	1/proportion foraging range as sea	Resulting weight	Proportional weight
St Abb's Head to Fast Castle	61408	56	2.139	0.412	0.330
Fowlsheugh	91358	73	1.656	0.279	0.223
Farne Islands	85816	76	1.758	0.257	0.206
Forth Islands	34580	67	2.603	0.197	0.158
Buchan Ness to Collieston Coast	39553	120	1.379	0.037	0.030
Troup, Pennan and Lion's Heads	31893	171	1.534	0.033	0.026
Non-SPA total	-	-	-	-	0.030

RAZORBILL

73. The non-breeding season defined by NatureScot (2020) is approximated by the autumn migration (August – October), winter (November - December) and spring migration (January - March) of Furness (2015).

74. The weightings for apportioning the non-breeding season razorbill to SPAs are given in Table 4.12 for the autumn and spring migrations, and in Table 4.13 for the winter.

75. The weightings were used to apportion the estimates of the numbers of adult and immature razorbills in the UK North Sea and Channel BDMPS during the non-breeding season at risk of mortality from displacement (Technical Appendix 11.4: Ornithology Displacement Report) to each of the SPAs and non-SPAs (Annex D).

Table 4.12: Apportionment of Adult and Immature Razorbills within the UK North Sea and Channel BDMPS During the Non-Breeding Season (Autumn and Spring Migrations: August – October, January – March).

SPA name	UK North Sea adults associated with the SPA	UK North Sea immatures associated with the SPA	UK North Sea total birds	Proportion adults	Proportion immatures
Fowlsheugh	7048	4757	591874	0.012	0.008
Forth Islands	5250	3544	591874	0.009	0.006
St Abb's Head to Fast Castle	2438	1646	591874	0.004	0.003
Buchan Ness to Collieston Coast	5833	4141	591874	0.010	0.007
Troup, Pennan and Lion's Heads	3486	2353	591874	0.006	0.004
Farne Islands	427	303	591874	0.001	0.001
Flamborough and Filey Coast	20002	15002	591874	0.034	0.025
North Caithness Cliffs	3230	2295	591874	0.005	0.004
East Caithness Cliffs	25000	16875	591874	0.042	0.029
UK North Sea non-SPA	20000	13500	591874	0.034	0.023
UK Western non-SPA	400	750	591874	0.001	0.001

Table 4.13: Apportionment of Adult and Immature Razorbills within the UK North Sea and Channel BDMPS During the Non-Breeding Season (Winter: November - December).

SPA name	UK North Sea adults associated with the SPA	UK North Sea immatures associated with the SPA	UK North Sea total birds	Proportion adults	Proportion immatures
Fowlsheugh	2114	529	218622	0.010	0.002
Forth Islands	1575	394	218622	0.007	0.002
St Abb's Head to Fast Castle	731	183	218622	0.003	0.001
Buchan Ness to Collieston Coast	1750	455	218622	0.008	0002
Troup, Pennan and Lion's Heads	1064	261	218622	0.005	0.001
Farne Islands	128	33	218622	0.001	0.000
Flamborough and Filey Coast	6001	1500	218622	0.027	0.007
North Caithness Cliffs	1020	255	218622	0.005	0.001
East Caithness Cliffs	7500	1875	218622	0.034	0.009
UK North Sea non-SPA	6000	1500	218622	0.027	0.007
UK Western non-SPA	2000	750	218622	0.009	0.003

GANNET

76. The non-breeding season based on NatureScot (2020) is approximated by the autumn migration (October to November) and spring migration (December to March) of Furness (2015).

77. The weightings for apportioning the non-breeding season gannet to SPAs are given in Table 4.14 for the autumn migrations, and in Table 4.15 for the rest of the spring migration.

78. As the proportions of birds from each SPA flying north/south changes depending on the migration period, so too does the proportion of birds at risk of collision with the Proposed Development Apportioning was therefore carried out separately for the autumn and spring migrations, and the weightings used to apportion the estimates of adult birds in the UK North Sea and Channel BDMPS by collision (Technical Appendix 11.3: Ornithology Collision Risk Modelling Report) to each of the SPAs in Appendix 11.6 Ornithology Population Viability Analysis Technical Appendix for each migration period.

Table 4.14: Apportioning of Gannets within the UK North Sea and Channel BDMPS during Autumn Migration (September to November) (Furness, 2015).

SPA name	Adults at SPA	Total adults and immatures in BDMPS	Number birds migrating south	Number birds migrating north	Total birds passing through Berwick Bank	Proportion adults	Proportion immatures
Forth Islands	150518	272438	171636	100802	312029	0.18	0.15
Flamborough & Filey Coast	26784	48479	36359	12120	312029	0.02	0.02
Hermaness, Saxa Vord and Valla Field	31266	56592	28296	0	312029	0.05	0.00
Noss	17304	31321	15660	0	312029	0.03	0.00
North Rona and Sula Sgeir	18450	33394	3339	0	312029	0.01	0.00
Sule Skerry and Sule Stack	9350	16924	1692	0	312029	0.00	0.00
Fair Isle	3634	6578	3289	0	312029	0.01	0.00

Table 4.15: Apportioning of Gannets within the UK North Sea and Channel BDMPS during Spring Migration (December to March) (Furness, 2015).

SPA name	Adults at SPA	Total adults and immatures in BDMPS	Number birds migrating south	Number birds migrating north	Total birds passing through Berwick Bank	Proportion adults	Proportion immatures
Forth Islands	150518	272438	198880	73558	333113	0.33	0.10
Flamborough & Filey Coast	26784	48479	24240	24240	333113	0.04	0.03
Hermaness, Saxa Vord and Valla Field	31266	56592	0	28296	333113	0.05	0.04
Noss	17304	31321	0	15660	333113	0.03	0.02
North Rona and Sula Sgeir	18450	33394	0	0	333113	0.00	0.00
Sule Skerry and Sule Stack	9350	16924	0	0	333113	0.00	0.00
Fair Isle	3634	6578	0	3289	333113	0.01	0.00

5. CONCLUSION

79. Apportioning provides a means of determining the proportions of birds and their colonies of origin within the Development area. The weightings/proportions in Section 4 were used to apportion breeding season and non-breeding season species specific estimated mortalities of birds (from collision and/or displacement) to their likely colony of origin (i.e., SPA or non-designated colony) (Annex D).

80. For kittiwake, apportioning using the MSS method predicted that the greatest proportion of birds at the Proposed Development area are from the St Abb's Head to Fast Castle SPA (52.2%). A further 17.2% of birds are apportioned to Fowlsheugh SPA. During the non-breeding season, proportions of adults are highest from East Caithness Cliffs SPA and Flamborough and Filey Coast SPA during the autumn (5.8% and 5.4% respectively) and spring migrations (7.7% and 7.2% respectively).

81. For herring gull, the greatest proportion of birds at the Proposed Development Array area are likely from the Forth Islands SPA in both the breeding and non-breeding seasons (same apportioning method; 58.8%). Mortality estimates at the colonies during the non-breeding season were adjusted for the influx of winter birds (Annex D).

82. For lesser black backed gull, 52.5% of birds at the Proposed Development Array area are likely from the Forth Islands SPA during the breeding season. During the non-breeding season, this proportion is significantly reduced for this SPA at 4.1% adults during winter; however, there is no predicted non-breeding season mortality for this species (Annex D). Breeding season proportions for the Farne Islands SPA and Coquet Island SPA were 13.6% and 0.2%, respectively.

83. For guillemot, the majority of birds at the Proposed Development area during the breeding season likely originate from the St Abbs Head to Fast Castle SPA (41.6%) and Fowlsheugh SPA (35.9%). A further 10.9% of birds are apportioned to the Forth Islands SPA. During the non-breeding season, the highest proportion of birds in the regional population were associated with St Abb's Head to Fast Castle, Fowlsheugh and Farne Islands SPAs at 33%, 22.3% and 20.6% respectively.

84. For razorbill, apportioned birds during the breeding season are almost equal between Fowlsheugh SPA (29.2%) and Forth Islands SPA (26.5%). A further 23.1% of birds are apportioned to St Abb's Head to Fast Castle SPA during the breeding season. Non-breeding season proportions were highest for the East Caithness Cliffs SPA and the Flamborough and Filey Coast SPA during autumn and spring migrations (4.2% and 3.4%, respectively) and winter (3.4% and 2.7%, respectively).

85. For puffin, breeding season birds at the Proposed Development area are primarily apportioned between Forth Islands SPA (50%), Farne Islands SPA (38.2%) and Coquet Island SPA (10.6%). Non-breeding season impacts on puffin were not assessed.

86. For gannet, 97.1% of breeding season birds are apportioned to the Forth Islands SPA. A further 18% and 33% of non-breeding season adult birds (autumn and spring migration, respectively) are attributed to the Forth Islands SPA.

6. SUMMARY

87. Apportioning provides a means of determining the proportions of birds and their colonies of origin within the Proposed Development area. Furthermore, the results from apportioning allow the impacts to be allocated across each of the relevant Special Protected Areas (SPAs). Potential impacts from collision and displacement are presented in the Ornithology Technical Appendices 11.3 and 11.4, respectively and the apportioned impacts by age class are provided in Annex D.

88. Apportioning has been undertaken for the following species:

- Kittiwake *Rissa tridactyla*
- Herring gull *Larus argentatus*
- Lesser black backed gull *Larus fuscus*
- Guillemot *Uria aalge*
- Razorbill *Alca torda*
- Puffin *Fratercula arctica*
- Gannet *Morus bassanus*

89. In the breeding season, apportioning to breeding colonies at SPAs and non-designated colonies within "foraging range" of the proposed Berwick Bank development has been undertaken using:

- NatureScot's interim guidance apportioning method (NatureScot, 2018); and
- Marine Scotland Science (MSS) apportioning method using Wakefield *et al*. (2017; 2019) and implemented through the MS Apportioning Tool.

90. Following the advice of NatureScot and Marine Scotland Science given through the Ornithology RoadMap process, foraging ranges were defined as the mean max foraging range + 1 SD from Woodward *et al*. (2019) for the NatureScot approach. The MSS method uses the maximum observed foraging range from GPS data and adds a 10% buffer to account for potentially unobserved foraging trips. Consequently, the lists of SPAs with connectivity derived from the two methods are not comparable.

91. In the non-breeding season, for all species except guillemot and herring gull, the information from Furness (2015) on Biologically Defined Minimum Population Scales (BDMPS) has been used, this included using a methodology for gannet that took account of seasonal migrations. For guillemot and herring gull, non-breeding season estimates are apportioned based on breeding season population sizes. For herring gull, a correction factor was applied to account for the influx of birds from overseas into the regional population during the non-breeding season.

92. For kittiwake, apportioning using the MSS method predicted that the greatest proportion of birds at the Proposed Development area are from the St Abb's Head to Fast Castle SPA (52.2%). A further 17.2% of birds are apportioned to Fowlsheugh SPA. During the non-breeding season, proportions of adults are highest from East Caithness Cliffs SPA and Flamborough and Filey Coast SPA during the autumn (5.8% and 5.4% respectively) and spring migrations (7.7% and 7.2% respectively).

93. For herring gull, the greatest proportion of birds at the Proposed Development area are likely from the Forth Islands SPA in both the breeding and non-breeding seasons (same apportioning method; 58.8%). Mortality estimates at the colonies during the non-breeding season were adjusted for the influx of winter birds.

94. For lesser black backed gull, 52.5% of birds at the Proposed Development Array area are likely from the Forth Islands SPA during the breeding season. During the non-breeding season, this proportion is significantly reduced for this SPA at 4.1% adults during winter, however there is no non-breeding season mortality for this species (Annex D). Breeding season proportions for the Farne Islands SPA and Coquet Island SPA were 13.6% and 0.2%, respectively.

95. For guillemot, using the MSS method, the majority of birds at the Proposed Development area during the breeding season likely originate from the St Abbs Head to Fast Castle SPA (41.6%) and Fowlsheugh SPA (35.9%). A further 10.9% of birds are apportioned to the Forth Islands SPA. During the non-breeding season, the highest proportion of birds in the regional population were associated with St Abb's Head to Fast Castle, Fowlsheugh and Farne Islands SPAs at 33%, 22.3% and 20.6% respectively.

96. For razorbill, based on the MSS method, apportioned birds during the breeding season are almost equal between Fowlsheugh SPA (29.2%) and Forth Islands SPA (26.5%). A further 23.1% of birds are apportioned to St Abb's Head to Fast Castle SPA during the breeding season. Non-breeding season proportions were highest for the East Caithness Cliffs SPA and the Flamborough and Filey Coast SPA during autumn and spring migrations (4.2% and 3.4%, respectively) and winter (3.4% and 2.7%, respectively).

97. For puffin, breeding season birds at the Proposed Development area are primarily apportioned between Forth Islands SPA (50%), Farne Islands SPA (38.2%) and Coquet Island SPA (10.6%). Non-breeding season impacts on puffin were not assessed.

98. For gannet, 97.1% of breeding season birds are apportioned to the Forth Islands SPA. A further 18% and 33% of non-breeding season adult birds (autumn and spring migration, respectively) are attributed to the Forth Islands SPA.

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ANNEX A SPA AND NON-SPA BREEDING SEASON APPORTIONING RESULTS BASED ON THE NATURESCOT METHOD (2018)

GANNET

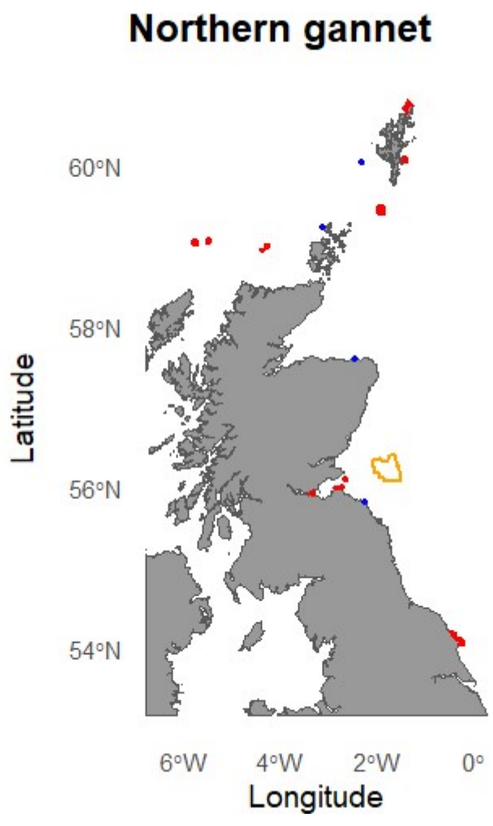

Figure A.1: **Sites Included in the Breeding Season Apportioning Calculations for Northern Gannet. The Orange Area Is the Site of the Proposed Development. The Red Areas Represent the SPAs and the Blue Areas Represent the Non-Designated Sites Included in the Apportioning Calculations.**

Table A.1: **Apportionment of Adult Northern Gannet on Site for SPAs and Non-Designated Breeding Populations. Mean Max Foraging Range + 1 SD = 509.4 km.**

SPA/colony name	SPA/colony code	Count of adults	Year	Distance to development	1/proportion foraging range as sea	Resulting weight	Proportional weight
Forth Islands SPA	UK9004171	150518	2014	67	1.420	14.840	0.971
Flamborough & Filey Coast SPA	UK9006101	26784	2017	263	1.658	0.200	0.013
Hermaness, Saxa Vord and Valla Field SPA	UK9002011	51160	2014	507	1.162	0.072	0.005
Noss SPA	UK9002081	27530	2019	429	1.178	0.055	0.004
Sule Skerry and Sule Stack SPA	UK9002181	18130	2013 /18	391	1.139	0.042	0.003
Fair Isle SPA	UK9002091	9942	2021	358	1.175	0.028	0.002
North Rona and Sula Sgeir SPA	UK9001011	22460	2013	475	1.133	0.035	0.002
Foula	98223	4886	2021	441	1.140	0.009	0.001
Noup Cliffs RSPB (West Westray 2)	84398	2768	2021	373	1.133	0.007	0.000
St Abb's Head NNR	85934	8	2019	59	1.445	0.001	0.000

GUILLEMOT

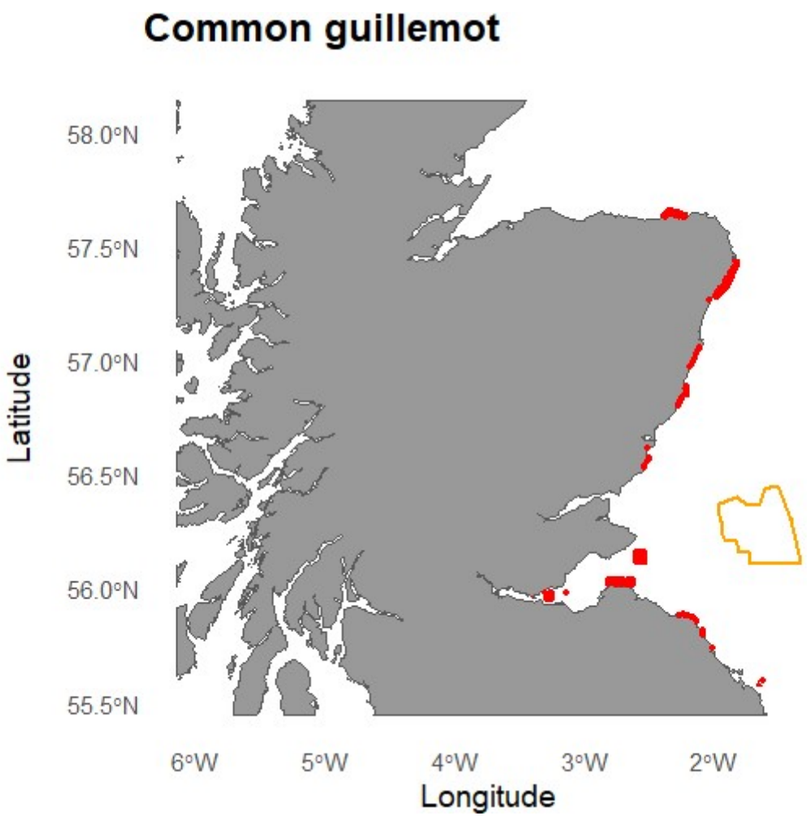

Figure A.2: **Sites Included in the Breeding Season Apportioning Calculations for Common Guillemot. The Orange Area Is the Site of the Proposed Development. The Red Areas Represent the SPAs and the Blue Areas Represent the Non-Designated Sites Included in the Apportioning Calculations.**

Table A.2: **Apportionment of Adult Common Guillemot on Site for SPAs and Non-Designated Breeding Populations. Mean Max Foraging Range + 1 SD = 153.7 Km. Note that these Weightings Were Used for Non-Breeding Season Apportioning as Representative of the Regional Population.**

SPA/colony name	SPA/colony code	Count of adults	Year	Distance to development	1/proportion foraging range as sea	Resulting weight	Proportional weight
St Abb's Head to Fast Castle	UK9004271	61408.00	2016 - 2018	56	2.139	0.356	0.325
Fowlsheugh	UK9002271	91359.00	2018	73	1.656	0.242	0.221
Farne Islands	UK9006021	85816.00	2019	76	1.758	0.222	0.203
Forth Islands	UK9004171	34580.00	2018 - 2021	67	2.603	0.171	0.156
East Caithness Cliffs	UK9001182	199966.00	2015	274	1.550	0.035	0.032
Buchan Ness to Collieston Coast	UK9002491	39552.78	2019	120	1.379	0.032	0.029
Troup, Pennan and Lion's Heads	UK9002471	31893.00	2017	171	1.534	0.014	0.013
Whistleberry	79002	1921.00	2017	79	1.709	0.004	0.004
Whiting Ness to Ethie Haven 4	86001	721.00	2018	69	2.188	0.003	0.003
The Slainges	78999	852.00	2017	82	1.691	0.002	0.002
Rouen Bay	79000	758.00	2017	79	1.701	0.002	0.002
Whiting Ness to Ethie Haven 7	86006	528.00	2018	68	2.128	0.002	0.002
Inchkeith	89748	212.00	2021	105	3.322	0.001	0.001
Swirl Cove	79001	295.00	2017	79	1.706	0.001	0.001
Kineff	79003	410.00	2017	79	1.716	0.001	0.001
Eyemouth to Burnmouth 1	85943	136.00	2000	62	2.031	0.001	0.001
Eyemouth to Burnmouth 2	85944	280.00	2018	62	2.029	0.001	0.001
Eyemouth to Burnmouth 4	85946	130.00	2018	59	2.032	0.001	0.001
Eyemouth to Burnmouth 5	85947	150.00	2018	59	2.031	0.001	0.001
Eyemouth to Burnmouth 6	85948	130.00	2018	59	2.030	0.001	0.001

SPA/colony name	SPA/colony code	Count of adults	Year	Distance to development	1/proportion foraging range as sea	Resulting weight	Proportional weight
Whiting Ness to Ethie Haven 8	86007	331.00	2018	69	2.111	0.001	0.001
Hare Ness to Seal's Cove	86718	628.00	2017	99	1.520	0.001	0.001
Seal's Cove to Findon Ness	86719	549.00	2017	99	1.531	0.001	0.001
Inchcolm	89745	1.00	2008	117	3.489	0.000	0.000
Newtonhill - May Craig	78973	311.00	2017	95	1.573	0.000	0.000
Cove Bay	78995	168.00	2017	102	1.507	0.000	0.000
Little John's Haven	79004	129.00	2017	79	1.720	0.000	0.000
Darn Bay	79005	82.00	2017	79	1.728	0.000	0.000
Yellow Ark	79006	58.00	2017	76	1.734	0.000	0.000
Berwick 3	84127	45.00	2000	67	1.986	0.000	0.000
Muchalls	85189	3.00	2017	96	1.585	0.000	0.000
Eyemouth to Burnmouth 3	85945	6.00	2018	59	2.031	0.000	0.000
Eyemouth to Burnmouth 7	85949	20.00	2018	59	2.029	0.000	0.000
Whiting Ness to Ethie Haven 5	86002	5.00	2000	69	2.179	0.000	0.000
Auchmithie	86003	16.00	2018	71	2.170	0.000	0.000
Whiting Ness to Ethie Haven 9	86008	7.00	2018	69	2.100	0.000	0.000
Buckiemill	86014	20.00	2017	70	2.080	0.000	0.000
Burn of Daff to Newtonhill	86722	335.00	2017	95	1.562	0.000	0.000
Cove to Hare Ness	87471	54.00	2017	102	1.514	0.000	0.000
Sands of Forvie	90877	59.00	2019	124	1.437	0.000	0.000
Black Slough to Burn of Daff	110487	12.00	2017	98	1.543	0.000	0.000

HERRING GULL

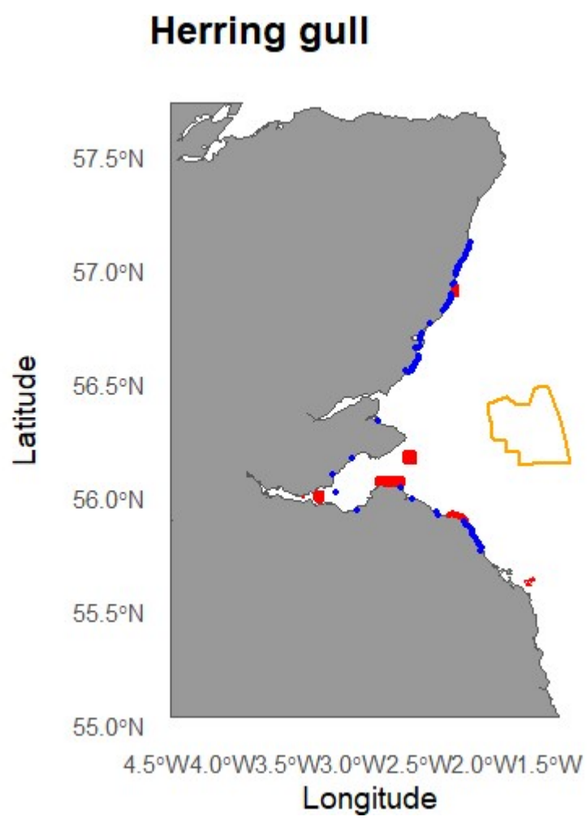

Figure A.3: **Sites Included in the Breeding Season Apportioning Calculations for Herring Gull. The Orange Area Is the Site of the Proposed Development. The Red Areas Represent the SPAs and the Blue Areas Represent the Non-Designated Sites Included in the Apportioning Calculations.**

Table A.3: Apportionment of Adult Herring Gull on Site for SPAs and Non-Designated Breeding Populations. Mean Max Foraging Range + 1 SD = 85.6 Km. Note that these Weightings Were Used for Non-Breeding Season Apportioning as Representative pf the Regional Population.

SPA/colony name	SPA/colony code	Count of adults	Year	Distance to development	1/proportion foraging range as sea	Resulting weight	Proportional weight
Forth Islands SPA	UK9004171	11868	2019 – 2021	67	3.131	0.896	0.588
Inchkeith	89748	5008	2016	105	4.661	0.229	0.150
Fowlsheugh SPA	UK9002271	1414	2018	73	1.835	0.053	0.035
Farne Islands SPA	**UK9006021**	**1496**	2019	**76**	**1.604**	**0.045**	**0.030**
St Abb's Head to Fast Castle SPA	UK9004271	612	2016 – 2020	56	1.883	0.040	0.026
Montrose Town (urban)	95870	790	2018	73	2.046	0.033	0.022
St Abbs to Eyemouth 2	85939	336	2018	57	1.796	0.020	0.013
Berwick-on-tweed & Tweedmouth	95897	492	1998	70	1.789	0.019	0.012
Catterline Bay within SPA	78997	514	2017	82	1.866	0.015	0.010
Whiting Ness to Ethie Haven 1	85998	366	2018	72	2.131	0.016	0.010
Braidon Bay	78998	418	2017	82	1.869	0.013	0.009
Rouen Bay	79000	318	2017	79	1.863	0.010	0.007
Yellow Ark	79006	280	2017	76	1.878	0.010	0.007
Strathlethan Bay	78933	272	2021	87	1.864	0.007	0.005
Eyemouth to Burnmouth 5	85947	128	2018	59	1.768	0.007	0.005
Whiting Ness to Ethie Haven 8	86007	175	2018	69	2.018	0.008	0.005
The Slainges	78999	200	2017	82	1.859	0.006	0.004
Burn of Daff to Newtonhill	86722	264	2017	95	1.778	0.006	0.004
Berwick 7	84131	86	2000	64	1.772	0.004	0.003
Eyemouth to Burnmouth 4	85946	72	2018	59	1.771	0.004	0.003
Whiting Ness to Ethie Haven 7	86006	84	2018	68	2.031	0.004	0.003
Buckiemill	86014	116	2017	70	2.06	0.005	0.003
Findon Ness to Black Slough	86720	178	2017	96	1.735	0.004	0.003
Dunbar Coast	99010	92	2000	71	2.395	0.005	0.003
Old Hall Bay – Castle Haven	78932	124	2018	87	1.876	0.003	0.002
Whistleberry	79002	90	2017	79	1.864	0.003	0.002
Eyemouth to Burnmouth 1	85943	50	2018	62	1.78	0.003	0.002
Arbroath (urban)	86012	64	2019	72	2.19	0.003	0.002
Broomfield Ind. Est.	110696	65	2018	74	2.048	0.003	0.002
Methil Docks	100960	16	2021	94	3.599	0.001	0.001
Prestonpans Station	113444	42	2021	102	4.048	0.002	0.001
May Craig – Muchalls	78974	82	2017	95	1.8	0.002	0.001
Greg Ness – Seals Hole	78993	44	2017	104	1.682	0.001	0.001

SPA/colony name	SPA/colony code	Count of adults	Year	Distance to development	1/proportion foraging range as sea	Resulting weight	Proportional weight
Cove Bay	78995	34	2017	102	1.701	0.001	0.001
Kineff	79003	44	2017	79	1.867	0.001	0.001
Little John's Haven	79004	34	2017	79	1.868	0.001	0.001
Darn Bay	79005	32	2017	79	1.874	0.001	0.001
Gourdon	79015	46	2017	77	1.888	0.002	0.001
East Fergus Place	79324	20	1999	105	4.587	0.001	0.001
Berwick 3	84127	16	2000	67	1.762	0.001	0.001
Berwick 5	84129	18	2000	67	1.77	0.001	0.001
Berwick 6	84130	38	2000	67	1.771	0.002	0.001
Muchalls	85189	58	2017	96	1.812	0.001	0.001
Doonie Point to Hall Bay	85190	78	2017	93	1.82	0.002	0.001
Reed Point to Cove	85918	40	2018	61	2.107	0.002	0.001
St Abbs to Eyemouth 1	85938	22	2018	59	1.799	0.001	0.001
St Abbs to Eyemouth 3	85940	14	2018	60	1.805	0.001	0.001
Eyemouth to Burnmouth 2	85944	40	2018	62	1.768	0.002	0.001
Eyemouth to Burnmouth 3	85945	32	2018	59	1.769	0.002	0.001
Eyemouth to Burnmouth 7	85949	32	2018	59	1.762	0.002	0.001
Eyemouth to Burnmouth 8	85950	32	2018	59	1.76	0.002	0.001
Burnmouth 1	85966	32	2000	62	1.78	0.002	0.001
Burnmouth 3	85968	14	2018	65	1.775	0.001	0.001

SPA/colony name	SPA/colony code	Count of adults	Year	Distance to development	1/proportion foraging range as sea	Resulting weight	Proportional weight
Whiting Ness to Ethie Haven 3	86000	25	2018	69	2.095	0.001	0.001
Whiting Ness to Ethie Haven 4	86001	52	2018	69	2.084	0.002	0.001
Whiting Ness to Ethie Haven 5	86002	28	2018	69	2.075	0.001	0.001
Auchmithie	86003	12	2018	71	2.066	0.001	0.001
Rickle Craig to Scurdie Ness 2	86016	38	2017	71	2.012	0.002	0.001
Ferryden (urban)	86021	48	2018	73	2.035	0.002	0.001
Hare Ness to Seal's Cove	86718	36	2017	99	1.722	0.001	0.001
Seal's Cove to Findon Ness	86719	36	2017	99	1.737	0.001	0.001
Cove to Hare Ness	87471	44	2017	102	1.712	0.001	0.001
Eyemouth (urban)	95896	30	2019	60	1.775	0.002	0.001
Black Slough to Burn of Daff	110487	62	2017	98	1.75	0.001	0.001
St. Baldred's Boat	85814	2	2021	74	2.547	0.000	0.000
Newtonhill – May Craig	78973	20	2017	95	1.794	0.000	0.000
Perthumie Bay 1	78986	2	2017	93	1.834	0.000	0.000
Perthumie Bay 2	78987	16	2017	93	1.842	0.000	0.000
Perthumie Bay 3	78988	10	2017	93	1.844	0.000	0.000

SPA/colony name	SPA/colony code	Count of adults	Year	Distance to development	1/proportion foraging range as sea	Resulting weight	Proportional weight
Skatie Shore	78990	2	2017	90	1.849	0.000	0.000
Burnbanks	78994	12	2017	102	1.698	0.000	0.000
Swirl Cove	79001	14	2017	79	1.865	0.000	0.000
Rob's Cove	79007	2	2017	76	1.878	0.000	0.000
Craig David	79008	2	1999	77	1.88	0.000	0.000
Mathers	79018	10	2000	74	1.978	0.000	0.000
St. Andrews 1	79032	2	1999	76	2.73	0.000	0.000
Berwick 4	84128	6	2000	67	1.77	0.000	0.000
Pease Burn to Redheugh Cottages	85921	2	2018	62	2.083	0.000	0.000
St Abbs to Eyemouth 4	85941	6	2018	60	1.782	0.000	0.000
Eyemouth to Burnmouth 6	85948	8	2018	59	1.766	0.000	0.000
Burnmouth 2	85967	6	2018	62	1.771	0.000	0.000
Burnmouth 4	85969	6	2018	65	1.774	0.000	0.000
Whiting Ness to Ethie Haven 2	85999	2	2018	69	2.103	0.000	0.000
Rumkemno	86004	8	2018	71	2.058	0.000	0.000
Whiting Ness to Ethie Haven 6	86005	6	2001	71	2.045	0.000	0.000
Whiting Ness to Ethie Haven 9	86008	5	2018	69	2.012	0.000	0.000
Whiting Ness to Ethie Haven 10	86009	2	2001	69	2.013	0.000	0.000
Rickle Craig to Scurdie Ness 1	86015	8	2001	71	2.039	0.000	0.000
St Cyrus NNR	91104	2	2017	74	1.989	0.000	0.000
St Abbs (urban)	95895	4	2019	59	1.798	0.000	0.000

LESSER BLACK-BACKED GULL

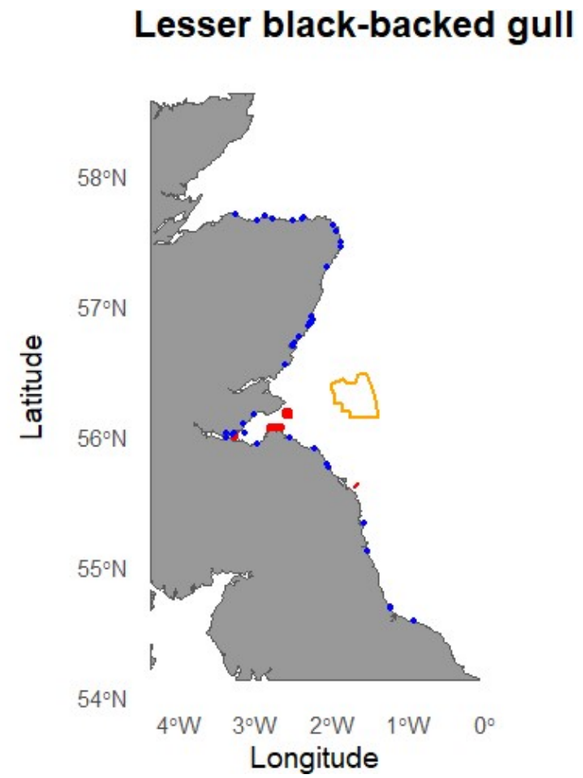

Figure A.4: Sites Included in the Breeding Season Apportioning Calculations for Lesser Black-Backed Gull. The Orange Area Is the Site of the Proposed Development. The Red Areas Represent the SPAs and the Blue Areas Represent the Non-Designated Sites Included in the Apportioning Calculations.

Table A.4: Apportionment of Adult Lesser Black-Backed Gull on Site for Spas and Non-Designated Breeding Populations. Mean Max Foraging Range + 1 SD = 236 Km.

SPA/colony name	SPA/colony code	Count of adults	Year	Distance to development	1/proportion foraging range as sea	Resulting weight	Proportional weight
Forth Islands SPA	UK9004171	4006	2018 - 2021	67	1.827	1.366	0.525
Inchcolm	89745	3666	2021	117	2.039	0.457	0.176
Inchkeith	89748	2426	2016	105	2.011	0.371	0.143
Farne Islands SPA	UK9006021	1362	2019	76	1.787	0.353	0.136
Inverkeithing (urban)	79052	76	1999	126	2.052	0.008	0.003
Coquet Island RSPB	UK9006031	40	2019	110	1.774	0.005	0.002
Inchgarvie	96962	38	2021	125	2.057	0.004	0.002
Carr Craig	96968	32	2021	117	2.036	0.004	0.002
Prestonpans Station	113444	28	2021	102	2.002	0.005	0.002
Blyth Town	84094	52	2018	135	1.779	0.004	0.002
Berwick-on-tweed & Tweedmouth	95897	12	1998	70	1.869	0.004	0.002
East Fergus Place	79324	12	1999	105	2.003	0.002	0.001
Hartlepool Town	85905	74	1999	195	1.798	0.003	0.001
Arbroath (urban)	86012	8	2000	72	1.892	0.002	0.001
Peterhead South Harbour (urban)	81010	8	2001	137	1.433	0.001	0
St Fergus Gas Terminal	85741	2	2021	147	1.416	0	0
Loch of Strathbeg RSPB	85820	2	2003	162	1.408	0	0
Haystack	96970	12	2021	117	2.042	0.001	0
Boulby Cliffs	100777	2	1998	210	1.754	0	0
Methil Docks	100960	4	2021	94	1.968	0.001	0
Tremuda/Old Hall Bay	78931	2	1999	84	1.698	0	0
The Slainges	78999	2	1999	82	1.718	0	0
Rouen Bay	79000	4	1999	79	1.722	0.001	0
Whistleberry	79002	2	1999	79	1.726	0	0
Yellow Ark	79006	2	2017	76	1.737	0.001	0
Mathers	79018	4	2000	74	1.792	0.001	0
Garron Point	81015	2	2017	215	1.504	0	0
Old Haven	81020	2	2017	197	1.466	0	0
Berwick 7	84131	2	2000	64	1.864	0.001	0
Hartlepool Docks	85904	6	1999	189	1.791	0	0
Moorburn Point to Fast Castle	85936	2	2000	57	1.87	0.001	0
Ferryden (urban)	86021	2	2001	73	1.831	0.001	0
Portknockie	86585	4	2013	220	1.513	0	0
Lossiemouth 1	86644	2	2019	245	1.541	0	0
Fowlsheugh RSPB	89304	2	2012	84	1.706	0	0
Sands of Forvie	90877	2	2010	124	1.529	0	0

SPA/colony name	SPA/colony code	Count of adults	Year	Distance to development	1/proportion foraging range as sea	Resulting weight	Proportional weight
Swallow Cove – Crawton	91199	2	2000	82	1.713	0	0
Montrose Town (urban)	95870	2	2018	73	1.828	0.001	0
Forth Rail Bridge	96963	2	2005	125	2.058	0	0
Dunbar Coast	99010	2	2000	71	1.92	0.001	0
Buchan Ness to Collieston	100776	20	2019	134	1.44	0.001	0
Troup & Lion's Head RSPB (Coast & Reserve)	100802	4	2001	187	1.44	0	0
Buckie	110244	18	2019	227	1.535	0	0
Broomfield Ind. Est.	110696	5	2018	74	1.822	0.001	0
Crovie to Collie Head	112120	2	2001	188	1.447	0	0

PUFFIN

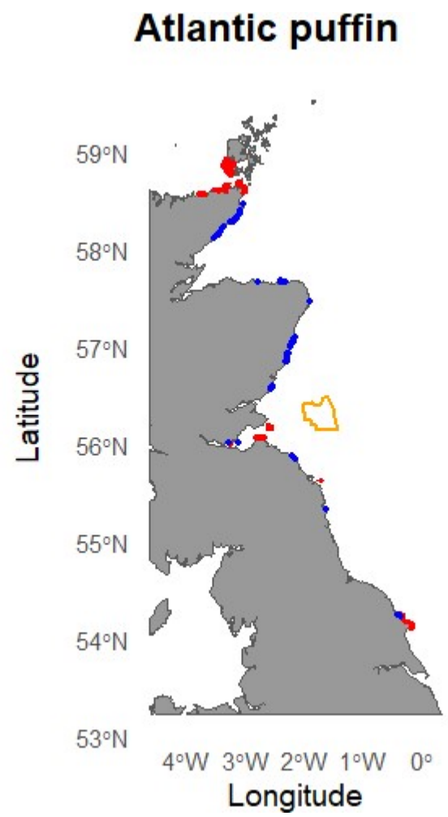

Figure A.5: **Sites Included in the Breeding Season Apportioning Calculations for Atlantic Puffin. The Orange Area Is the Site of the Proposed Development. The Red Areas Represent the SPAs and the Blue Areas Represent the Non-Designated Sites Included in the Apportioning Calculations.**

Table A.5: **Apportionment of Adult Atlantic Puffin on Site for SPAs and Non-Designated Breeding Populations. Mean Max Foraging Range + 1 SD = 265.4 km.**

SPA/colony name	SPA/colony code	Count of adults	Year	Distance to development	1/proportion foraging range as sea	Resulting weight	Proportional weight
Forth Islands	UK9004171	87240	2017 - 2021	67	1.733	3.725	0.500
Farne Islands	UK9006021	87504	2019	76	1.697	2.843	0.382

SPA/colony name	SPA/colony code	Count of adults	Year	Distance to development	1/proportion foraging range as sea	Resulting weight	Proportional weight
Coquet Island RSPB	88850	50058	2019	110	1.735	0.794	0.107
Inchkeith	89748	3200	2018	105	1.862	0.060	0.008
North Caithness Cliffs	UK9001181	3034	2015/ 2016	280	1.263	0.005	0.001
Hoy	UK9002141	361	2017	312	1.244	0.001	0.000
Flamborough & Filey Coast	UK9006101	958	2008	263	1.731	0.003	0.000
Strathlethan Bay	78933	15	1999	87	1.592	0.000	0.000
St Abb's Head NNR	85934	2	2018	59	1.743	0.000	0.000
Inchcolm	89745	28	2012	117	1.878	0.000	0.000
Thornyhive Bay	78930	1	1999	84	1.600	0.000	0.000
Tremuda/Old Hall Bay	78931	3	2018	84	1.598	0.000	0.000
Old Hall Bay - Castle Haven	78932	86	1999	87	1.595	0.002	0.000
Newtonhill - May Craig	78973	3	1999	95	1.566	0.000	0.000
Cove Bay	78995	3	1999	102	1.539	0.000	0.000
The Slainges	78999	5	2017	82	1.613	0.000	0.000
Rouen Bay	79000	2	2017	79	1.616	0.000	0.000
Swirl Cove	79001	25	1999	79	1.617	0.001	0.000
Whistleberry	79002	3	2017	79	1.618	0.000	0.000
Kineff	79003	92	1999	79	1.620	0.003	0.000
Little John's Haven	79004	110	1999	79	1.621	0.003	0.000
Darn Bay	79005	8	1999	79	1.623	0.000	0.000
Yellow Ark	79006	10	1999	76	1.624	0.000	0.000
Inver Hill	79465	4	1999	280	1.363	0.000	0.000
Poll Gallon	79466	10	1999	278	1.361	0.000	0.000
Screadan	79468	9	1999	278	1.357	0.000	0.000
Sithean Dubh	79471	37	1999	277	1.352	0.000	0.000
Dunbeath Bay	79472	1	1999	278	1.351	0.000	0.000
Cleit Bheag	79497	139	2015	278	1.348	0.000	0.000
Hill Head	79503	13	1999	271	1.336	0.000	0.000
Occumster	79504	1	2015	271	1.334	0.000	0.000
Overton	79506	2	2015	268	1.330	0.000	0.000
Whaligoe 2	79508	12	2015	268	1.320	0.000	0.000
Stack of Ulbster	79509	2	1999	267	1.319	0.000	0.000
Gearty Head	79510	1	1999	267	1.317	0.000	0.000
Sarclet Head	79511	4	2015	270	1.315	0.000	0.000
Corbiegeo	79512	7	1999	270	1.314	0.000	0.000
Ires Geo	79513	1	2015	270	1.312	0.000	0.000
Helman Head	79514	1	2015	271	1.311	0.000	0.000
The Brough	79515	2	2015	271	1.309	0.000	0.000
Ord of Caithness 2	80491	1	2015	282	1.370	0.000	0.000
Cnoc na Stri 1	80492	3	2015	282	1.369	0.000	0.000
Cnoc na Stri 2	80493	2	2015	282	1.369	0.000	0.000
Badbea 2	80499	3	2015	280	1.365	0.000	0.000
Berriedale	80500	17	1999	278	1.360	0.000	0.000
Ramsgate	80506	2	2015	277	1.353	0.000	0.000

SPA/colony name	SPA/colony code	Count of adults	Year	Distance to development	1/proportion foraging range as sea	Resulting weight	Proportional weight
Roy Geo	80507	1	2015	268	1.333	0.000	0.000
Ness Castle	80510	6	2015	267	1.326	0.000	0.000
Whaligoe 1	80511	4	2015	267	1.323	0.000	0.000
Noss Head	80513	3	2018	277	1.299	0.000	0.000
Garron Point	81015	32	2017	215	1.446	0.000	0.000
Doonie Point to Hall Bay	85190	1	2017	93	1.574	0.000	0.000
Eyemouth to Burnmouth 6	85948	2	2000	59	1.739	0.000	0.000
Eyemouth to Burnmouth 7	85949	10	2000	59	1.738	0.001	0.000
Whiting Ness to Ethie Haven 4	86001	6	2018	69	1.704	0.000	0.000
Whiting Ness to Ethie Haven 5	86002	4	2001	69	1.704	0.000	0.000
Auchmithie	86003	5	2018	71	1.703	0.000	0.000
Rumkemno	86004	1	2001	71	1.701	0.000	0.000
Whiting Ness to Ethie Haven 6	86005	9	2000	71	1.700	0.000	0.000
Whiting Ness to Ethie Haven 7	86006	6	2018	68	1.699	0.000	0.000
Whiting Ness to Ethie Haven 8	86007	3	2018	69	1.696	0.000	0.000
Hare Ness to Seal's Cove	86718	7	2017	99	1.545	0.000	0.000
Seal's Cove to Findon Ness	86719	7	2017	99	1.551	0.000	0.000
Findon Ness to Black Slough	86720	2	2015	96	1.553	0.000	0.000
Filey 1	87420	1	2013	265	1.749	0.000	0.000
Filey 2	87421	1	2014	265	1.747	0.000	0.000
Filey 3	87422	36	2014	265	1.746	0.000	0.000
Fowlsheugh RSPB	89304	46	2018	84	1.605	0.001	0.000
Swallow Cove - Crawton	91199	7	2018	82	1.609	0.000	0.000
Buchan Ness to Collieston	100776	182	2019	134	1.411	0.002	0.000
Troup & Lion's Head RSPB (Coast & Reserve)	100802	9	2017	187	1.415	0.000	0.000
Black Slough to Burn of Daff	110487	2	2017	98	1.556	0.000	0.000
Crovie to Collie Head	112120	90	2001	188	1.420	0.000	0.000
Pennan Head	112122	21	2017	185	1.413	0.000	0.000
Aberdour Bay	112123	21	2001	182	1.410	0.000	0.000

ANNEX B SPA AND NON-SPA BREEDING SEASON APPORTIONING RESULTS FROM THE MSS METHOD IN THE MS TOOL

KITTIWAKE

Table B.1: Apportionment of Adult Kittiwake on Site for SPAs and Non-Designated Breeding Populations, Using the MS Tool.

SPA/colony	Wakefield weight (%)	Weight
St Abb`s Head to Fast Castle	52.17	0.5217
Non-SPA	17.34	0.1734
Fowlsheugh	17.17	0.1717
Forth Islands	5.70	0.0570
Farne Islands	4.50	0.0450
Buchan Ness to Collieston Coast	1.19	0.0119
Firth of Forth	1.16	0.0116
Troup; Pennan and Lion`s Heads	0.49	0.0049
East Caithness Cliffs	0.07	0.0007
Flamborough Head and Bempton Cliffs	0.05	0.0005
Ythan Estuary, Sands of Forvie and Meikle Loch SPA	0.03	0.0003
Coquet Island	0.01	0.0001
North Caithness Cliffs	0.00	0.0000
Copinsay	0.00	0.0000
Pentland Firth Islands SPA	0.00	0.0000
Hoy	0.00	0.0000
Pentland Firth Islands	0.00	0.0000
Auskerry	0.00	0.0000

GUILLEMOT

Table B.2: Apportionment of Adult Guillemot on Site for SPAs and Non-Designated Breeding Populations, Using the MS Tool.

SPA/colony	Wakefield weight (%)	Weight
St Abb`s Head to Fast Castle	41.56	0.4156
Fowlsheugh	35.91	0.3591
Forth Islands	10.94	0.1094
Farne Islands	8.82	0.0882
Non-SPA	1.05	0.0105
Buchan Ness to Collieston Coast	0.85	0.0085
Troup; Pennan and Lion`s Heads	0.50	0.0050
East Caithness Cliffs	0.25	0.0025
North Caithness Cliffs	0.06	0.0006
Fair Isle	0.04	0.0004
Marwick Head	0.01	0.0001
West Westray	0.01	0.0001
Copinsay	0.01	0.0001
Flamborough Head and Bempton Cliffs	0.00	0.0000
Hoy	0.00	0.0000
Rousay	0.00	0.0000
Calf of Eday	0.00	0.0000
Pentland Firth Islands SPA	0.00	0.0000
Papa Westray (North Hill and Holm) SPA	0.00	0.0000
Auskerry	0.00	0.0000

RAZORBILL

Table B.3: Apportionment of Adult Razorbill on Site for SPAs and Non-Designated Breeding Populations, Using the MS Tool.

SPA/colony	Wakefield weight (%)	Weight
Fowlsheugh	29.20	0.2920
Forth Islands	26.48	0.2648
St Abb`s Head to Fast Castle	23.11	0.2311
Non-SPA	9.35	0.1200
East Caithness Cliffs	2.27	0.0227
Troup; Pennan and Lion`s Heads	2.12	0.0212
Flamborough Head and Bempton Cliffs	0.71	0.0071
Farne Islands	0.41	0.0041
North Caithness Cliffs	0.10	0.0010
Copinsay	0.02	0.0002
Pentland Firth Islands	0.01	0.0001
Hoy	0.00	0.0000
Auskerry	0.00	0.0000
Redhythe Point	0.00	0.0000

ANNEX C ASSIGNMENT OF SUBSITES TO SPA FOR THE APPLICATION OF THE MS TOOL

Full Annex provided in separate document.

ANNEX D APPORTIONMENT OF SEASONAL MORTALITY ESTIMATES TO SPAS AND NON-SPAS

Full Annex provided in separate document