Outer Dowsing Offshore Wind

Report to Inform Appropriate Assessment

Annex 1: Offshore and Intertidal Ornithology Apportioning

Date: July 2024

Document Reference: 7.1.1
Pursuant to APFP Regulation: 5(2)(g)
Rev: 2.0

Company:	**Outer Dowsing Offshore Wind**	Asset:	**Whole Asset**
Project:	**Whole Wind Farm**	Sub Project/Package:	Whole Asset
Document Title or Description:	Offshore and Intertidal Ornithology Apportioning		
Internal Document Number:	PP1-ODOW-DEV-CS-REP-0201_02	3rd Party Doc No (If applicable):	N/A

Rev No.	**Date**	**Status / Reason for Issue**	**Author**	**Checked by**	**Reviewed by**	**Approved by**
V1.0	March 2024	For DCO Application	GoBe	Outer Dowsing	Shepherd & Wedderburn	Outer Dowsing
V2.0	July 2024	Response to Section 51 Advice	GoBe	GoBe	Outer Dowsing	Outer Dowsing

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Abbreviations

Acronym	Expanded name
BDMPS	Biologically Defined Minimum Population Scales
CRM	Collision Risk Modelling
DAS	Digital Aerial Survey
EPP	Evidence Plan Process
FFC SPA	Flamborough and Filey Coast Special Protection Area
HRA	Habitats Regulations Assessment
MMF	Mean-Maximum Foraging
OWF	Offshore Windfarm
RIAA	Report to Inform Appropriate Assessment
SD	Standard Deviation
SNCB	Statutory Nature Conservation Body
SPA	Special Protection Area
WTG	Wind turbine generators

Definitions

Term	Definition
The Project	Outer Dowsing Offshore Wind Project
Apportioning	Defining the proportion of a projects impact felt by a colony.
Array area	The area offshore within which the generating stations will be situated (including wind turbine generators (WTG), offshore platforms and Inter-array cables).
Baseline	The status of the environment at the time of assessment without the development in place.
Bio-season	A period within the annual cycle of a species that can broadly be defined by the species behaviour and location.
Collision	Impact upon birds through collision with wind turbine generators.
Displacement	Mechanism by which birds are impacted through being denied access to, or passage through a given area.
Habitats Regulations Assessment (HRA)	Habitats Regulations Assessment. A process which helps determine likely significant effects and (where appropriate) assesses adverse impacts on the integrity of European conservation sites and Ramsar sites. The process consists of up to four stages of assessment: screening, appropriate assessment, assessment of alternative solutions and assessment of imperative reasons of over-riding public interest (IROPI) and compensatory measures.
Impact	An impact to the receiving environment is defined as any change to its baseline condition, either adverse or beneficial.
Intertidal	Area where the ocean meets the land between high and low tides.
Wind turbine generator (WTG)	All the components of a wind turbine, including the tower, nacelle, and rotor.

Reference Documentation

Document Number	Title
6.3.12.2	**Collision Risk Modelling Assessment**
6.3.12.3	**Displacement Assessment**
7.1	**Report to Inform Appropriate Assessment**
7.1.1	**HRA Screening Report**

1 Introduction

1. This annex supplements the Report to Inform Appropriate Assessment (RIAA), with the aim of outlining the approach to apportioning impacts from Outer Dowsing Offshore Wind (hereafter “the Project”) to ornithological receptors at designated sites screened in for assessment (Appendix 7.1.1: HRA Screening Report). The direct impact of the Project has been assessed and presented in the corresponding Collision Risk Modelling (CRM) Annex (Volume 3, Appendix 12.2: Collision Risk Modelling Assessment) and Displacement Annex (Volume 3, Appendix 12.3: Displacement Assessment).
2. Apportioning is the process by which the mortalities calculated for the Project are predicted to impact specific colonies. This allows an assessment of whether the Project will have an acceptable level of impact on individual colonies (especially designated sites, where population maintenance may be a key conservation objective), as well as more widely across regional or national populations.
3. The approach by which collision and displacement mortalities are apportioned to relevant sites by the Applicant is detailed within this report.

2 Key Considerations for Apportioning

2.1 Defining which Birds to Apportion

2.1.1 Bio-Seasons

4. The behaviour and distribution of seabirds varies throughout the year, which makes it essential to consider seasonality within assessments. Species can be present at a given site at different times of year depending on their ecology, and during the breeding season birds have their foraging range constrained by the need to attend to nests and provision chicks. Therefore, species are assigned biologically defined seasons (bio-seasons) where there are distinct differences in population size, behaviour, or distribution in order to assess the impact of OWFs over these periods. The bio-seasons used throughout the assessments were defined by Furness (2015) for all screened in species and are presented in Table 1 below. Impacts assessed within the RIAA were apportioned to SPAs within each of these bio-seasons.
5. Table 1 shows that some species have a different number of non-breeding bio-seasons to account for periods during which migration occurs through UK waters. For some species, both a migration-free breeding season and a 'full' breeding season are presented in Furness (2015), i.e., a bioseason within which the species is exclusively breeding, and a bioseason covering the whole period during which breeding occurs, respectively. For all species, the Applicant has used the full breeding season (as opposed to the migration-free breeding season).

Table 1. Bio-seasons of seabird species screened in for assessment, as defined by Furness (2015).

Species	Bioseason					
	Migration-free breeding	Post-breeding migration	Return Migration	Migration-free winter	Breeding	Non-breeding
Guillemot	-	-	-	-	Mar-Jul	Aug-Feb
Razorbill		Aug-Oct	Jan-Mar	Nov-Dec	Apr-Jul	-
Puffin	-	-	-	-	Apr-Aug	Sep--Mar
Red-throated diver					May-Aug	Sep-Apr
Gannet		Oct-Nov	Dec-Feb	-	Mar-Sep	-
Kittiwake		Sep--Dec	Jan-Feb	-	Mar-Aug	-
Sandwich tern		Sep	Apr	Oct-Mar	May-Aug	
Common tern		Sep	Apr		May-Aug	Oct-Mar
Lesser-black backed gull		Sep-Oct	Mar	Nov-Feb	Apr-Aug	

Species	Bioseason					
	Migration-free breeding	Post-breeding migration	Return Migration	Migration-free winter	Breeding	Non-breeding
Great black-backed gull	-	-	-	-	Apr-Aug	Sep-Mar
Little gull					May-Aug	Sep-Apr

2.1.2 Proportion of Breeding Adults in the Population

6. Where impacts upon populations at specific colonies need to be assessed, the number of breeding adults that are impacted by the offshore windfarm (OWF) (taken as a proportion of the individuals which are calculated by CRM and displacement) is required. To calculate the proportion of mortalities attributable to each colony, the proportion of adults in the population during the breeding season can be derived from known demographic rates such as those presented in Horswill and Robinson (2015) or from the tables in Appendix A of Furness (2015). The latter are presented in Table 2 below. In a small number of cases, where birds ages can be adequately determined from DAS data, site specific age structures can be used. In many cases, SNCB's support the use of adult proportions calculated using demographic rates, but for certain species (where aging is feasible from DAS images) a site specific adult proportion is preferred.

2.1.3 Sabbaticals

7. In a given breeding season, not all adults will breed, with some adults skipping a breeding season and taking a 'sabbatical'. This may be for a range of reasons, though predominantly due to birds either (i) making an adaptive decision to conserve energy in a given year to improve survival probability, or (ii) birds being unable to breed in a given year due to constraints (e.g. insufficient food availability, loss of breeding partner etc.). Not accounting for these non-breeding birds would result in an overestimate of breeding colony population size. Therefore, in accordance with both Marine Scotland guidance (Marine Scotland 2017 a,b) and in line with assessments undertaken for the Round 4 Plan Level HRA (NIRAS, 2022), impacts assigned to 'sabbatical birds' could be removed from the assessment. Sabbatical rates used should be based on values advised by NatureScot (2018) or sourced from Horswill and Robinson (2015), with values used presented in Table 2. It should be noted that for some species (e.g. terns), sabbatical rates cannot be defined due to a lack of data. Due to inconsistencies in the proportion of birds taking sabbaticals between years, Natural England do not endorse the use of sabbatical rates and as such, these are not considered any further.

Table 2. Demographic data used for the apportioning of impacts for the RIAA.

Species	Adult Proportion			Adult Survival
	Adult Proportion (Furness 2015)	Sabbatical rate	Adult proportion including sabbatical rate (where relevant)	
Red-throated diver	0.60	-	0.60	0.84
Common Scoter	-	-	0.434	0.783
Gannet	0.550	0.100	0.495	0.919
Guillemot	0.570	0.070	0.530	0.939
Razorbill	0.570	0.070	0.530	0.895
Puffin	0.490	0.070	0.456	0.906
Kittiwake	0.530	0.100	0.477	0.854
Common tern	0.60	-	0.60	0.883
Sandwich tern	0.610	-	0.610	0.898
Lesser black-backed gull	0.60	0.350	0.390	0.885

3 Defining Linkage to Colonies

3.1 Breeding Season Apportioning

8. Apportioning impacts from the Project to specific breeding populations during the breeding season should be undertaken using the interim guidance from NatureScot (2018). Breeding adults are limited in the distance and time over which they can forage by the need to return regularly to the nest site, therefore it is assumed that all adult birds potentially impacted during the breeding season can be attributed to colonies within a given range. The NatureScot (2018) guidance provides an evidence based approach for calculating which colonies impacts are apportioned to during the breeding bio-season. This guidance was deemed the most appropriate to use for assessing the impact from the Project as it has been widely used throughout the UK. The methodology calculates an estimated proportion of breeding adults associated with each colony based on the following parameters:
   - The population of each colony;
   - Established species-specific foraging ranges (Woodward *et al.,* 2019);
   - The distance from each colony (geometric centre) to Project array area (geometric centre); and
   - The proportion of sea within the mean-maximum foraging (MMF) range +1 Standard Deviation (SD) of the colony, as published by Woodward *et al*. (2019).
9. NatureScot (2018) guidance states using the following equation for apportioning calculations:

$$Weight = \left(\frac{Colony\ Population}{Sum\ of\ Populations}\right) \times \left(\frac{Sum\ of\ Distance^2}{Colony\ Distance^2}\right) \times \left(\frac{\frac{1}{Colony\ Sea\ Proportion}}{Sum\ of\ \frac{1}{Sea\ Proportions}}\right)$$

10. The guidance (NatureScot, 2018) suggests including colonies in the apportioning calculations that are within the MMF range of the species. However, it is worth noting that in the UK, it is becoming more widely expected that designated sites should be screened based on the MMF range plus one standard deviation (SD) presented in Woodward *et al*. (2019). On this basis, all designated Special Protection Areas (SPAs), and Ramsar sites within MMF range +1SD were included.

3.1.1 Distance from Colony to the Project

11. Distances were calculated using Geographic Information Systems (GIS) and were measured from geometric centre of the colony to geometric centre of the Project's array. Where straight line distances crossed over land, at-sea distances were manually calculated. Where there were multiple colonies within an SPA within MMF range or MMF range +1SD then each colony was considered separately, therefore distances were based on the centre of each colony rather than the centre of the SPA. Note that assessing from the geometric centre is the proposed approach given within the NatureScot (2018) apportioning guidance. However, where sites were within MMF range +1SD from edge of colony to edge of array, but were beyond MMF range +1SD when going from centre to centre, these SPAs were still included in the apportioning analysis as there is still potential connectivity with the wind farm.

3.1.2 Proportion of Sea within Foraging Range

12. The area of suitable foraging habitat within the radius of 1 MMF range plus 1 SD for each species from each colony was calculated as follows: using GIS, a buffer was drawn around each colony for each species describing their MMF range or MMF range +1SD. The foraging area used for all species was only considered to be the at sea area, therefore any area that was not sea was excluded. Where areas of sea were within foraging range from the colony by straight line but were further than foraging range when assuming birds only travel over sea, these areas were excluded manually. The resultant area was then converted into a proportion by dividing this area by the area of the circle with radius equal to the foraging range.
13. Using the calculation and parameters described above, a resultant weighting for each colony within foraging range was calculated. For each species, the weight apportioned to each colony is presented in Table 12

3.2 Non-Breeding Season Apportioning

14. Outside of the breeding bio-season, birds are not constrained by the need to return to a nest, and populations can contain both individuals from UK breeding colonies and from further away. As such, a much lower percentage of birds can be apportioned to any particular breeding colony population. Apportionment for the Project during the non-breeding bio-seasons was undertaken by calculating the proportion that each SPA colony population contributes to the non-breeding bio-geographical population. This approach is agreed the best current practice by UK Statutory Nature Conservation Bodies (SNCBs) (Nature Scot, 2018). This approach used the following data:
    - bio-seasons defined by Furness (2015);
    - SPA breeding adult populations taken from Furness (2015);
    - Non-breeding season population sizes (UK Biologically Defined Minimum Population Scales (BDMPS) equivalent) based on data from Furness (2015); and

- Proportions of SPA adult population remaining in relevant regions during the non-breeding bio-seasons as provided by Furness (2015). Where there was a lack of information on the proportion that remain in the region during the non-breeding bio-seasons, this was assumed to be 100% unless a justification for a lower proportion could be made.

15. The resulting apportionment is presented in Table 3below. For Scottish SPA population non-breeding season apportionments please see Annex B: Non-Breeding Season Apportioning to Scottish Colonies.

Table 3. Species bio-season apportionment of BDMPS populations to SPAs as derived from Furness (2015) during the non-breeding season.

Species	Bio-season	SPA	% Apportioned to SPA
Kittiwake	Return migration	Flamborough and Filey Coast SPA	7.19%
	Post-breeding migration		5.44%
Herring gull	Non-breeding	Flamborough and Filey Coast SPA	0.43%
Lesser black-backed gull	Return migration	Alde Ore Estuary (AOE) SPA	3.33%
	Post-breeding migration		3.33%
	Migration-free winter		4.92%
Sandwich tern	Return migration	North Norfolk Coast	21.73%
	Post-breeding migration		21.73%
Guillemot	Non-breeding	Farne Islands	3.73%
		Flamborough and Filey Coast SPA	4.41%
Razorbill	Return migration	Farne Islands	0.07%
	Post-breeding migration		0.02%
	Migration-free winter		0.07%
	Return migration	Flamborough and Filey Coast SPA	3.38%
	Post-breeding migration		3.38%
	Migration-free winter		0.91%
Puffin	Non-breeding	Farne Islands	34.50%
		Flamborough and Filey Coast SPA	0.82%
		Coquet Island	10.64%
Gannet	Return migration	Flamborough and Filey Coast SPA	4.85%
	Post-breeding migration		6.23%
	Return migration	Forth Islands	31.27%
	Post-breeding migration		21.89%

3.3 Colony Population Sizes

16. Once apportioned, the impacts on relevant designated sites, were assessed against both citation counts and more recent counts provided in Table 4. Citation counts were based on the citation documents provided for relevant sites (Natural England, 2021, NatureScot, 2018). More recent colony sizes were based on data provided in the Seabird Monitoring Programme Database (BTO, 2023) for all species except red-throated diver which was based on Iden *et al*. (2019). Count data used was based on the year/s corresponding to the baseline surveys (2019 - 2021) or the closest year available. Where more than one colony count was available during the baseline survey years, the average of all counts was used. All counts were converted into the number of individual breeding adults. For Scottish SPA population counts please see Annex B: Non-Breeding Season Apportioning to Scottish Colonies.

Table 4. Population abundance data (number of individuals) used in assessment for screened in sites and features, with citation and most recent counts.

Site	Species	Citation Count (year)	Updated Count (year)
Greater Wash	Red-throated diver	1,407 (2002/3 - 2005/06)	1,787 (2016)
	Common Scoter	3,449 (2003/04-2005/06)	3,517 (2016
Flamborough and Filey Coast SPA	Guillemot	83,214 (2008-2011)	149,980 (2022)
	Razorbill	21,140 (2008-2011)	61,346 (2022)
	Puffin	-	3,080 (2022)
	Gannet	16,938 (2008-2012)	30,466 (2023)
	Kittiwake	167,400 (1987)	89,148 (2022)
	Herring gull	-	283 (2022)
North Norfolk Coast SPA	Sandwich tern	7,400 (1996)	14,588 (2020-2022)
Farne Islands SPA	Guillemot	65,751 (2010-2014)	46,332 (2019)
	Razorbill	572 (2001)	427 (2019)
	Puffin	76,798 (2008-2013)	87,504 (2019)
	Kittiwake	8,241 (2010-2014)	8,804 (2019)
	Sandwich tern	1,724 (2010-2014)	834 (2019)
Coquet Island SPA	Puffin	31,686 (2008-2013)	25,029 (2019)
	Sandwich tern	2,600 (2010-2014)	4,428 (2022)
	Kittiwake	932 ()	1,038 (2022)
Forth Islands SPA	Gannet	43,200 (1990)	150,508 (2014)
Alde Ore Estuary SPA	Lesser black-backed gull	28,140 (1994/97)	3,498 (2023)

4 SNCB Apportioning

17. Broadly, the method advocated by NatureScot (2018) is accepted by all SNCBs. The differences in the approach used to apportion impacts are generally related to the use of bio-seasons, how the proportion of adults within the population is defined, and the application of sabbatical rates. The differences, and the influence these differences have on the outcome for the Project, are outlined below.

4.1 Differences in Use of Bio-Seasons

18. Primarily, deviations from how the bio-seasons defined by Furness (2015) are used in apportioning are related to how the breeding season, or any migratory periods are defined. The breeding season can either be a bio-season- within which the species is exclusively breeding, or a bio-season- covering the whole period during which breeding occurs. The latter definition will include a period where some birds are breeding but others are still migrating, both before and after breeding has occurred. In species such as auks, peaks at the beginning of the wider definition of the breeding season could lead to large numbers of birds being apportioned to an SPA which breed elsewhere. The bio-seasons- broadly endorsed by SNCB's are presented inTable 1; however, SNCB's may recommend additional bio-seasons- where project data suggests that potential impacts are not being fully accounted for.
19. If foraging ranges of central place foragers are used when apportioning breeding season impacts to colonies, the Applicant believes that the breeding season should be defined as the period during which individuals are constrained by the need to incubate or provision a chick, i.e. the period for which the foraging ranges are relevant.

4.2 Differences in Apportioning the Proportion of Adults within the Population

20. The aim of apportioning is to define the level of impact onto a colony. As colonies are made up of breeding birds, and breeding birds must be adult, assigning a proportion of birds within an impacted population as adults is essential. For each species, Furness (2015) calculated a proportion of the UK population which would be adult, using productivity and survival rates. Similarly, Horswill and Robinson (2015) presented demographic data for the UK's seabirds from which population structures could be modelled. However, these proportions are not endorsed by SNCB's, preferring apportioning of adults based on local demographic data or from DAS data, where possible, over the use of modelled population structures. However, for most species, ages of individuals can either not be defined across the whole age range (i.e. juveniles might be distinct, but immature birds may appear as adults, such as with the kittiwake), cannot be defined from DAS images (for example razorbill), or, cannot be defined in the field at all (for example guillemot). Precautionarily, SNCB's may recommend assigning all birds apportioned to a particular colony or suite of colonies as adults.

21. Where a bespoke 'post breeding migration' bio-season is applied, the SNCB approach to adult apportioning considers the number of young birds potentially in the population. However, this is not maintained through to either full, or migration free non-breeding seasons, or, to any 'return migration' seasons.
22. In non-breeding bio-seasons-, where impacts are assigned to colonies based upon their contribution into biologically defined minimum population scales, all birds are assumed to be adult.
23. Where empirical data from DAS cannot inform the proportion of adults within a population (i.e. for almost all seabird species apart from gannet, gulls and terns), the Applicant believes that modelled population structures with some precaution incorporated will provide a more accurate representation of adult proportions than the assumption that all birds within a population are adult.

4.2.1 Sabbatical Rates

24. In any given population of adults, a certain proportion will not breed in a given year. This is likely to be a result of a range of, and potentially an accumulation of, environmental stressors that might impact upon the body condition of the birds, or factors that dissuade them from breeding, such as food availability. The proportion not breeding is known as the sabbatical rate, and although this might vary year on year, a baseline sabbatical rate can be calculated with some confidence for some species. However, precautionarily, because of the uncertainty regarding a sabbatical rate in any given year, SNCB's do not endorse the use of sabbatical rates when apportioning adults to breeding populations.
25. The Applicant believes that use of generic sabbatical rates such as those calculated by Horswill and Robinson (2015) present a more accurate picture than assuming that a breeding population has no sabbaticals at all. However, in line with guidance from Natural England, sabbatical rates have not been used when apportioning numbers of impacted adults to SPA'sApplicant's Apportioning Approaches.

5 Applicants Apportioning Approaches

26. For certain species, existing apportioning approaches were deemed to be less appropriate than a bespoke, evidence based approach. The following bespoke approaches have been applied by the applicant.

5.1 Gannet and Sandwich Tern

27. Breeding season apportioning for gannet and Sandwich tern was not undertaken using the NatureScot (2018) guidance.
28. For gannet, available evidence shows high segregation in foraging areas from UK gannet colonies. Therefore, core foraging areas of gannet from the Flamborough and Filey Coast SPA are not expected to be used by adults from other colonies during the breeding season (Wakefield *et al*., 2013). Based on this, and advice provided by Natural England during the Evidence Plan Process (EPP) process (Volume 1, Chapter 12: Intertidal and Offshore Ornithology, Section 12.3), it was considered that 100% of adults encountered during the breeding season were from the Flamborough and Filey SPA.
29. For Sandwich tern, the only SPA within mean-maximum (34.3km) foraging range plus one standard deviation (23.2km) of the Project is the North Norfolk Coast SPA (Woodward *et al*., 2019). Based on this, and advice provided by Natural England during the EPP process, 100% of Sandwich terns were apportioned to this site during the breeding season.

5.2 Guillemot

5.2.1 Breeding Season Apportioning

30. Guillemot are susceptible to impacts from displacement, and displacement impacts are calculated per bio-season. For guillemot, breeding season impacts are apportioned to source colonies using the method described in 3.1 with the mean of peak counts per bio-season being the number taken through the impact assessment. Guillemot bio-seasons are presented in Table 1.
31. DAS data show a clear peak in guillemot numbers in April. Table 5 presents how high the April peaks are in comparison with the other months that make up the breeding season. The mean of these April peaks make up the breeding season population taken to assessment.

Table 5. Guillemot breeding season abundance by month over three breeding seasons

Month	2021	2022 Survey 1	2022 Survey 2	2023
March	6,369	6,792	8,171	6,667
April	21,585	24,984	11,594	9,462
May	4,719	12,806	4,110	3,929
June	1,062	2,253	4,221	1,881
July	7,644	2,089	6,525	2,166

32. The high April peaks at the Project contrast with the rest of the data from the breeding season, and there is no evidence or robust rationale for assuming that all of these birds are adults that are associated with the FFC SPA. Lower totals could be expected during the chick rearing period (June and July) when birds are more constrained, and likely to make shorter foraging flights. However, the relatively low counts for March and May in particular suggest that some of the birds that comprise the high April population may be associated with different colonies. It can be assumed that these colonies are further north than FFC SPA, as the numbers involved are too high to be accounted for by colonies in the southern North Sea and English Channel.
33. Some species have complex non-breeding bio-seasons to account for periods during which migration occurs through UK waters. For some species, both a migration-free breeding season and a 'full' breeding season is presented in Furness (2015), i.e., a bio-season within which the species is exclusively breeding, and a bio-season covering the whole period during which breeding occurs, respectively. Since the full breeding season will extend into the late stages of the period where birds are migrating towards colonies from wintering grounds, and the early stages of post-breeding migration, it is considered likely that large numbers of birds recorded during these periods of overlap are travelling through the area on migration as opposed to being breeding birds within the area.

5.2.1.1 Definitions of the Guillemot Breeding Season

34. Furness (2015) defines two breeding seasons for guillemot, a 'breeding season' which runs from March to July, and a 'migration free breeding season' that runs from March to June. Other authors describe a later breeding season, for example Kober *et al*. (2010) describe the guillemot breeding season as May to June. Cramp *et al*. (1985) describes egg laying as commencing in late April, with the majority taking place in May and June within the UK and Ireland. For colonies further north, these dates are later, e.g. in southern Iceland laying is on average one week later, in northern Norway it is on average two weeks later, and in Novaya Zemlya it is on average three weeks later. Dunn *et al*. (2020) describe recent egg laying on the Isle of May as exclusively in May.

35. Furness's definition of the breeding season is "the period between modal return of breeding adults to colonies in 'spring' to modal departure from colonies at the end of the breeding season." So, in essence Furness describes a period of colony attendance, rather than a breeding season. During this period, constraints on birds attending the are not likely to be the same as when the birds are actually breeding. The Applicant understands that during colony attendance before breeding, birds will still have strong links to the colony and their movements may be constrained. However, the extent of constraint before eggs are laid (and other periods of 'non-breeding colony attendance') is not known. As such, the Applicant believes that apportioning during the breeding season, defined by MMFR + 1 SD, should only apply to the period where these foraging ranges are known to apply. Studies from the Isle of May suggest that these constraints may not be present throughout the breeding period defined by Furness (2015). Dunn *et al.* (2020) present how daily energy budgets in North Sea guillemots are highest during April, suggesting that birds are not spending long periods of time lingering at colonies, but are more likely to be feeding intensively in order to prepare themselves for the breeding season. Data from birds tracked from the Isle of May show a 50% kernel density contour that stretches approximately 300 km north, and over 300 km south and west from the breeding colony in March (no data are available for April). The southernmost extent of this 50% kernel density contour reaches as far south as Suffolk. Assuming that birds from other North Sea colonies exhibit similar behaviour, it is likely that there are substantial numbers of birds associated with more northerly, large North Sea colonies (such as the Isle of May, or the Farne Islands) in the southern North Sea in March, and these birds may be travelling northwards towards their colonies in April. The Applicant believes that the apportioning of 50% of birds from the Project to FFC SPA during April acknowledges the likelihood of connection to the colony at this time, but to a lesser degree than during the incubation and chick rearing periods.

5.2.1.2 Guillemot Migration in March and April

36. Although Furness (2015) considered the period of March to June to be a migration free breeding period in UK guillemots, there is evidence to suggest that some substantial migration of guillemots takes place in the North Sea in the spring. Dunn *et al*. (2020) demonstrated how a large proportion of the Isle of May population can be hundreds of kilometres from the colony in March. DAS surveys of the Rampion 2 array area with 4km buffer estimated a guillemot population of 7,840 birds in March 2021 (Rampion 2 Offshore Wind Farm, 2023). This is a larger number than the population supported by local colonies (indeed it is larger than the entire English Channel and Channel Island breeding population, which was approximately 5,723 individuals in 2022), so it is reasonable to assume that birds associated with colonies elsewhere were involved. As colonies around the English Channel tend to be small, it is also reasonable to assume that this large transient population would move northwards towards the larger North Sea colonies.

37. In the North Sea, guillemot migration from wintering grounds towards more northerly breeding colonies may continue through into April and May. Off County Durham, "spring passage (of guillemots) does not usually begin in earnest until late April... ...and peaks in May" (Bowey and Newsome, 2012). Land based counts of guillemots from Whitburn, Tyne and Wear, show that there are frequently large northerly movements of guillemot in late April and May. Sixteen of the 20 peak counts for guillemot fall within this period, with a peak count of 20,000 birds on 5th May 2019. As Table 6 shows, using citizen science data taken from Trektellen.org, the direction of passage during these large movements off the coast of North East England is almost exclusively northwards. Rows of text in bold highlight represent counts from the spring migration period. The median date from the spring high counts is 8th May, and nine of these peak counts are from the period of 12 – 19th May, suggesting that peak passage of guillemots off the coast of north east England is around the second to third weeks of May.

Table 6. Peak land-based counts of guillemot from Whitburn, Tyne and Wear (from Trektellen.org).

Date	Count	Percentage heading north
15/05/2019	**20,000**	**100**
03/05/2019	**11,000**	**100**
20/05/2017	**9,500**	**100**
21/09/2019	9,380	100
13/05/2018	**9,100**	**100**
15/05/2015	**7,860**	**100**
25/02/2019	7,440	0.31
24/09/2017	6,700	100
15/05/2013	**6,600**	**100**
15/05/2016	**6,400**	**100**
17/05/2019	**5,760**	**100**
17/10/2009	5,700	100
23/05/2014	**5,500**	**100**
16/05/2018	**5,500**	**100**
28/04/2012	**5,306**	**100**
12/05/2016	**5,300**	**100**
01/05/2012	**5,245**	**100**
13/05/2014	**5,115**	**100**
07/05/2017	**4,600**	**100**
25/04/2012	**4,500**	**100**

38. Return dates in guillemot colonies are known to be influenced by different variables. In Shetland, colony size influences return date. A reduction in colony size decreases competition for the most suitable nest sites, and as such, breeding birds under less pressure to return to the colony may do so later in the year. At the Isle of May, guillemot return rates are influenced by the North Atlantic Oscillation (NAO), which describes the differences between two common high pressure features in the North Atlantic. Isle of May guillemot return rates were earlier when there was a large positive NAO index (Heubeck *et al.,* 2006). SMP data suggest that Shetland and Orkney guillemot colonies have suffered a marked decline since the Seabird 2000 census (JNCC 2023), and the additional impacts of avian influenza are not yet quantified. The NAO index was very low during the winter of 2020 - 21 (NAO data, UAE). Both of these factors could explain why large numbers of guillemots were away from their breeding colonies in April 2021 and 2022.
39. Guillemots were seldom noted in flight during DAS surveys. However, in April 2022, there was a relatively high proportion of birds recorded in flight, moving towards the north and northeast (Figure 1). If this was standard behaviour for birds associated with the FFC SPA, it would be a pattern expected throughout the breeding season, yet proportions of birds recorded in flight in May to July are extremely low. Likewise if these birds were associated with the FFC SPA and were using the survey area for foraging, for example, it might be expected that there were at least some observations of birds in transit from the colony. When considering the strong contingent of birds in flight to the north and north-east in April 2022, with no evidence of any movement in the direction of the survey area from the colony (either in that month, or on any other spring or breeding season surveys) it is pragmatic to conclude that numbers in April include birds migrating to more northerly colonies, rather than solely comprising birds from FFC SPA.
40. MRsea modelling of guillemot densities in the array area with 4 km buffer show that group sizes are low during the months of May, June and July, when birds are incubating and/or foraging for young. Group sizes increase when birds are dispersing in August and September. This suggests that birds flock less when actively breeding, flocking together once they are dispersing or migrating. Group sizes are also high in April, suggesting that birds are less likely to be actively breeding in this month, and more likely to be migrating.

Figure 79 **Summarised direction of movement of flying guillemots in the Outer Dowsing survey area between March 2021 and February 2023**

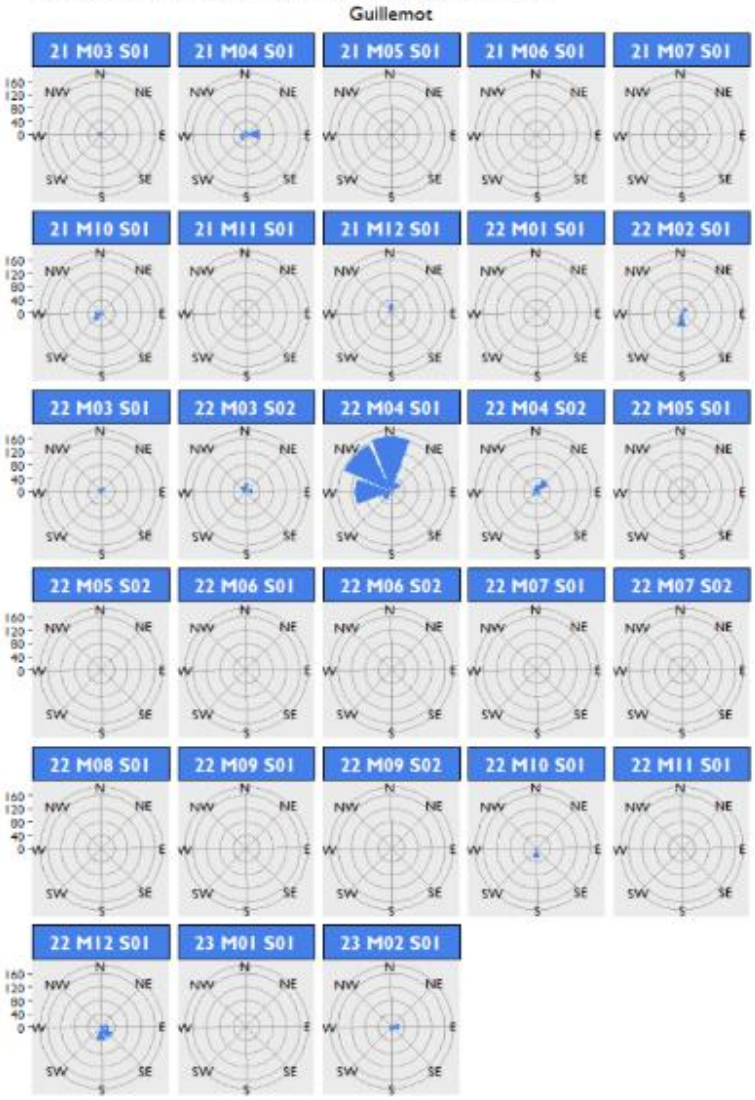

Figure 1: Rose diagrams depicting flight directions of Guillemots recorded on DAS surveys of the Project array area. Taken from 'Digital video aerial surveys of seabirds and marine megafauna at Outer Dowsing: 24-month Report March 2021 to February 2023'.

5.2.1.3 Tracking of breeding adults from FFC SPA

41. Adult guillemots, breeding at, and tracked from FFC SPA during the breeding season show very little connectivity with the Project. Hotspots for FFC SPA breeding guillemots derived from tracking data using Utilisation Distributions, Maximum Curvature and Getis-Ord analyses define an area that shows no spatial overlap with the Project, suggesting that the majority of birds breeding at FFC SPA do not use the Project for foraging during the breeding season, preferring an inshore area centred around Flamborough Head that lies at least 50 km to the north-west of the Project (Cleasby *et al* 2020). If this behaviour is typical of breeding season guillemots from that colony, the Applicant believes it is unlikely that large aggregations (potentially numbering 20,000 birds) at locations outwith these foraging hotspots are comprised solely of birds breeding at the colony.

5.2.2 Guillemot Colony Attendance

42. Dunn *et al*. (2020) demonstrate how colony attendance levels are relatively low in March (with levels similar to February) and only increase slightly in April. Colony attendance then grows through May, and attendance is substantially higher in late May than it is in April. Using data from tagged birds breeding on the Isle of May, Dunn *et al*. estimated rates of colony attendance within a sample of 100 adult birds of breeding age. Density scores relating to a numerical category (i.e., fewer than 10, 10 - 20 etc) were assigned to each day of the study. Using the maximum possible number for each daily density score, we can calculate an average of maximum colony attendance per month. These data show that colony attendance in April was substantially lower than in May (averaging a maximum of 48.5 birds on the cliff in April, compared to 91.4 for May, from a sample of 100 birds. As such, with colony attendance low, and many birds potentially over 300 km from the colony, at a colony level it would be more evidence showing that the early months of the breeding season for guillemot (March and April) should not be considered a period of full colony attendance, or a period where birds are constrained in the same way as they are during incubation and chick rearing periods.

43. Guillemot attend colonies throughout the year, with increased attendance after the period of post breeding dispersal. Studies on the Isle of May show that of 207 breeding plots studied in October, all were visited, with a mean number of visits during the study period of 32 (i.e. each plot was visited on average 32 times). Of 1,182 observations of colour ringed birds during this late autumn study, 1,161 (98.2%) were attending a site which they had bred at or previously occupied (Harris & Wanless, 1989). This suggests that attendance during this period is almost exclusively of birds that breed at the colony. Although the proportion of the colony in attendance outside of the breeding season is not known, the study referenced above suggests it may be higher than in the early months of the breeding season (March and April), where not all birds are in the vicinity of the colony, and attendance rates are relatively low. As such, in terms of assessment, it may be prudent to treat the early months of the breeding season (March and April) in the same way that other periods of 'non-breeding' colony attendance are treated, or at least to apportion a lower number of birds to the colony than is done for the periods of incubation and chick rearing.

5.3 Adult Proportions

44. Discerning the age structure of populations of guillemots at sea is difficult. Most non-adult birds are indistinguishable from adults under excellent observing conditions, so for the most part, aging birds from field observations or DAS datasets is not possible. Likewise, tracking studies have focussed on adult birds, meaning that our understanding of the at sea locations of immatures, and the level of mixing of age groups has not been improved by these studies.

45. As some ages of guillemot can be identified in the hand, or at autopsy, beached bird survey data could inform age structures, but would need to be treated cautiously as natural mortality occurs at different rates across age classes of birds. However, the age structures of birds impacted by oil spills should give some insight into age structures at sea. Acknowledging that from a given colony, birds of different ages may winter in different areas, looking at data from an array of oil pollution incidents, and at different times of year should allow us to ascertain broadly how many non-adult birds might be in an at sea population of guillemots. Baillie and Mead (1982) demonstrated that contact with oil during pollution events is not age related. Table 7hows the percentages of tideline corpses of different ages that were oiled, as collected over two recovery periods.

Table 7. Percentages of aged tideline corpses with signs of oiling over two recovery periods, taken from Baillie and Mead (1982).

Recovery period	% age of 1cy birds oiled	% age of imm (i.e., not ad or 1cy) birds oiled	%age of adult birds oiled
1967 – 79	41	58	64
1980 – 81	80	75	62
Averaged	60.5	66.5	63

46. If exposure to oil during pollution events is not age related, then age structures of birds exposed to oil pollution should reflect the age structure of the birds in the impacted area pre-exposure.

47. Examination of carcasses of guillemots impacted by the Tricolor oil spill in February 2003 showed that 76% of these birds were adults, with 6% aged as immature, and 18% aged as first year (i.e. fledged the previous year) (Camphuysen & Leopold, 2004). This was considered to be an 'extraordinary' ratio of adults to non adults when compared to age ratios collected from other oil spills. These, along with the Tricolor ratios, can be seen in Table 8.

Table 8. Ages of aged birds from oil spills in Europe.

Oil spill	Location	Year	Month	1st yr	Imm	Adult
Tricolore	Netherlands	2002	December	18	6	76
?	Zeeland	1991	?	78.9		21.1
?	Texel	1992	?	85.5		14.5
Prestige	Sw Spain	2002	November	89.0		11.0
Braer	Shetland	1993	January	77.0		23.0
Erica	Biscay	1999	December	58.0		42.0

Oil spill	Location	Year	Month	1st yr	Imm	Adult
Stylis	North Sea (Norway)	1981	January	87.0		13.0

48. The average proportion of adults in populations impacted by oil spills is 28.65%. Focussing just on those populations impacted in the North Sea, the proportion of adults is 29.52%. Using established productivity and survival rates, Furness stable age ratios estimate that the population is comprised of 57% adults, 19% juveniles and 24% non-juvenile immatures. Horswill and Robinson (2015) suggested that although a UK wide average survival rate may be applicable due to survival being similar at colonies that are increasing or declining, data suggest that regional rates, based on populations that share wintering grounds, may be more accurate. Birds from FFC SPA will overwinter in similar areas to those from the Isle of May, and as such, survival rates for this colony will be robust when used in modelling populations from FFC SPA. Horswill and Robinson also provide robust survival rates at different age classes, and regional productivity rates. With these data, and knowledge of breeding populations and colony specific productivity rates, a robust population structure can be modelled for colonies that broadly share a winter range. Based on these demographic rates the proportion of adults in the population is estimated at 53.1%.
49. Ring recoveries from the Tricolor spill identified eastern Scotland as the breeding location of recovered ringed birds, and assessment of biometrics of guillemot carcasses from this spill suggested that the subspecies *U.a.aalge* was involved (rather than *U.a.albionis*, the subspecies breeding on the coast of eastern England and elsewhere in the southern North Sea. Wing lengths of adult birds suggest a latitude of approximately 57 degrees north, which is roughly consistent with an east coast location near Aberdeen. (Camphuysen & Leopold, 2004). Votier *et al*. (2008) demonstrate that young birds are likely to disperse further from breeding colonies than adults. As such, large non-breeding populations at sea far from breeding colonies, such as the winter population in the southern North Sea, can be expected to host a large proportion of non-adult birds.
50. This demonstrates that in winter, at least in some parts of the southern North Sea, the guillemot population is made up of birds almost exclusively linked to colonies in eastern Scotland or on Scandinavian coasts at a latitude of 57 degrees north. It is also reasonable to assume that this population holds a range of age classes, with at the very least approximately 25%, but likely a much higher proportion not being adult.

6 Kittiwake

6.1 Apportioning of Adults Based on Site DAS Data

51. For kittiwake, aging criteria become very subtle after the birds first summer (i.e., after the breeding season, one year after a bird fledged - in its second calendar year), and unlikely to be easily detected from DAS images. At this age, differences between adult and immature birds may be undetectable, or so subtle that less experienced reviewers assign these birds as adults.
52. As these aging criteria are extremely subtle, all 2nd and 3rd year birds will be aged as adults. However, these birds are extremely unlikely to be breeding anywhere at this age.
53. Acknowledging that aging immature kittiwakes from DAS images will be difficult for approximately half the year in second calendar year birds, and impossible for birds in their third and fourth calendar years (when they appear as, and will be aged as, adults) means that using the proportion of birds aged as adults from DAS data over-estimates the number of adults present as:
    - Aging is not consistently simple throughout the species lifespan, so some ages are less likely to be recorded than others;
    - Percentages aged are generally low - on average 42% of birds were not aged at all;
    - Birds in their second calendar year will be difficult to detect from August onwards; and
    - birds aged as adults from DAS will contain an unknown proportion of undetectable third and fourth calendar year birds.
54. Noting that there may be issues using the number of juveniles determined by DAS (due to low rates of age determination by image reviewers) or modelling the number of adult like non adults using FFC SPA specific productivity rates (as it cannot be assumed that dispersal is uniform across all ages), the Applicant believes that using the modelled age structures presented by Furness (2015) gives the most appropriate age structure for birds using the proposed array area. However, based on guidance from Natural England, an adult apportioning rate of 91%, based on site specific adult proportions of aged birds, is used by the Applicant.

6.2 Sabbatical Rates

55. Current understanding of kittiwake philopatry and productivity rates infer that at the colony level, established Kittiwake populations are maintained by immigrant adults (a productivity rate of approximately 3.5 young per AON would be needed to maintain a colony based on productivity alone). As the FFC SPA population is stable, and productivity peaked at 1 bird per AON in 2023, the Applicant assumes that the colony is being maintained by adult immigration.

56. Danchin *et al.* (2002) describe how the process of dispersal (analogous here to newly arrived immigrants) introduces temporal and energetic costs through the requirement to find both suitable breeding sites and partners, and as such, are less likely to breed. They predict that the sabbatical rate was 1.7 times higher in newly arrived birds than in those well established at a colony. However, in line with guidance from Natural England, sabbatical rates have not been used when apportioning numbers of impacted adults to SPA's.

57. The Applicant believes that for a colony that has high levels of immigration, and is therefore likely to have high levels of non-breeding, the sabbatical rate published by Horswill and Robinson will present a more representative proportion of non-breeders than the assumption that there are no sabbaticals at all.

6.3 Apportioning with Offshore Breeders

58. The Applicant conducted a survey of breeding seabirds on offshore oil and gas installations in an area 20 kms from the array in 2022 and 2023. As the effort was inconsistent between both years, with much better coverage from the 2023 survey, the data from that year are presented here, in Table 9.

Table 9. Numbers of kittiwake nests on offshore oil and gas platforms in 2023

Platform number	Occupied nests (AONs)	Trace nests	Other individuals present
1	0	0	8
2	0	0	8
3	0	0	11
4	40	37	16
5	36	37	11
6	0	0	0
7	69	0	17
8	0	0	1
9	0	0	0
10	0	0	2
11	0	0	6
12	273	18	324
13	402	27	283
14	0	0	28
15	16	1	31
16	0	0	11
17	0	0	3
Totals	836	120	760

59. An apportioning approach which incorporates the kittiwake numbers presented above can be considered precautionary as:

- Count data from platforms is likely to under-represent the actual number of birds present due to the possibility that some nests would not be detectable owing to the viewing angle, proximity of the vessel, or location of the nest on a part of the structure not visible to observers on a vessel;
- Apportioning will only consider the numbers definitely breeding offshore, i.e., numbers of adults associated with AONs;
- Birds from platforms beyond the 20km radius could also forage in the array area. Only considering birds present on platforms within a 20 km radius of the array area means that birds associated with platforms further afield, and potentially using the array area, are not considered.

6.3.1 Apportioning results with and without offshore oil and gas installation breeders

60. Apportioning both with and without offshore breeding birds is provided in Table 9. The three colonies that comprise the FFC SPA population are in bold. Those colonies where no impact has been apportioned are greyed out. For many colonies the apportioning is very small and, due to the use of only two significant places, show as zero in Table 10.

Table 10. Changes in proportional weighting of kittiwake breeding colonies with the introduction of offshore breeders.

Colony	Proportional Weight of colony (excluding offshore breeders)	Proportional Weight of colony with offshore breeders included
Flamborough 8 (incl. harbour but not buildings)	0.00	0.00
Offshore platforms	-	0.31
Bridlington Town	0.00	0.00
Flamborough Head and Bempton Cliffs	**0.84**	**0.58**
Filey 1	**0.01**	**0.01**
Filey 2	0.05	0.03
Filey 3	**0.03**	**0.02**
Lowestoft	0.01	0.00
Cayton Bay 2	0.00	0.00
Cayton Bay 1	0.00	0.00
Sandside	0.00	0.00
Harbourside Houses	0.00	0.00
Castle Headland	0.02	0.02
Nelson Pub and Foreshore	0.00	0.00
Sea Cadets	0.00	0.00
Spa Bridge	0.00	0.00
Grand Hotel	0.00	0.00
Sulman's (urban)	0.00	0.00
Huntress Row	0.00	0.00
Old Britannia Inn/Eastborough	0.00	0.00

Colony	Proportional Weight of colony (excluding offshore breeders)	Proportional Weight of colony with offshore breeders included
Royal Hotel	0.00	0.00
Town Hall	0.00	0.00
Long Nab	0.00	0.00
Hundale	0.00	0.00
Cloughton Wyke	0.00	0.00
Robin Hoods Bay - Ness Point	0.00	0.00
Minsmere RSPB (Scrape & Beach)	0.00	0.00
Hawsker Bottoms 1	0.00	0.00
Hawsker Bottoms 2	0.00	0.00
Sizewell Rigs 1	0.00	0.00
Saltwick Nab 2	0.00	0.00
Saltwick Nab 1	0.00	0.00
Coquet Island RSPB	0.00	0.00
Farne Islands	0.01	0.01
Total	1	1

61. As shown in Table 10, in this case, introducing offshore colonies to apportioning reduces impacts apportioned to terrestrial colonies by 31% across the board. When considering impacts to FFC SPA, the summed proportional weights of the four colonies comprising the SPA is reduced from 0.93 to 0.61.

6.3.2 Justification for using Offshore Breeding Birds in Apportioning

62. If the array area is a suitable enough foraging site for kittiwake breeding at coastal colonies to make repeated long and energetically costly flights, then it must also be a suitable foraging area for birds breeding within, and (relatively) close to the array. As such, it can be assumed that birds breeding within the 20km radius use this site for feeding. There is no evidence that these 'local' breeders are less likely to be in the array area, or less likely to be detected by DAS, therefore, to ensure a robust assessment of the impacts of the Project, these local breeders should be considered when apportioning the impacts derived from abundances calculated from DAS data.

63. The method presented in 6.3 solely uses the data collected by the Project for those platforms local to the array area. Considering the high number of other platforms within the wider southern North Sea and the data from previous projects (Hornsea Four), it is assumed that this therefore represents an underestimate of the influence of offshore colonies. Consequently, the inclusion of offshore colonies within the apportioning process for the Project is considered appropriate, as agreed with Natural England (see Consultation table within the RIAA (document 7.1)), and the approach precautionary.

7 Summary of apportioning approaches used

64. Table 11presents a summary of the apportioning approaches used by the Applicant for each species. The Furness *et al.* (2015) full breeding season is used for all species.

Table 11. Summary of Apportioning Approaches

Species	Summary of apportioning approach
Kittiwake	61.3% to FFC SPA (including offshore breeding birds within apportioning, using NatureScot method) Site-specific adult proportion of 0.91
Gannet	100% to FFC SPA Site-specific adult proportion of 0.93
GBBG	NatureScot method
LBBG	NatureScot method Furness adult proportion
Sandwich tern	100% to NNC SPA Furness adult proportion
Herring Gull	NatureScot method Furness adult proportion
Guillemot	50% apportioned to FFC SPA 57% adults
Razorbill	100% apportioned to FFC SPA 57% adults
Puffin	NatureScot method Furness adult proportion
Common tern	mCRM only
Little gull	mCRM only

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Annex A: Breeding Season Apportioning Tables

Table 12. Breeding season apportionment calculations for screened in species based on the NatureScot Apportionment methodology (NatureScot, 2018).

Site	Distance from ODOW (km)	Count	Percentage sea	1/Psea	Distance^2	Resulting Weight for SPA	Proportional Weight of SPA
Kittiwake							
Flamborough 8 (incl. harbour but not buildings)	112.7	202	55.4	0.018	12701	0.003	0.001
Offshore platforms	20.0	1672	57.9	0.017	400	0.791	0.341
Bridlington Town	112.8	310	55.2	0.018	12724	0.005	0.002
Flamborough Head and Bempton Cliffs	114.8	79,306	51.8	0.019	13179	1.274	0.549
Filey 3	125.7	4114	56.1	0.018	15800	0.051	0.022
Filey 1	125.8	1580	55.6	0.018	15826	0.020	0.008
Lowestoft	126.5	892	68.6	0.015	16002	0.009	0.004
Filey 2	126.7	6368	55.8	0.018	16053	0.078	0.034
Cayton Bay 2	131.6	0	54.5	0.018	17319	0.000	0.000
Cayton Bay 1	131.8	0	54.4	0.018	17371	0.000	0.000
Sandside	135.9	0	54.5	0.018	18469	0.000	0.000
Harbourside Houses	136.0	74	54.5	0.018	18496	0.001	0.000
Castle Headland	136.1	3266	54.6	0.018	18523	0.035	0.015
Nelson Pub and Foreshore	136.1	26	54.4	0.018	18523	0.000	0.000
Sea Cadets	136.1	0	54.5	0.018	18523	0.000	0.000
Spa Bridge	136.1	378	54.2	0.018	18523	0.004	0.002

Site	Distance from ODOW (km)	Count	Percentage sea	1/Psea	Distance^2	Resulting Weight for SPA	Proportional Weight of SPA
Grand Hotel	136.2	586	54.2	0.018	18550	0.006	0.003
Sulman's (urban)	136.2	38	54.3	0.018	18550	0.000	0.000
Huntress Row	136.3	292	54.2	0.018	18578	0.003	0.001
Old Britannia Inn/Eastborough	136.3	52	54.4	0.018	18578	0.001	0.000
Royal Hotel	136.3	68	54.2	0.018	18578	0.001	0.000
Town Hall	136.3	46	54.2	0.018	18578	0.001	0.000
Long Nab	140.5	90	54.8	0.018	19740	0.001	0.000
Hundale	143.4	0	54.7	0.018	20564	0.000	0.000
Cloughton Wyke	143.8	0	54.5	0.018	20678	0.000	0.000
Robin Hoods Bay - Ness Point	153.3	0	54.4	0.018	23501	0.000	0.000
Minsmere RSPB (Scrape & Beach)	155.1	0	42.2	0.024	24056	0.000	0.000
Hawsker Bottoms 1	156.7	212	54.3	0.018	24555	0.002	0.001
Hawsker Bottoms 2	157.8	410	54.2	0.018	24901	0.003	0.001
Sizewell Rigs 1	158.2	1004	61.5	0.016	25027	0.007	0.003
Saltwick Nab 2	159.1	356	54.1	0.018	25313	0.003	0.001
Saltwick Nab 1	160.6	80	53.7	0.019	25792	0.001	0.000
Coquet Island RSPB	268.8	1038	47.0	0.021	72253	0.003	0.001
Farne Islands	296.9	7166	48.1	0.021	88150	0.019	0.008
Lesser black-backed gull							
Berney Marshes	120.6	40	55.1	0.018	14544	0.003	0.003
Blakeney Point	69.7	8	53.7	0.019	4858	0.096	0.098
Breydon Water	113.6	36	55.7	0.018	12905	0.000	0.000
Felixstowe Docks	205.4	3144	51.1	0.020	42189	0.000	0.000
Filey Town	126.0	2	56.2	0.018	15876	0.163	0.167

Site	Distance from ODOW (km)	Count	Percentage sea	1/Psea	Distance^2	Resulting Weight for SPA	Proportional Weight of SPA
Flamborough 8 (incl. harbour but not buildings)	112.7	2	56.3	0.018	12701	0.006	0.007
Great Yarmouth	104.0	1500	55.8	0.018	10816	0.133	0.136
Hamford Water	204.9	166	40.8	0.025	41984	0.002	0.002
Havergate Island (AOE SPA)	180.7	3048	46.0	0.022	32652	0.000	0.000
Holkham NNR	73.6	10	50.5	0.020	5417	0.000	0.000
Holme Dunes NNR	84.1	0	43.1	0.023	7073	0.001	0.001
Hunstanton Town	87.9	2	35.4	0.028	7726	0.242	0.248
Ipswich	198.0	21	41.1	0.024	39204	0.000	0.000
Lowestoft	126.2	4000	68.2	0.015	15926	0.020	0.020
Minsmere RSPB (Scrape & Beach)	155.1	4	49.0	0.020	24056	0.193	0.198
Orfordness Beach (Orford Ness 1) (AOE SPA)	179.2	450	46.2	0.022	32113	0.001	0.001
Outer Trial Bank	106.5	1164	34.9	0.029	11342	0.003	0.003
Ransomes and Rapiar (Industrial Site)	215.1	30	47.9	0.021	46268	0.001	0.001
Ransomes Euro Park (urban)	210.0	100	49.3	0.020	44100	0.001	0.001
Rat Island	238.0	16	35.5	0.028	56644	0.000	0.000
Read's Island RSPB	123.9	8	29.1	0.034	15351	0.098	0.100
Snettisham RSPB	98.6	0	35.9	0.028	9722	0.007	0.007
Southtown	104.0	900	55.8	0.018	10816	0.000	0.000
Stiffkey	70.7	28	52.3	0.019	4998	0.003	0.003
Titchwell Marsh RSPB	80.2	0	44.6	0.022	6432	0.096	0.098
Herring gull							
Blakeney Point	69.7	26	51.3	0.019	4858	0.012	0.012
Brancaster	79	2	40.5	0.025	6241	0.001	0.001

Site	Distance from ODOW (km)	Count	Percentage sea	1/Psea	Distance^2	Resulting Weight for SPA	Proportional Weight of SPA
Flamborough Head and Bempton Cliffs	114.8	566	58.3	0.017	13179	0.084	0.086
Gibraltar Point	82.2	0	38.0	0.026	6757	0.000	0.000
Holkham NNR	73.6	238	46.2	0.022	5417	0.109	0.111
Holme Dunes NNR	84.1	0	36.7	0.027	7073	0.000	0.000
Outer Trial Bank	106.5	1532	21.0	0.048	11342	0.738	0.752
Scolt Head Island NNR	77	2	42.5	0.024	5929	0.001	0.001
Snettisham RSPB	98.6	6	23.5	0.043	9722	0.003	0.003
Spurn Head	77.8	0	52.8	0.019	6053	0.000	0.000
Stiffkey	70.7	70	49.6	0.020	4998	0.032	0.033
Titchwell Marsh RSPB	80.2	2	39.9	0.025	6432	0.001	0.001
Great black-backed gull							
Snettisham RSPB		2	23.9	0.042	98.6	1.000	1.000
Sandwich tern							
Blakeney Point	69.7	6268	56.0	0.018	4858	0.426	0.425
Holkham NNR	73.6	0	49.9	0.020	5417	0.000	0.000
Holme Dunes NNR	84.1	0	37.8	0.026	7073	0.000	0.000
Scolt Head Island NNR	77	8320	45.1	0.022	5929	0.575	0.575
Stiffkey	70.7	0	54.5	0.018	4998	0.000	0.000
Gannet							
Flamborough Head and Bempton Cliffs	114.8	30,466	52.4	0.019	13179	1.609	0.637
Bass Rock	378.7	150518	42.6	0.023	143414	0.898	0.356
St Abb's Head NNR	341.4	22	45.8	0.022	116554	0.000	0.000
Troup & Lion's Head RSPB (Coast & Reserve)	526.8	9650	67.4	0.015	277518	0.019	0.007
Guillemot							

Site	Distance from ODOW (km)	Count	Percentage sea	1/Psea	Distance^2	Resulting Weight for SPA	Proportional Weight of SPA
Flamborough and Filey Coast SPA	114.8	149,980	56.942	0.018	13179	0.000	0.000
Razorbill							
Flamborough and Filey Coast SPA	114.8	61,346	56.027	0.018	13179	1.000	1.000
Puffin							
Coquet Island	257.0	50,058	46	0.022	66049	0.417	0.783
Filey 1	125.8	0	56.300	0.018	15826	0.000	0.000
Filey 2	126.7	1	56.400	0.018	16053	0.000	0.000
Filey 3	125.7	36	56.800	0.018	15800	0.001	0.002
Flamborough Head and Bempton Cliffs	114.8	3,080	51.605	0.019	13179	0.115	0.215

Annex B: Non-Breeding Season Apportioning to Scottish Colonies

Table 13: Citation counts and the non-breeding season apportionment proportions (%) for Scottish colonies based on Furness (2015).

Species	Site	Citation Count	Proportional weight of colony (%) (Autumn / Spring)
Kittiwake	Buchan Ness to Collieston Coast SPA	60,904	1.8 / 2.4
	Calf of Eday SPA	3,434	0.2 / 0.2
	Copinsay SPA	19,100	0.1 / 0.1
	East Caithness Cliffs SPA	65,000	5.8 / 7.7
	Fair Isle SPA	36,320	0.1 / 0.1
	Forth Islands (UK) SPA	16,800	0.4 / 0.6
	Foula SPA	7,680	0.0 / 0.1
	Fowlsheugh SPA	73,300	1.4 / 1.8
	Hermaness, Saxa, Vord and Valla Field SPA	1,844	0.1 / 0.1
	Hoy SPA	6,000	0.1 / 0.1
	Marwick Head SPA	15,400	0.1 / 0.1
	North Caithness Cliffs SPA	26,200	1.5 / 1.9
	Noss SPA	14,040	0.1 / 0.1
	Rousay SPA	9,800	0.3 / 0.3
	St Abb's Head SPA	42,340	0.5 / 0.7
	Sumburgh Head SPA	2,732	0.0 / 0.0
	Troup, Pennan and Lion's Heads SPA	63,200	2.2 / 2.8
	West Westray	47,800	1.7 / 2.3
Gannet	Forth Islands (UK) SPA	43,200	21.9 / 31.3
	Fair Isle SPA	2,332	1.4 / 2.2
	Hermaness, Saxa, Vord and Valla Field SPA	32,800	8.5 / 13.7
	Noss SPA	13,720	3.4 / 5.5
Puffin	Fair Isle SPA	23,000	9.2
	Forth Islands (UK) SPA	28,000	53.7
	Foula SPA	48,000	19.4
	Hermaness, Saxa, Vord and Valla Field SPA	55,000	20.4
	Hoy SPA	7,000	3.0
	North Caithness Cliffs SPA	4,160	0.8
	Noss SPA	2,348	0.7
Razorbill (migration / winter)	St Abb's Head SPA	2,180	0.4 / 0.1
	East Caithness Cliffs SPA	15,800	4.2 / 1.1
	Fair Isle SPA	3,400	0.3 / 0.1
	Forth Islands (UK) SPA	1,400	0.9 / 0.2
	Foula SPA	6,200	0.1 / 0.0
	Fowlsheugh SPA	5,800	1.2 / 0.3

Species	Site	Citation Count	Proportional weight of colony (%) (Autumn / Spring)
	North Caithness Cliffs SPA	4,000	0.5 / 0.2
	Troup, Pennan and Lion's Heads SPA	4,800	0.6 / 0.2
	West Westray	1,946	0.2 / 0.1
Guillemot	Buchan Ness to Collieston Coast	17,280	1.3
	Calf of Eday	12,645	0.5
	Copinsay	29,450	0.5
	East Caithness Cliffs	106,700	9.2
	Fair Isle	32,300	1.1
	Forth Islands (UK)	32,000	1.6
	Foula	37,500	1.4
	Fowlsheugh	56,450	3.0
	Hermaness, Saxa, Vord and Valla Field	25,000	0.4
	Hoy	26,800	0.5
	Marwick Head	37,700	1.0
	North Caithness Cliffs	38,300	4.1
	Noss	38,970	1.3
	Rousay	10,600	0.5
	St Abb's Head	31,750	2.5
	Sumburgh Head	16,000	0.4
	Troup, Pennan and Lion's Heads	44,600	0.9
	West Westray	42,150	2.9