Cenos Offshore Windfarm Limited

Cenos EIA

Appendix 24 – Apportioning Report

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XODUS

Aberdeen

5th Floor Capitol Building
429-431 Union Street . Aberdeen
AB11 6DA . UK

www.xodusgroup.com

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1 Introduction

1 The proposed Cenos Offshore Windfarm (hereafter 'the Project') is a proposed floating offshore wind farm, located approximately 185km off the coast of Peterhead, northeast Scotland. The Project is proposed by Cenos Offshore Windfarm Ltd. ('the Applicant') and is a Joint Venture (JV) between Flotation Energy (FE) and Vårgrønn As (Vårgrønn).

2 This Appendix describes the seasonal apportioning of seabirds at the Array Area to colonies within and outwith Special Protection Areas (SPAs) to inform the Habitats Regulation Appraisal (HRA), submitted alongside Environmental Impact Assessment Report (EIAR).

3 Apportioning estimates the proportion of birds present within the impacted area (e.g. the Array Area or Array Area plus 2km buffer) that derive from different colonies. This allows for the impacts of the Project to be allocated to the relevant colony populations. Potential impacts from collision with turbines and distributional responses are presented in EIAR Vol. 4, Appendix A21: Collision Risk Modelling Report and EIAR Vol. 4, Appendix A22: Distributional Responses Report respectively. Estimated mortality from collision and distributional responses apportioned to SPAs is presented in EIAR Vol. 4, Appendix A24: Apportioning Report Annex 4 and population-level impacts presented in EIAR Vol. 4, Appendix A25: Population Viability Analysis Report.

4 The analysis carried out to determine apportioning for breeding and non-breeding seasons can be split into three stages which are described in Section 2 and summarised below:

- Colonies with connectivity to the Project were identified using seabird foraging ranges (Woodward *et al.,* 2019) from identified breeding colonies (usually SPAs). The approach carried out was based on advice from NatureScot (2023a) and results in long lists of colonies for each species of interest.
- Breeding season apportioning calculations were carried out following interim guidance from NatureScot (2018) to determine the proportional weightings for each colony.
- Non-breeding season impacts against the breeding season colonies were then calculated using information on seasonal regional populations presented in Furness (2015), referred to as Biologically Defined Minimum Population Scales (BDMPS). Although there is no formal guidance in place to detail any recommended methodologies, non-breeding season apportioning was carried out following examples from Pentland Floating Offshore Windfarm (PFOWF) application PFOWF (2022) and MacArthur (2015).

5 The key species for which breeding and non-breeding season apportioning are required for quantitative assessment of the Project are:

- Black-legged kittiwake (*Rissa tridactyla),* hereafter 'kittiwake';
- Northern gannet (*Morus bassanus*), hereafter 'gannet'; and
- Atlantic puffin (*Fratercula arctica*), hereafter 'puffin'.

6 The approach to apportioning was discussed and agreed with NatureScot during the Ornithology Catch Up on 7th August 2024 and the Cenos Post-Scoping Consultation meeting on 21st October 2024.

2 Method

2.1 Definition of seasons

7 NatureScot (2020) provides guidance on seasonal definitions to use in the assessment of ornithological impacts. However, non-breeding season apportioning is reliant on information on seasonal definitions from Furness (2015) which identifies autumn and spring passage periods for some species within the non-breeding season. Due to this, seasonal definitions were taken from NatureScot (2020) for breeding season apportioning and Furness (2015) for non-breeding season apportioning (Table 1).

8 For kittiwake and gannet, the non-breeding season is split into migration periods by Furness (2015). To allow for incorporation of apportioning results into the rest of the assessment, which uses NatureScot (2020) seasons, autumn and spring migration periods had to be slightly altered so there was no overlap or gaps between seasons. The NatureScot breeding season was maintained, and where Furness (2015) autumn and spring migrations overlapped with NatureScot (2020) breeding season, Furness (2015) non-breeding seasons were foreshortened. If there was a gap between the end of the Furness (2015) non-breeding season and the start of the NatureScot (2020) breeding season, the non-breeding season was elongated. This avoided overestimation in seasonal mortality estimates.

9 Estimated mortalities and how these were taken forward for population modelling can be found in the relevant Appendices (e.g. EIAR Vol. 4, Appendix A21: Collision Risk Modelling Report and EIAR Vol. 4, Appendix A25: Population Viability Analysis Report). A similar approach to truncating/elongating Furness (2015) non-breeding seasons has been applied for other Scottish offshore wind farm applications such as PFOWF (2022) and Berwick Bank (SSE Renewables, 2022). This approach was not necessary for puffin as the non-breeding season is presented as one season in Furness (2015).

10 The approach to seasonality within apportioning was discussed and agreed with NatureScot at the Ornithology Catchup on 7th August 2024 and within the accompanying note received 10th September 2024.

Table 1 **Seasonal periods used within apportioning. NatureScot (2020) seasonal definition used for the breeding season and adjusted Furness (2015) seasonal definitions for the non-breeding season. Furness (2015) non-breeding periods shortened to fit within the NatureScot non-breeding season, where applicable (see paragraph 10). Breeding season = blue, non-breeding season = green, autumn migration = orange, spring migration = red**

Species	Ref	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Kittiwake	NatureScot (2020)												
	Furness (2015)												
Gannet	NatureScot (2020)												
	Furness (2015)												
Puffin	NatureScot (2020)												
	Furness (2015)												

2.2 Connectivity of colonies (SPA and non-SPA)

2.2.1 Determining connectivity

11 A 'long list' of the colonies with connectivity and their breeding population sizes for each species of interest were collated before carrying out apportioning following NatureScot guidance (NatureScot, 2023a). All colony data were derived from the Seabird Monitoring Programme (SMP) database, hosted by the British Trust for Ornithology (BTO). The authors were provided with a full download from the SMP database spanning 1986 to 2023 from the BTO on 25th May 2023. These data were initially used and where applicable, substituted by more recent data hosted on the online SMP database. The SMP contains data from the seabird censuses, the most recent being the Seabird Count which was conducted between 2015 and 2021.

12 In this Appendix, colonies are said to have connectivity with the Project if the at-sea distance from the closest edge of the colony to the closest edge of the Array Area is less than or equal to the foraging range (km), as presented in Woodward *et al.* (2019). Measuring distance to colonies in this manner follows the advice received from NatureScot at the Cenos Post-Scoping Consultation meeting on 21st October 2024.

13 For SPA colonies, polygons representing each SPA were available, so distances were measured from the closest edge of the Array Area to the closest edge of the SPA polygon. For non-SPA colonies, polygons were not available; grid references for sub-sites were available which were converted to point data. For these non-SPA sites, distances were measured from the closest edge of the Array Area to the point representing the sub-site of each colony with the largest count, within the non-SPA site.

14 The foraging range used is typically the mean maximum foraging range (mmfr) plus one Standard Deviation (SD) taken from Woodward *et al.* (2019). However, for gannet this also includes by additional foraging range data specific to gannet originating from Forth Islands and St Kilda SPAs, following NatureScot guidance (2023a) (Table 2).

15 At-sea distance, as opposed to straight line distance, was used during connectivity assessment. This is assumed to provide more biologically meaningful results as seabirds are not likely to cross over land while travelling. The HRA Screening Report (Cenos Offshore Windfarm Ltd, 2024) measured distance between seabird colonies and the Array Area using *"…the shortest straight-line distance not taking account of coastal land masses"*. **It is therefore expected that there may be some discrepancies between the distances to colonies listed within this report and the HRA Screening Report**. The use of at-sea distance is recommended with the NatureScot interim apportioning guidance (NatureScot, 2018) and has been regularly employed in several Scottish offshore wind farm applications.

Table 2 Mean maximum foraging range plus one standard deviation (SD) (Woodward *et al.*, 2019) used during connectivity and apportioning

Species	Mean maximum foraging range (km)	SD (km)	Mean maximum foraging range plus one SD (km)
Kittiwake	156.1	144.5	300.6
Gannet[1]	315.2	194.2	509.4
Puffin	137.1	128.3	265.4

[1]*Following guidance from NatureScot (2023a), foraging ranges of 590km was used for gannet at Forth Islands SPA.*

16 For Forth Islands SPA, it is likely to be more biologically meaningful to measure from the Isle of May rather than the closest edge of the SPA boundary, as this area hosts the majority of kittiwake and puffin present within the SPA. Therefore, a point representing the Isle of May was used instead of the closest edge of the SPA polygon. This point was within foraging range for both species and therefore Forth Islands SPA is included in further assessment of kittiwake and puffin.

17 Although Flamborough and Filey Coast SPA, North Rona and Sula Sgeir SPA, St Kilda SPA and Sule Skerry and Sule Stack SPA were found to have connectivity with the Project for gannet when screened in using the foraging range from Woodward *et al.* (2019), these sites were not included in breeding season apportioning. As reported in the HRA Screening Report (Cenos Offshore Windfarm Ltd, 2024), gannet from these sites are unlikely to interact with the Project. This is based on evidence from telemetry data which shows clear space partitioning of UK gannet (Wakefield *et al.*, 2013). For gannet at Flamborough and Filey Coast SPA, telemetry data shows no overlap with the Array Area. The Scoping Opinion from Marine Directorate Licensing Operations Team (MD-LOT) (received September 2024) confirms that there is likely to be no Likely Significant Effect (LSE) on the gannet qualifying interest at Flamborough and Filey Coast SPA due to the presence of the Project, therefore this SPA is not included any further in assessment. The same logic has been applied to gannet at North Rona and Sula Sgeir SP, St. Kilda SPA and Sule Skerry and Sule Stack SPA, which are therefore also not included any further within assessment of breeding season gannet.

2.2.2 Collation of breeding season colony counts

18 SPA and non-SPA colony counts were collated by combining the counts of the relevant sub-sites. The most recent counts for each sub-site with connectivity to the Project were taken from the SMP database. The counts for each sub-site were then converted to individuals (IND) and combined to generate breeding adult colony counts for each of the relevant colonies.

19 If the most recent counts for a sub-site were recorded prior to the year 2000, the sub-site was excluded from analysis and if more than one count was recorded in the same year the counts were summed, after converting counts into IND.

20 Counts were converted into IND using the following rules:

- Apparently Occupied Burrows (AOB), Apparently Occupied Nests (AON) and Apparently Occupied Sites (AOS) were converted by multiplying counts by two.
- Counts that were recorded in IND or birds on the sea (SEA) were not converted.

21 The colony long lists for each species and their associated breeding season populations can be found in Section 2.5.

2.3 Breeding season apportioning

22 During the breeding season, many seabird species are central-place foragers and most individuals recorded at-sea will be breeding adults associated with a breeding colony. The purpose of breeding season apportioning is to determine the proportions of birds detected in the Array Area that are likely to be coming from colonies with 'connectivity' to the Project.

23 Breeding season apportioning was conducted for kittiwake, gannet and puffin following the 'theoretical approach' presented in NatureScot's interim guidance note (NatureScot, 2018). This method provides an apportioning "weighting" to each breeding colony within the mmfr + 1SD (Woodward *et al.,* 2019) of the Project. These represent the proportion or percentage of individuals within the Array Area estimated to be coming from each colony of interest.

24 The approach to apportioning was discussed and agreed with NatureScot during the Ornithology Catch Up on 7th August 2024, the subsequent advice note received 10th September 2024 and the Cenos Post-Scoping Consultation meeting on 21st October 2024.

25 For gannet, an additional breeding season scenario was run at Forth Islands SPA as requested by NatureScot. An alternative colony count from the gannet colony at Bass Rock from 2023 was used and is presented in EIAR Vol. 4, Appendix A21: Apportioning Report: Annex 3: Additional gannet scenario at Forth Islands SPA. NatureScot requested this additional scenario be run using data after the Highly Pathogenic Avian Influenza Virus (HPAIV) outbreak, to compare how the predicted population level impacts differ when using colony data collected pre and post HPAIV at a colony which was badly affected. The outcome of population modelling using these data is presented in EIAR Vol. 4, Appendix A25: Population Viability Analysis Report.

2.3.1 NatureScot method

26 Apportioning weightings for kittiwake, gannet and puffin were calculated using the method described in NatureScot (2018) using colony counts from the collated colony long lists in Section 2.5. The resulting weightings for each colony were calculated using the population sizes (adult IND), the 'at-sea' distance of each colony from the closest edge of the Array Area and the area of sea encompassed by the foraging range as shown below.

$$Resulting\ weighting = \left(\frac{colony\ population}{sum\ of\ populations}\right) x \left(\frac{\sum(Distance^2)}{Distance^2}\right) x \left(\frac{\frac{1}{Proportion\ of\ foraging\ range}}{\sum\frac{1}{Proportion\ of\ foraging\ range}}\right)$$

27 For SPA colonies, the distances from the colony to the Array Area were calculated from the closest edge of the Array Area to the closest edge of the SPA. For non-SPA colonies, distance was calculated from the edge of the Array Area to the SMP sub-site (location taken from the SMP database) with the largest colony count.

28 Proportional weightings were calculated by dividing the resulting weighting for each colony by the sum of the resulting weightings for all colonies.

29 The apportioning calculation from NatureScot (2018) has been translated by HiDef Aerial Survey Limited ("HiDef") into the R programming language and has been run using R v4.3.3 (R Core Team, 2024). Code can be provided upon request.

2.4 Non-breeding season apportioning

30 In the non-breeding season, seabirds are not associated with breeding colonies and may range widely, with some species undertaking migrations. Instead of using foraging ranges to determine colonies with potential connectivity, as for the breeding season, non-breeding season apportioning uses non-breeding season regional populations from Furness (2015) following advice from NatureScot (2023b) (Table 3).

31 There is currently no formal guidance on how to conduct non-breeding season apportioning. Generally, the accepted approach for projects in Scottish waters has been to use data presented in the Furness (2015) BDMPS report to apportion impacts during the non-breeding season. The use of the Furness (2015) BDMPS report and associated data during the non-breeding season was requested by NatureScot in the response to the Scoping Report received 23rd May 2024.

32 As presented in the PFOWF application (2022), there have been ongoing discussions around the methods used to apportion impacts back to SPA colonies during the non-breeding season, including a presentation by NatureScot at the Bird Impact Assessment Workshop in February 2020. The NatureScot Scoping Response for the Project dated 23rd May 2024, confirms that this approach is correct.

33 During migration periods outside the breeding season, the project is within a migratory corridor for gannet dispersing from and returning to, the colonies under assessment. This means that not all colonies will be at risk of potential impacts from the proposed Project, depending on the location of the colony and direction of migration. Some birds move north away from colonies to the south of the proposed Project, while some birds from colonies to the north of the proposed Project move south (MacArthur Green, 2015; Seagreen Offshore Wind Farm (SOWF), 2019). The number of birds utilising the Project area therefore needs to be adapted to take this in to account.

2.4.1 Kittiwake and puffin

34 For kittiwake and puffin, non-breeding season apportioning was carried out by dividing the full colony count (adults and immatures) for each colony of interest by the relevant BDMPS estimate reported in Furness (2015), shown in Table 3.

Table 3 Biologically Defined Minimum Population Scale (BDMPS) estimates used in non-breeding season apportioning for kittiwake and puffin (Furness, 2015).

Species	BDMPS region	Season	BDMPS estimate (adults and immature)
Kittiwake	UK North Sea	Autumn migration	829,937
		Spring migration	627,816
Puffin	UK North Sea and Channel	Non-breeding season	231,957

35 To carry out non-breeding season apportioning, full colony counts (i.e. adults and immatures) reported in Appendix A of Furness (2015) were used. All SPAs used by Furness (2015) to calculate

each BDMPS, as well as any additional colonies which were found to have connectivity with the proposed Project during the breeding season, are presented in Section 3.3. Non-SPA colonies were grouped into two separate colonies: 'UK North Sea non-SPA colonies' and 'UK Western non-SPA colonies'.

36 For SPA colonies with connectivity to the Project which are not presented in Furness (2015), non-breeding season colony counts were estimated using the counts collated for breeding season apportioning and information from Furness (2015). First, the colony count of breeding adults, collated as described in Section 2.2, was multiplied by the proportion of breeding adults from the 'UK North Sea non-SPA colonies' expected to occur within the relevant BDMPS region during the non-breeding season(s). This proportion was calculated by dividing the number of 'North Sea adults' by the number of 'Breeding Adults' reported in Furness (2015) as shown in Equation 1. To estimate the number of immatures within the BDMPS region, the proportion of immatures that make up the UK population was calculated and multiplied by the estimated number of adults within the BDMPS region, as shown in Equation 2. This follows the same approach as presented for Berwick Bank Offshore Windfarm (SSE Renewables, 2022)

$$\textit{Estimated adults} = \textit{breeding season count } x \frac{\textit{UK North Sea non-SPA colonies number of adults within region}}{\textit{UK North Sea non-SPA colonies number of breeding adults}} \quad (1)$$

$$\textit{Estimated immatures} = \textit{Estimated adults } x \frac{\textit{Total UK number of immatures}}{\textit{Total UK number of adults}} \quad (2)$$

37 A worked example of how the colony count was calculated for kittiwake during autumn migration at Coquet Island SPA is shown in Equations 3 and 4. The breeding season count is taken from Table 5 and the remaining values are found in Appendix A of Furness (2015).

$$\textit{Estimated adults} = 1,038\ x \frac{84,000}{140,000} \quad (3)$$

$$\textit{Estimated immatures} = \textit{Estimated adults } x \frac{162,914}{269,215} \quad (4)$$

38 For kittiwake, colony counts collated for the breeding season apportioning were used for Coquet Island SPA, Firth of Forth SPA and Ythan Estuary, Sands of Forvie and Meikle Loch SPA and for puffin, counts were estimated for Buchan Ness to Collieston Coast SPA, Fowlsheugh SPA and Troup, Pennan and Lion's Head SPA.

39 Colony estimates for each species were then divided by the BDMPS value for the region of interest to the Project (i.e. UK North Sea and Channel Waters; UK North Sea) to get the proportion of the BDMPS population associated with each colony. Following the assumption that there is equal mixing of birds throughout the BDMPS region, this is equal to the proportion of birds found within the Array Area from each colony.

2.4.2 Gannet

40 To carry out non-breeding season apportioning for gannet, the number of individuals travelling north and south was calculated using telemetry data from adult gannet during autumn and spring migration periods (MacArthur Green, 2015). The method follows that of MacArthur Green (2015) used for cumulative assessment of gannet collision risk, which was then used to apportion birds to gannet

colonies for the application for Seagreen Offshore Wind Farm SOWF (2019), which has since been consented.

41 The population for each colony was calculated by multiplying the number of adults by the ratio of immatures to adults reported in Furness (2015). These values were then multiplied by the proportion of birds flying north and south for each colony taken from MacArthur Green (2015).

42 Once the number of birds flying north and south for each colony was estimated, an adjusted BDMPS for the biogeographical region of interest was by summing the number of individuals flying south from colonies north of the project and the number of birds flying north from colonies south of the Project. Values used to calculate adjusted BDMPS values for gannet non-breeding season apportioning are highlighted in green in Table 4.

43 Colonies which were screened into breeding season apportioning (Table 6), as well as those used in Furness (2015) were included in these calculations if adults showed connectivity with the relevant BDMPS region. Although presented in Appendix A (Furness, 2015) for the BDMPS region of interest to the Project, as Ailsa Craig SPA and Grassholm SPA show no adult connectivity during autumn or spring migration they have not been included in non-breeding apportioning for gannet.

44 Where possible, colony counts (adults and immatures) for each colony were updated based on the colony long lists collated during connectivity analysis. For colonies which are present in the SMP database colony counts were updated and where colonies were not present, counts were taken from MacArthur Green (2015).

45 For colonies not included in MacArthur Green (2015), the proportion of birds flying north and south for each season was assumed to be the same as the geographically closest colony presented in the report.

46 The final adjusted BDMPS estimates (adults and immatures) for gannet during the autumn and spring migration periods were 296,363 birds and 322,993 birds respectively. The method for undertaking non-breeding season gannet apportioning was discussed and agreed with NatureScot at the Ornithology Catch Up on 7th August 2024 and in their accompanying response received 10th September 2024.

Table 4 **Summary of values used to calculate the adjusted Biologically Defined Minimum Population Scales (BDMPS) for gannet autumn and spring migration periods. Number of individuals summed to calculate adjusted BDMPS estimates are highlighted in green. The adjusted BDMPS for autumn migration period is equal to number of birds flying south from colonies north of the project and the number of birds flying north from colonies south of the project and vice versa for the spring migration period**

Colony	No. of adults	Unit	No. of adults (IND)	No. of immatures (IND)	Colony size (adults and immatures)	Autumn migration				Spring migration			
						Prop. flying south	No. flying south	Prop. flying north	No. flying north	Prop. flying north	No. flying north	Prop. flying south	No. flying south
Faeroes[1]	2,500	AON	5,000	4,050	9,050	0.42	3,801	0.00	0	0.20	1,810	0.00	0
Fair Isle SPA	4,827	AON	9,654	7,820	17,474	0.50	8,737	0.00	0	0.50	8,737	0.00	0
Foula SPA	2,086	AOS	4,172	3,379	7,551	0.50	3,776	0.00	0	0.50	3,776	0.00	0
Hermaness, Saxa Vord and Falla SPA	18,739	AOS	37,478	30,357	67,835	0.50	33,918	0.00	0	0.50	33,918	0.00	0
Iceland[1]	37,216	AON	74,432	60,290	134,722	0.42	56,583	0.00	0	0.10	13,472	0.00	0
Marwick Head SPA[2]	58	AOS	116	94	210	0.50	105	0.00	0	0.50	105	0.00	0
North Rona and Sula Sgeir SPA	9,495	AOS	18,990	15,382	34,372	0.10	3,437	0.00	0	0.00	0	0.00	0
Norway[1]	6,000	AON	12,000	9,720	21,720	0.50	10,860	0.00	0	0.20	4,344	0.00	0
Noss SPA	12,335	AON	24,670	19,983	44,653	0.50	22,327	0.00	0	0.50	22,327	0.00	0

Colony	No. of adults	Unit	No. of adults (IND)	No. of immatures (IND)	Colony size (adults and immatures)	Autumn migration				Spring migration			
						Prop. flying south	No. flying south	Prop. flying north	No. flying north	Prop. flying north	No. flying north	Prop. flying south	No. flying south
St Kilda SPA	60,290	AOS	120,580	97,670	218,250	0.10	21,825	0.00	0	0.00	0	0.00	0
Sule Skerry and Sule Stack SPA	9,065	AOS	18,130	14,685	32,815	0.10	3,282	0.00	0	0.00	0	0.00	0
Troup, Pennan and Lion's Heads SPA	4,376	AON	8,752	7,089	15,841	0.63	9,980	0.37	5,861	0.27	4,277	0.73	11,564
West Westray SPA	1,386	AOS	2,772	2,245	5,017	0.50	2,509	0.00	0	0.50	2,509	0.00	0
Flamborough Head and Filey Coast SPA	15,794	AOS	31,588	25,586	57,174	0.75	42,881	0.25	14,294	0.50	28,587	0.50	28,587
Forth Islands SPA	75,259	AOS	150,518	121,920	272,438	0.63	171,636	0.37	100,802	0.27	73,558	0.73	198,880
Helgoland[1]	656	AON	1,312	1,063	2,375	1.00	2,375	0.00	0	1.00	2,375	0.00	0
St Abb's Head to Fast Castle SPA[2]	95	AON	190	154	344	0.63	217	0.37	127	0.27	93	0.73	251

[1]Colonies not screened into breeding season long list for gannet; counts taken from MacArthur Green (2015).

[2]Proportion of birds flying north/south were not available from MacArthur Green (2015). Proportions of the geographically closest colonies from were used.

2.5 Adult vs immature birds and sabbatical birds

47 Seabird populations consistent of birds of multiple age classes, with adult and immature birds typically differentiated between within impact assessment of offshore wind farms. Understanding the proportion of breeding adult birds is essential as this portion of the population is assessed within HRA. Within the population, there will be a proportion of non-adult (immature) birds which will not be associated with colonies but should be accounted for when apportioning potential impacts to species and protected sites.

48 To determine the split of adult and immature birds, the proportion of each age class per species was derived from various sources. During the breeding season, age class proportions from the site-specific DAS of the Project (kittiwake and gannet; see EIAR Vol. 4, Appendix A19: Ornithology Baseline Report) and stable age structure as taken from the Natural England PVA Tool (puffin; which uses data derived from Horswill and Robinson (2015)) were used. For puffin at Farne Islands SPA, national survival rates and site-specific productivity rates were inputted to the tool, while for puffin at Forth Islands SPA, national survival rates alongside breeding success rates for Scotland (as provided by the PVA tool) were used. The proportion of adults to immatures was obtained once a stable age structure was achieved in the PVA baseline outputs.

49 Within DAS footage, as plumage is very similar it may be difficult to differentiate between kittiwake which are immature and not yet able to breed and adult birds, especially for individuals in their 4th calendar year. Due to this, using age derived data from DAS footage may overestimate the proportion of breeding adult birds within the population. However, since this is a precautionary approach, as adult mortalities will have a greater effect on the overall population, age data derived from site-specific DAS is used to apportion predicted impacts for kittiwake. Site-specific age data derived from DAS is also used for gannet in the breeding season.

50 For all species during the non-breeding season, site-specific age class proportions as presented in Appendix A of Furness (2015) were used. Age class proportions per species and per SPA are presented in Annex 1: Age class proportions used to apportion impacts.

51 Sabbatical rates were applied as a straightforward reduction to adult mortality during the breeding season. This was a 10% reduction for adult kittiwake and gannet mortality, and a 7% reduction for adult puffin mortality.

3 Results

3.1 Colony long lists

52 Per species, long lists of colonies expected to have connectivity with the Array Area are presented. Colony long lists are listed alphabetically and associated breeding populations (IND) can be found for each species in Table 5 to Table 7. Connectivity to colonies is determined by species-specific foraging ranges as presented in Section 2.2 (Table 2).

53 Colony long lists include those at designated and non-designated sites and are presented in alphabetical order. At-sea distance was used to calculate distance between sites and the Array Area. Sub-sites which make up colonies are presented in EIAR Vol. 4, Appendix A23: Regional Populations and Associated Colony Counts.

3.1.1 Kittiwake

54 The colony long list used during breeding season apportioning for kittiwake is shown in Table 5.

55 Both Fishtown of Usan to River North Esk and St Abbs to Eyemouth were both screened into the long list for kittiwake, but the most recent colony counts, both from 2018, were found to be zero. As there were no adults present at these colonies they have been excluded from Table 5 and further analysis.

Table 5 Kittiwake colony long list of SPA and non-SPA colonies found to be within the mean maximum foraging range plus one SD (km) (Woodward *et al.*, 2019) and associated breeding colony counts (converted to individuals (IND))

Colony	Colony count	Unit	Year	Converted colony counts (IND)
Berwick to Scottish Border	1,527	AON	2000	3,054
Buchan Ness to Collieston Coast SPA[1]	13,547	AON	2023	27,094
Burn of Daff	1,093	AON	2017	2,186
Catterline to Inverbervie	2,001 / 45.5	AON / IND	2017	4,093
Copinsay SPA	296	AON	2023	592
Coquet Island SPA[3]	347	AON	2024	694
East Caithness Cliffs SPA	24,479	AON	2015	48,958
Eyemouth to Burnmouth	709	AON	2018	1,418
Farne Islands SPA[2]	3,583	AON	2023	7,166
Findon Ness - Hare Ness	1,177	AON	2017	2,354
Firth of Forth SPA	1,155	AON	2007	2,310
Forth Islands SPA[1]	7,090	AON	2019 & 2024	14,180
Fowlsheugh SPA[1]	20,078	AON	2018 & 2023	40,156
Fraserburgh	81	AON	2021	162
Girdle Ness to Hare Ness	2,093	AON	2017	4,186
Hall Bay to Craigeven Bay	79	AON	2017	158
Howick – Cullornose Point – Dunstanburgh Castle Point	1,336	AON	2019 & 2024	2,672
Lunan Bay to Arbroath	563 / 470	AON / IND	2018	2,066
Marsden Bay	2,388	AON	2016	4,776

Colony	Colony count	Unit	Year	Converted colony counts (IND)
Montrose to Lunan Bay	370	AON	2017	740
Newton Hill	2	AON	2017	4
Newtonhill – Hall Bay	298	AON	2017	596
North Caithness Cliffs SPA	8,469	AON	2015 & 2023	16,938
Peterhead	33	AON	2021	66
Portknockie	31	AON	2018	62
Portsoy to Cullen	516	AON	2017	1,032
River Dee to Muchals	461	IND	2024	922
River Tyne to Seaton Sluice	1,257	AON	2015	2,514
Rosehearty to Bay of Cullen	28	AON	2017	56
Seahouses	206	AON	2019	412
St Abb's Head to Fast Castle SPA[1]	5,602	AON	2023	11,204
Stonehaven to Wine Cove	280 / 30.5	AON / IND	2018 & 2021 / 2021	621
Troup, Pennan and Lion's Heads SPA[1]	13,672	AON	2017 & 2023	27,344
Ythan Estuary, Sands of Forvie and Meikle Loch SPA[3]	473	AON	2024	946

[1] Kittiwake named as a qualifying feature of SPA.

[2] Kittiwake named as a component of seabird assemblage within SPA.

[3] Kittiwake not named as a qualifying feature or a component of seabird assemblage within SPA.

3.1.2 Gannet

56 Gannet colonies were initially screened into assessment based on the mmfr + 1SD as presented in Woodward *et al.* (2019). Flamborough and Filey Coast SPA was screened out following the Scoping Opinion, where MD-LOT deferred to the Natural England response which determined there is no Likely Significant Effect (LSE) on gannet at this SPA due to the presence of Project. The same reasonings was used to screen out North Rona and Sula Sgeir SPA, St. Kilda SPA and Sule Skerry and Sule Stack SPA (see Section 2.2.1).

Table 6 Gannet colony long list of SPA and non-SPA colonies found to be within the mean maximum foraging range plus one SD (km) (Woodward *et al.*, 2019) and associated breeding colony counts (converted to individuals (IND))

Colony	Colony count	Unit	Year	Converted colony counts (IND)
Fair Isle SPA[2]	4,827	AON	2023	9,654
Forth Islands SPA[1,2]	75,259	AOS	2014	150,518
Foula SPA[4]	2,086	AOS	2023	4,172
Hermaness, Saxa Vord and Valla Field SPA[2]	18,739	AOS	2023	37,478
Marwick Head SPA[4]	58	AOS	2023	116
Noss SPA[2]	12,335	AON	2023	24,670
St Abb's Head to Fast Castle SPA[4]	95	AON	2023	190
Troup, Pennan and Lion's Heads SPA[4]	4,376	AON	2023	8,752
West Westray SPA[4]	1,386	AON	2023	2,772

[1] Connectivity was carried out using a foraging range equal to mmfr + 1SD for all sites apart from Forth Islands SPA and St Kilda SPA which used a range of 590km and 709km respectively, following NatureScot guidance (NatureScot, 2023).

[2] Gannet named as a qualifying feature of SPA.

[3] Gannet named as a component of seabird assemblage within SPA.

[4] Gannet not named as a qualifying feature or a component of seabird assemblage within SPA.

3.1.3 Puffin

57 Girdle Ness to Hare Ness and St Abb's Head to Fast Castle SPA were both screened into the colony long list but were found to have colony counts of zero. Due to this both colonies have been excluded from the long list presented in Table 7 and further assessment.

Table 7 Puffin colony long list of SPA and non-SPA colonies found to be within the mean maximum foraging range plus on SD (km) (Woodward *et al.*, 2019) and associated breeding colony counts (converted to individuals (IND))

Colony	Colony count	Unit	Year	Converted colony counts (IND)
Buchan Ness to Collieston Coast SPA[2]	3 / 24.5 / 3.5	AOB / IND / SEA	2023	62
Burn of Daff	1 / 2.5	IND / SEA	2017	7
Catterline to Inverbervie	5	IND	2017	10
Coquet Island SPA	17,541	AOB	2024	35,082
Farne Islands SPA[2]	43,752	AOB	2019	87,504
Findon Ness – Hare Ness	8 / 1.5	IND / SEA	2015 & 2017 / 2017	19
Forth Islands SPA[1]	3,9997 / 6,051 / 14	AOB / AON / SEA	2017 & 2023 / 2023 / 2023	92,124
Fowlsheugh SPA[2]	13 / 61	IND / SEA	2018 & 2022 / 2018	148
Lunan Bay to Arbroath	13	IND	2018	26
Newton Hill	0.5 / 0.5	IND / SEA	2017	2
Newtonhill – Hall Bay	1.5	SEA	2017	3
Stonehaven to Wine Cove	0.5	SEA	2018	1
Troup, Pennan and Lion's Heads SPA[2]	15.5	IND	2001 & 2017	31

[1] *Puffin named as a qualifying feature of SPA.*

[2] *Puffin named as a component of seabird assemblage in SPA.*

[3] *Puffin not named as a qualifying feature or a component of seabird assemblage in SPA.*

3.2 Breeding season apportioning

58 Results of breeding season apportioning are presented in Table 8 to Table 10. Each table presents the colony count, distance from the Array Area and weighting for each site.

3.2.1 Kittiwake

59 Breeding season apportioning results using the NatureScot (2018) method were used to determine the sites used within SeabORD analysis as part of the assessment of distributional responses (EIAR Vol. 4, Appendix A22: Distributional Reponses and EIAR Vol. 4, Appendix A22: Distributional Responses Annex 2 - SeabORD) and are presented in Table 8.

Table 8 Apportionment of kittiwake to SPA and non-designated sites during the breeding season, following NatureScot (2018) guidance

Colony	Colony count (IND)	Distance from Array Area (km)	Resulting weighting	Proportional weighting
Fowlsheugh SPA	40,156	216	0.232	0.23
Buchan Ness to Collieston Coast SPA	27,094	206	0.160	0.16
East Caithness Cliffs SPA	48,958	292	0.134	0.13
Troup, Pennan and Lion's Heads SPA	27,344	242	0.115	0.12
Forth Islands SPA	14,180	265	0.060	0.06
St Abb's Head to Fast Castle SPA	11,204	273	0.045	0.05
North Caithness Cliffs SPA	16,938	299	0.042	0.04
Farne Islands SPA	7,166	254	0.033	0.03
Girdle Ness to Hare Ness	4,186	208	0.026	0.03
Catterline to Inverbervie	4,093	229	0.021	0.02
Marsden Bay	4,776	300	0.017	0.02
Berwick to Scottish Border	3,054	272	0.012	0.01
Burn of Daff	2,186	213	0.013	0.01
Eyemouth to Burnmouth	1,418	277	0.006	0.01
Findon Ness - Hare Ness	2,354	216	0.013	0.01
Firth of Forth SPA	2,310	280	0.009	0.01
Howick - Cullornose Point - Dunstanburgh Castle Point	2,672	261	0.012	0.01
Lunan Bay to Arbroath	2,066	257	0.009	0.01

Colony	Colony count (IND)	Distance from Array Area (km)	Resulting weighting	Proportional weighting
River Dee to Muchalls	922	212	0.005	0.01
River Tyne to Seaton Sluice	2,514	295	0.009	0.01
Ythan Estuary, Sands of Forvie and Meikle Loch SPA	946	206	0.006	0.01
Copinsay SPA	592	298	0.001	0.00
Coquet Island SPA	694	265	0.003	0.00
Fraserburgh	162	225	0.001	0.00
Hall Bay to Craigeven Bay	158	213	0.001	0.00
Montrose to Lunan Bay	740	253	0.003	0.00
Newton Hill	4	213	0.000	0.00
Newtonhill - Hall Bay	596	213	0.004	0.00
Peterhead	66	209	0.000	0.00
Portknockie	62	280	0.000	0.00
Portsoy to Cullen	1,032	280	0.003	0.00
Rosehearty to Bay of Cullen	56	251	0.000	0.00
Seahouses	412	262	0.002	0.00
Stonehaven to Wine Cove	621	225	0.003	0.00

3.2.2 Gannet

60 Gannet breeding season apportioning was carried out following guidance presented in NatureScot (2018) and results are presented in Table 9.

Table 9 Apportionment of gannet to SPA colonies during the breeding season, following NatureScot (2018) guidance

Colony	Colony count (IND)	Distance from Array Area (km)	Resulting weighting[1]	Proportional weighting
Forth Islands SPA	150,518	265	1.231	0.80
Hermaness, Saxa Vord and Valla Field SPA	37,478	459	0.087	0.06
Noss SPA	24,670	389	0.081	0.05
Troup, Pennan and Lion's Heads SPA	8,752	242	0.077	0.05
Fair Isle SPA	9,654	337	0.042	0.03
Foula SPA	4,172	413	0.012	0.01
West Westray SPA	2,772	350	0.011	0.01
Marwick Head SPA	116	363	0.000	0.00
St Abb's Head to Fast Castle SPA	190	273	0.002	0.00

[1]Resulting weightings were calculated using a foraging range equal to mmfr + 1 SD for all sites apart from Forth Islands SPA which used a range of 590km, following NatureScot guidance (NatureScot, 2023a).

3.2.3 Puffin

61 Puffin breeding season apportioning was carried out following the guidance presented in NatureScot (2018) and results are presented in Table 10.

Table 10 Apportionment of puffin to SPA and non-SPA colonies during the breeding season, following NatureScot (2018) guidance

Colony	Colony count (IND)	Distance from Array Area (km)	Resulting weighting	Proportional weighting
Farne Islands SPA	87,504	254	0.363	0.42
Forth Islands SPA	92,124	265	0.367	0.42
Coquet Island SPA	35,082	265	0.137	0.16
Buchan Ness to Collieston Coast SPA	62	206	0.000	0.00
Burn of Daff	7	216	0.000	0.00
Catterline to Inverbervie	10	229	0.000	0.00
Findon Ness - Hare Ness	19	216	0.000	0.00
Fowlsheugh SPA	148	216	0.001	0.00
Lunan Bay to Arbroath	26	257	0.000	0.00
Newton Hill	2	213	0.000	0.00
Newtonhill - Hall Bay	3	213	0.000	0.00
Stonehaven to Wine Cove	1	225	0.000	0.00
Troup, Pennan and Lion's Heads SPA	31	242	0.000	0.00

3.3 Non-breeding season apportioning

3.3.1 Kittiwake

62 Results for apportioning during autumn and spring migration for kittiwake are presented in Table 11 and Table 12 respectively. Colony counts are primarily taken from Appendix A of Furness (2015).

Table 11 Apportionment of kittiwake to SPA and non-SPA colonies during autumn migration (Furness, 2015)

Colony	No. adults	No. immatures	Total colony population	BDMPS (adults and immatures)	Proportion
Flamborough and Filey Coast SPA	45,140	26,482	71,623	829,937	0.09
East Caithness Cliffs SPA	48,492	28,449	76,941	829,937	0.09
Buchan Ness to Collieston Coast SPA[1]	15,050	8,830	23,880	829,937	0.03
Troup, Pennan and Lion's Head SPA[1]	17,875	10,487	28,362	829,937	0.03
West Westray SPA	14,466	8,487	22,953	829,937	0.03
Fowlsheugh SPA[1]	11,204	6,573	17,778	829,937	0.02
North Caithness Cliffs SPA	12,180	7,146	19,326	829,937	0.02
Farne Islands SPA[1]	4,132	2,424	6,555	829,937	0.01
Forth Islands SPA	3,720	2,182	5,902	829,937	0.01
St Abb's Head to Fast Castle SPA[1]	4,084	2,396	6,479	829,937	0.01
Ailsa Craig SPA	10	43	53	829,937	0.00
Calf of Eday SPA	869	526	1,422	829,937	0.00
Canna and Sanday SPA	16	72	89	829,937	0.00
Cape Wrath SPA	207	910	1,117	829,937	0.00
Copinsay SPA	799	469	1,268	829,937	0.00
Coquet Island SPA[1]	416	252	668	829,937	0.00
Fair Isle SPA	925	543	1,468	829,937	0.00
Firth of Forth SPA	1,386	839	2,225	829,938	0.00

Colony	No. adults	No. immatures	Total colony population	BDMPS (adults and immatures)	Proportion
Flannan Isles SPA	28	122	150	829,937	0.00
Foula SPA	392	230	623	829,937	0.00
Handa SPA	37	165	202	829,937	0.00
Hermaness, Saxa Vord and Valla Field SPA	469	275	744	829,937	0.00
Hoy SPA	476	279	756	829,937	0.00
Marwick Head SPA	631	370	1,002	829,937	0.00
Mingulay and Berneray SPA	45	196	241	829,937	0.00
North Colonsay and Western Cliffs SPA	111	490	601	829,937	0.00
North Rona and Sula Sgeir SPA	25	110	135	829,937	0.00
Noss SPA	608	357	965	829,937	0.00
Rathlin Island SPA	158	697	856	829,937	0.00
Rousay SPA	2,117	1,242	3,359	829,937	0.00
Rum SPA	16	69	85	829,937	0.00
Shiant Isles SPA	11	48	59	829,937	0.00
Skomer, Skokholm and the Seas off Prembrokeshire SPA	21	92	113	829,937	0.00
St. Kilda SPA	19	84	103	829,937	0.00
Sumburgh Head SPA	252	148	400	829,937	0.00
Ythan Estuary, Sands of Forvie and Meikle Loch SPA[1]	568	343	911	829,937	0.00
UK North Sea non-SPA colonies	84,000	49,280	133,280	829,937	0.16
UK Western non-SPA colonies	600	2,640	3,240	829,937	0.00

[1] *SPA has connectivity with the Project during the breeding season.*

Table 12 Apportionment of kittiwake to SPA and non-SPA colonies during spring migration (Furness, 2015)

Colony	No. adults	No. immatures	Total colony population	BDMPS (adults and immatures)	Proportion
East Caithness Cliffs SPA	48,492	21,336	69,828	627,816	0.11
Flamborough & Filey Coast SPA	45,140	19,862	65,002	627,816	0.10
Troup, Pennan and Lion's Head SPA[1]	17,875	7,865	25,740	627,816	0.04
Buchan Ness to Collieston Coast SPA[1]	15,050	6,622	21,673	627,816	0.03
Fowlsheugh SPA[1]	11,204	4,930	16,134	627,816	0.03
North Caithness Cliffs SPA	12,180	5,359	17,539	627,816	0.03
West Westray SPA	14,466	6,365	20,831	627,816	0.03
Farne Islands SPA	4,132	1,818	5,950	627,816	0.01
Forth Islands SPA	3,720	1,637	5,357	627,816	0.01
St Abb's Head to Fast Castle SPA[1]	4,084	1,797	5,880	627,816	0.01
Ailsa Craig SPA	10	17	27	627,816	0.00
Calf of Eday SPA	896	394	1,291	627,816	0.00
Canna and Sanday SPA	16	29	45	627,816	0.00
Cape Wrath SPA	207	364	571	627,816	0.00
Copinsay SPA	799	352	1,151	627,816	0.00
Coquet Island SPA	416	186	602	627,816	0.00
Fair Isle SPA	925	407	1,332	627,816	0.00
Firth of Forth SPA	1,386	619	2,005	829,938	0.00
Flannan Isles SPA	28	49	77	627,816	0.00
Foula SPA	392	173	565	627,816	0.00
Handa SPA	37	66	103	627,816	0.00

Colony	No. adults	No. immatures	Total colony population	BDMPS (adults and immatures)	Proportion
Hermaness, Saxa Vord and Valla Field SPA	469	206	676	627,816	0.00
Hoy SPA	476	210	686	627,816	0.00
Marwick Head SPA	631	278	909	627,816	0.00
Noss SPA	45	78	123	627,816	0.00
Mingulay and Berneray SPA	111	196	307	627,816	0.00
North Colonsay and Western Cliffs SPA	25	44	69	627,816	0.00
North Rona and Sula Sgeir SPA	608	268	876	627,816	0.00
Rathlin Island SPA	158	279	437	627,816	0.00
Rousay SPA	2,117	931	3,048	627,816	0.00
Rum SPA	16	28	43	627,816	0.00
Shiant Isles SPA	11	19	30	627,816	0.00
Skomer, Skokholm and the Seas off Pembrokeshire SPA	21	37	58	627,816	0.00
St Kilda SPA	19	34	53	627,816	0.00
Sumburgh Head SPA	252	111	363	627,816	0.00
Ythan Estuary, Sands of Forvie and Meikle Loch SPA[1]	568	253	821	627,816	0.00
UK North Sea non-SPA colonies	84,000	36,960	120,960	627,816	0.19
UK Western non-SPA colonies	600	1,056	1,656	627,816	0.00

[1] SPA has connectivity with the Project during the breeding season.

3.3.2 Gannet

63 Results for apportioning during autumn and spring migration for gannet, using the adjusted BDMPS estimates, are presented in Table 13 and Table 14 respectively.

Table 13 Apportionment of gannet to SPA colonies during autumn migration (Furness, 2015)

Colony	Flight direction of migrating birds	No. individuals within BDMPS region (adults and immatures)	Adjusted BDMPS (adults and immatures)	Proportion
Forth Island SPA[1]	North	100,802	296,363	0.34
Hermaness, Saxa Vord and Valla Field SPA[1]	South	33,918	296,363	0.11
Noss SPA[1]	South	22,327	296,363	0.08
St Kilda SPA	South	21,825	296,363	0.07
Flamborough Head and Flley Coast SPA	North	14,294	296,363	0.05
Fair Isle SPA[1]	South	8,737	296,363	0.03
Troup, Pennan and Lion's Heads SPA[1]	South	9,980	296,363	0.03
Foula SPA[1]	South	3,776	296,363	0.01
North Rona and Sula Sgeir SPA	South	3,437	296,363	0.01
Sule Skerry and Sule Stack SPA	South	3,282	296,363	0.01
West Westray SPA[1]	South	2,509	296,363	0.01
Marwick Head SPA[1]	South	105	296,363	0.00
St Abb's Head to Fast Castle SPA[1]	North	127	296,363	0.00

[1] SPA has connectivity with the Project during the breeding season.

Table 14 Apportionment of gannet to SPA and non-SPA colonies during spring migration (Furness, 2015)

Colony	Flight direction of migrating birds	No. individuals within BDMPS region (adults and immatures)	Adjusted BDMPS (adults and immatures)	Proportion
Forth Island SPA[1]	South	198,880	322,993	0.62
Hermaness, Saxa Vord and Valla Field SPA[1]	North	33,918	322,993	0.11
Flamborough Head and Filey Coast SPA	South	28,587	322,993	0.09
Noss SPA[1]	North	22,327	322,993	0.07
Fair Isle SPA[1]	North	8,737	322,993	0.03
Foula SPA[1]	North	3,776	322,993	0.01
Troup, Pennan and Lion's Head SPA[1]	North	4,277	322,993	0.01
West Westray SPA[1]	North	2,509	322,993	0.01
Marwick Head SPA[1]	North	105	322,993	0.00
North Rona and Sula Sgeir SPA	North	0	322,993	0.00
St Abb's Head to Fast Castle SPA[1]	South	251	322,993	0.00
St Kilda SPA	North	0	322,993	0.00
Sule Skerry and Sule Stack SPA	North	0	322,993	0.00

[1] SPA has connectivity with the Project during the breeding season.

3.3.3 Puffin

64 Results for apportioning during non-breeding for puffin are presented in Table 15.

Table 15 Apportionment of puffin to SPA and non-SPA colonies during the non-breeding season

Colony	No. adults	No. immatures	Total colony population	BDMPS (adults and immatures)	Proportion
Forth Islands SPA[1]	62,231	2,589	64,820	231,957	0.28
Farne Islands SPA[1]	39,962	1,662	41,624	231,957	0.18
Coquet Island SPA[1]	12,344	514	12,858	231,957	0.06
Hermaness, Saxa Vord and Valla Field SPA	7,098	984	8,083	231,957	0.04
Foula SPA	6,750	936	7,686	231,957	0.03
Fair Isle SPA	3,212	445	3,657	231,957	0.02
Hoy SPA	1,050	146	1,196	231,957	0.01
Flamborough & Filey Coast SPA	958	40	998	231,957	0.00
St Kilda SPA	285	296	580	231,957	0.00
North Caithness Cliffs SPA	293	41	333	231,957	0.00
Noss SPA	241	33	274	231,957	0.00
Shiant Isles SPA	130	136	266	231,957	0.00
Sule Skerry and Sule Stack SPA	119	124	243	231,957	0.00
Buchan Ness to Collieston Coast SPA[1]	16	1	16	231,957	0.00
Canna and Sanday SPA	2	2	4	231,957	0.00
Cape Wrath SPA	3	3	7	231,957	0.00
East Caithness Cliffs SPA	82	11	94	231,957	0.00

Colony	No. adults	No. immatures	Total colony population	BDMPS (adults and immatures)	Proportion
Flannan Isles SPA	31	32	63	231,957	0.00
Fowlsheugh SPA[1]	37	2	39	231,957	0.00
Mingulay and Berneray SPA	6	7	13	231,957	0.00
North Rona and Sula Sgeir SPA	11	11	22	231,957	0.00
Rathlin Island SPA	1	1	3	231,957	0.00
Skomer, Skokholm and the Seas off Pembrokeshire SPA	48	50	98	231,957	0.00
Troup, Pennan and Lion's Heads SPA[1]	8	0	8	231,957	0.00
UK North Sea non-SPA colonies	17,500	1,456	18,956	231,957	0.08
UK western non-SPA colonies	90	94	184	231,957	0.00

[1] *SPA has connectivity with the Project during the breeding season.*

4 Conclusions

65 Apportioning provides a means of determining the proportions of impacted birds from specific colonies present within the Array Area. The weightings from breeding season apportioning and the proportions from non-breeding season apportioning will be used to assign impacted birds (from collision and/or distributional responses) to their likely colony of origin.

66 For kittiwake, breeding season apportioning predicted the majority of individuals within the Array Area were from Fowlsheugh SPA (23%). Other colonies which had a high proportion of individuals present within the Array Area include Buchan Ness to Collieston Coast SPA (16%), East Caithness Cliffs SPA (13%) and Troup, Pennan and Lion's Heads SPA (12%). During the non-breeding season, the highest proportion of birds were found to come from Flamborough and Filey Coast SPA in the autumn migration period and East Caithness Cliffs SPA in the spring migration period (9% and 11% respectively).

67 During the breeding season the majority of gannet within the Array Area are expected to be associated with Forth Islands SPA (80%). Other colonies contributing relatively high proportions of gannet within the Array Area include Hermaness, Saxa Vord and Valla Field SPA (6%), Noss SPA (5%) and Troup, Pennan and Lion's Heads SPA (5%). During autumn and spring migration, Forth Islands SPA was found to have the largest proportion of individuals potentially travelling through the site during both migration periods (34% and 62%)

68 The majority of puffin present in the Array Area during the breeding season are expected to be associated with Farne Islands SPA and Forth Islands SPA (both 42%). The only other colony found with birds apportioned to was Coquet Island SPA (16%). During the non-breeding season, the majority of birds were expected to be originating from the same two SPAs, with 28% and 18% of birds from Forth Islands SPA and Farne Islands SPA respectively.

69 For kittiwake and gannet, the non-breeding season is split into spring and autumn migration periods in Furness (2015), meaning two separate apportioning values are presented in this report. Weightings from apportioning will be applied to mortality estimates for species, within foreshortened Furness (2015) seasons, to avoid overestimation of impacts. Apportioned mortalities will be presented for two periods as defined by NatureScot (2020): breeding and non-breeding.

70 The apportioning weightings for each species and SPA colony where the species of interest is a qualifying species, and may be relevant for Appropriate Assessment, are presented in Table 16.

71 Within Table 16, no adjustment for adult/immature ratios in the breeding or non-breeding season or consideration of sabbatical rates during the breeding season, are applied to apportioning weightings. The apportioning weightings presented represent those as calculated using the approaches to apportioning as presented in Sections 2.3 and 2.4.

Table 16 Apportioning weightings for adult birds during breeding and non-breeding seasons at SPA colonies, where species are qualifying species. Only colonies which had a weighting greater than 0.00 for either season are presented

SPA colony	Breeding season weighting	Non-breeding season weighting*
Kittiwake		
Buchan Ness to Collieston Coast SPA	0.16	A – 0.03 S – 0.03
East Caithness Cliffs SPA	0.13	A – 0.09 S – 0.11
Farne Islands SPA	0.03	A – 0.01 S – 0.01
Flamborough and Filey Coast SPA	-	A – 0.09 S – 0.10
Forth Islands SPA	0.06	A – 0.01 S – 0.01
Fowlsheugh SPA	0.23	A – 0.02 S – 0.03
North Caithness Cliffs SPA	0.04	A – 0.02 S – 0.03
St Abb's Head to Fast Castle SPA	0.05	A – 0.01 S – 0.01
Troup, Pennan and Lion's Head SPA	0.12	A – 0.03 S – 0.04
West Westray SPA	-	A – 0.03 S – 0.03
Gannet		
Fair Isle SPA	0.03	A – 0.03 S – 0.03
Flamborough and Filey Coast SPA	-	A – 0.05 S – 0.09
Forth Islands SPA	0.80	A – 0.34 S – 0.62
Hermaness, Saxa Vord and Valla Fields SPA	0.06	A – 0.11 S – 0.11

SPA colony	Breeding season weighting	Non-breeding season weighting*
North Rona and Sula Sgeir SPA	-	A – 0.01 S – 0.00
Noss SPA	0.05	A – 0.08 S – 0.07
St Kilda SPA	-	A – 0.07 S – 0.00
Sule Skerry and Sule Stack SPA	-	A – 0.01 S – 0.00
Puffin		
Fair Isle SPA	-	0.02
Farne Islands SPA	0.42	0.18
Forth Islands SPA	0.42	0.28
Foula SPA	-	0.03
Hermaness, Saxa Vord and Valla Field SPA	-	0.04
Hoy SPA	-	0.01

**For species which have autumn and spring migration periods, 'A' and 'S' represent each migration period respectively*

4.1 Further adjustments for non-breeding season impacts

74 Post apportionment, for kittiwake and gannet, impacts during the two migratory periods (autumn and spring migration) must be added together to give one total mortality estimate for the non-breeding season, as presented in NatureScot (2020).

75 For collision impacts, monthly estimates were derived using Collision Risk Modelling (CRM), which were totalled, per season. Where the impact occurred in a month where the season changed halfway through that month, the impact was split 50:50. The impact (mortality) was multiplied by the apportioning weighting for each migratory period to give the estimated mortality for spring and autumn. These were summed to give impacts representative of the NatureScot non-breeding season.

76 For impacts from distributional responses, the proportion of months which make up the NatureScot (2020) non-breeding season, in each migratory period, was calculated. E.g. 7.5 months in NatureScot non-breeding season which constitutes 3.5 months in the spring migration period and 4.0 months in the autumn migration period. The estimated impact for the non-breeding season was multiplied by this proportion to split impacts into each spring and autumn period, and apportioning weightings applied. Impacts were summed to derive the impact per colony for the full NatureScot non-breeding season. Annual impacts per colony are presented in Annex 2, with impacts per season presented in EIAR Vol. 4 Appendix: A25 Population Viability Analysis Report.

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Annex 1: Age class proportions used to apportion impacts

77 Table 17 to Table 19 present the age class proportions used to apportion impacts to kittiwake, gannet and puffin to SPAs, relevant to impact assessment. Various sources were used to determine age class proportions, which is explained in more detail in Section 2.5.

78 During the breeding season, age class information from site-specific DAS was used for kittiwake and gannet, while for puffin, the stable age structure from the Natural England PVA Tool (which uses data derived from Horswill and Robinson, 2015) was used.

79 For all species in the non-breeding season, information from Appendix A of Furness (2015) was used.

Table 17 Kittiwake: proportion of adult birds used to apportion predicted impacts to Special Protection Areas (SPAs). Reference used to derive proportions of adult birds indicated within brackets

SPA	Breeding season (site-specific digital aerial surveys)	Spring migration period (Furness 2015)	Autumn migration period (Furness 2015)
Buchan Ness to Collieston Coast SPA	0.95	0.69	0.63
East Caithness Cliffs SPA	0.95	0.69	0.63
Flamborough and Filey Coast SPA	0.95	0.69	0.63
Forth Islands SPA	0.95	0.69	0.63
Fowlsheugh SPA	0.95	0.69	0.63
North Caithness Cliffs SPA	0.95	0.69	0.63
St Abb's Head to Fast Castle SPA	0.95	0.69	0.63
Troup, Pennan and Lion's Head SPA	0.95	0.69	0.63
West Westray SPA	0.95	0.69	0.63

Table 18 Gannet: proportion of adult birds used to apportion predicted impacts to Special Protection Areas (SPAs). Reference used to derive proportions of adult birds indicated within brackets

SPA	Breeding season (site-specific digital aerial surveys)	Spring migration period (Furness 2015)	Autumn migration period (Furness 2015)
Fair Isle SPA	0.98	0.68	0.55
Flamborough and Filey Coast SPA	0.98	0.68	0.58
Forth Islands SPA	0.98	0.68	0.58
Hermaness, Saxa Vord and Valla Field SPA	0.98	0.68	0.55
North Rona and Sula Sgeir SPA	0.98	0.00	0.38
Noss SPA	0.98	0.68	0.55
St Kilda SPA	0.98	0.00	0.38
Sule Skerry & Sule Stack SPA	0.98	0.00	0.38

Table 19 Puffin: proportion of adult birds used to apportion predicted impacts to Special Protection Areas (SPAs). Reference used to derive proportions of adult birds indicated within brackets

SPA	Breeding season (Natural England PVA Tool, derived from Horswill and Robinson (2015))	Non-breeding season (Furness 2015)
Fair Isle SPA	n/a	0.88
Farne Islands SPA	0.59	0.96
Forth Islands SPA	0.65	0.96
Foula SPA	n/a	0.88
Hermaness, Saxa Vord and Valla Field SPA	n/a	0.88
Hoy SPA	n/a	0.88

Cenos Offshore Wind Farm EIA (Volume 4) Appendix A24: Apportioning Report - Annex 2: Seabird mortalities apportioned to Special Protection Areas (SPAs)

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Distribution List

Name	Organisation	Email Address
[Redacted]	Cenos Offshore Windfarm Ltd	[redacted]
[Redacted]	Cenos Offshore Windfarm Ltd	[redacted]
[Redacted]	Cenos Offshore Windfarm Ltd	[redacted]

Tables

1 This Annex uses information presented in EIAR Vol. 4, Appendix A24: Apportioning Report, to determine seabird mortalities at Special Protection Areas (SPAs) due to the presence of the Project.

2 The species considered sensitive to either collision risk, distributional responses or both are:

- Black-legged kittiwake (*Rissa tridactyla*), hereafter 'kittiwake';
- Atlantic puffin (*Fratercula arctica*), hereafter 'puffin'; and
- Northern gannet (*Morus bassanus*); hereafter 'gannet'.

3 Table 2 to Table 4 present the annual collision and displacement mortalities apportioned to each SPA within foraging distance of the Project for each species.

4 The weightings used for apportioning impacts to each SPA are those calculated in EIAR Vol. 4, Appendix A24: Apportioning Report, presented in Section 3.2 and 3.3.

5 For all species, two scenarios are presented: high and low. These two scenarios incorporate the range of displacement and mortality rates used within assessment of distributional responses. The displacement and mortality rates used in each scenario are presented in Table 1.

Table 1 Displacement and mortality rates used in low and high scenarios per species

Species	Low scenario		High scenario	
	Breeding season	Non-breeding season	Breeding season	Non-breeding season
Kittiwake	30% / 1%	30% / 1%	30% / 3%	30% / 3%
Puffin	60% / 3%	60% / 1%	60% / 5%	60% / 3%
Gannet	70% / 1%	70% / 1%	70% / 3%	70% / 3%

6 No species/site combinations passed the threshold of a 0.02 percentage point change to baseline adult survival, as requested by NatureScot, to require project alone PVA.

Table 2 Kittiwake annual mortalities from collision and distributional responses apportioned to SPA

Site	Adult collision mortality	Adult displacement mortality		Total project alone adult mortality		Percentage point change in adult survival	
		Low	High	Low	High	Low	High
Buchan Ness to Collieston Coast SPA	1.21	0.09	0.28	1.30	1.48	0.005	0.005
East Caithness Cliffs SPA	1.25	0.09	0.27	1.34	1.52	0.003	0.003
Flamborough and Filey Coast SPA	0.31	0.02	0.05	0.33	0.36	0.000	0.000
Forth Islands SPA	0.44	0.03	0.10	0.47	0.54	0.003	0.004
Fowlsheugh SPA	1.68	0.13	0.39	1.81	2.07	0.005	0.005
North Caithness Cliffs SPA	0.37	0.03	0.08	0.40	0.45	0.002	0.003
St Abb's Head to Fast Castle SPA	0.34	0.03	0.08	0.36	0.42	0.003	0.004
Troup, Pennan and Lion's Head SPA	0.92	0.07	0.21	0.98	1.12	0.004	0.004
West Westray SPA	0.10	0.01	0.02	0.10	0.12	0.002	0.002

Table 3 Puffin annual mortalities from distributional responses apportioned to SPA. Refer to Table 1 for definitions of low and high

Site	Adult displacement mortality		Total project alone adult mortality		Percentage point change in adult survival	
	Low	High	Low	High	Low	High
Fair Isle SPA	0.01	0.02	0.01	0.02	0.000	0.000
Farne Islands SPA	0.98	1.73	0.98	1.73	0.001	0.002
Forth Islands SPA	1.13	2.02	1.12	2.02	0.001	0.002
Foula SPA	0.01	0.03	0.01	0.03	0.000	0.001
Hermaness, Saxa Vord and Valla Field SPA	0.01	0.04	0.01	0.04	0.001	0.002
Hoy SPA	0.00	0.01	0.00	0.01	0.000	0.001

Table 4 Gannet annual mortalities from collision and distributional responses apportioned to SPA

Site	Adult collision mortality	Adult displacement mortality		Total project alone adult mortality		Percentage point change in adult survival	
		Low	High	Low	High	Low	High
Fair Isle SPA	0.46	0.07	0.21	0.53	0.67	0.006	0.007
Flamborough and Filey Coast SPA	0.10	0.09	0.27	0.19	0.37	0.001	0.001
Forth Islands SPA	12.81	1.69	5.08	14.51	17.89	0.010	0.012
Hermaness, Saxa Vord and Valla Field SPA	1.05	0.20	0.61	1.25	1.65	0.003	0.004
North Rona and Sula Sgeir SPA	0.01	0.00	0.01	0.01	0.02	0.000	0.000
Noss SPA	0.92	0.15	0.46	1.08	1.38	0.004	0.006
St Kilda SPA	0.07	0.02	0.06	0.09	0.12	0.000	0.000
Sule Skerry & Sule Stack SPA	0.01	0.00	0.01	0.01	0.02	0.000	0.000

Cenos Offshore Wind Farm EIA (Volume 4) Appendix A24 – Apportioning Report - Annex 3: Additional gannet scenario at Forth Islands SPA

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[Redacted]	Cenos Offshore Windfarm Ltd	[redacted]
[Redacted]	Cenos Offshore Windfarm Ltd	[redacted]

Tables

1 Additional scenario for gannet at Forth Islands SPA

1 This Annex supports information presented in EIAR Vol. 4, Appendix A24: Apportioning Report, and provides an additional breeding season apportioning scenario for northern gannet (*Morus bassanus*; hereafter 'gannet') at Forth Islands Special Protection Area (SPA).

2 Gannet were among the species most affected by the Highly Pathogenic Avian Influenza Virus (HPAIV) outbreak, with the virus first reported at Bass Rock (the gannet colony within Forth Islands SPA) in June 2022 (Lane *et al.,* 2023). Site-specific Digital Aerial Surveys (DAS) for the Project spanned the period of the outbreak (April 2021 to March 2023), therefore NatureScot advised the Project (advice received via email 7th November 2024) that an additional scenario for gannet at Forth Islands SPA be run, using the gannet colony count at Forth Islands SPA from 2023. This is to allow comparison between pre- and post- HPAIV populations and how they influence population level impacts. Population level impacts are derived through Population Viability Analysis (PVA) and presented in EIAR Vol. 4, Appendix A25: Population Viability Analysis Report.

3 The most recent colony count for gannet hosted on the Seabird Monitoring Programme (SMP) database for the Forth Islands SPA is from 2014, which has been used within gannet breeding season apportioning presented in EIAR Vol. 4, Appendix A24: Apportioning Report. The same methodology as described in EIAR Vol. 4, Appendix A24: Apportioning Report was used to derive apportioning weightings and apportion impacts to colonies; namely the NatureScot theoretical approach as presented in NatureScot (2018).

4 To facilitate comparison between derived apportioning weightings and apportioned impacts to Forth Islands SPA using gannet colony counts from 2014 and 2023, the results from both approaches are presented in Table 1. The apportioned mortality from collision and distributional responses to Forth Islands SPA when using both colony counts is presented in Table 2.

Table 1 Apportioning weightings derived using 2014 and 2023 Bass Rock colony counts for gannet at Forth Islands SPA

Year of Count	Colony count (AOS)	Colony count (IND)	Distance from Array Area (km)	Resulting weighting	Proportional weighting
2014	75,259	150,518	265	1.231	0.80
2023	51,844	103,688	265	1.056	0.73

Table 2 Gannet annual mortalities from collision and distributional responses apportioned to Forth Islands SPA using 2014 and 2023 colony counts

Year of count	Adult collision mortality	Adult displacement mortality		Total project alone adult mortality		Percentage point change in adult survival	
		70% / 1%	70% / 3%	70% / 1%	70% / 3%	70% / 1%	70% / 3%
2014	12.81	1.69	5.08	14.51	17.89	0.010	0.012
2023	11.64	1.50	4.50	13.14	16.14	0.013	0.016